NJCAT TECHNOLOGY VERIFICATION

CAPSTONE MODEL C200 MICROTURBINE

CAPSTONE TURBINE CORPORATION®

January 2010

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1. Introduction

1.1 New Jersey Corporation for Advance Technology (NJCAT) Program

NJCAT is a not-for-profit corporation to promote in New Jersey the retention and growth of technology-based businesses in emerging fields such as environmental and energy technologies. NJCAT provides innovators with the regulatory, commercial, technological and financial assistance required to bring their ideas to market successfully. Specifically, NJCAT functions to:

- Advance policy strategies and regulatory mechanisms to promote technology commercialization;
- Identify, evaluate, and recommend specific technologies for which the regulatory and commercialization process should be facilitated;
- Facilitate funding and commercial relationships/alliances to bring new technologies to market and new business to the state; and
- Assist in the identification of markets and applications for commercialized technologies.

The technology verification program specifically encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals are formed to implement a comprehensive evaluation of vendor specific performance claims. Thus, suppliers have the competitive edge of an independent third party confirmation of claims.

Pursuant to N.J.S.A. 13:1D-134 et seq. (Energy and Environmental Technology Verification Program) the New Jersey Department of Environmental Protection (NJDEP) and NJCAT have established a Performance Partnership Agreement (PPA) whereby NJCAT performs the technology verification review and NJDEP certifies that the technology meets the regulatory intent and that there is a net beneficial environmental effect of the technology. In addition, NJDEP/NJCAT work in conjunction to develop expedited or more efficient timeframes for review and decision-making of permits or approvals associated with the verified/certified technology.

The PPA also requires that:

- The NJDEP shall enter into reciprocal environmental technology agreements concerning the evaluation and verification protocols with the United States Environmental Protection Agency, other local required or national environmental agencies, entities or groups in other states and New Jersey for the purpose of encouraging and permitting the reciprocal acceptance of technology data and information concerning the evaluation and verification of energy and environmental technologies; and

- The NJDEP shall work closely with the State Treasurer to include in State bid specifications, as deemed appropriate by the State Treasurer, any technology verified under the Energy and Environment Technology Verification Program.

1.2 Verification

On November 10, 2008, Capstone Turbine Corporation, 21211 Nordhoff Street, Chatsworth, CA 91311, submitted a formal request for participation in the NJCAT Technology Verification Program. The technology proposed – The Capstone MicroTurbine (Model C200) – is a 200kW compact, turbine generator that delivers electricity onsite, or close to the point where it is needed..

The request (after pre-screening by NJCAT staff personnel in accordance with the technology assessment guidelines) was accepted into the verification program. This verification report covers the evaluation based upon the performance claim of the vendor, Capstone, that the C200 microturbine according to New Jersey Department of Environmental Protection Administrative Code 7:27, subchapters 8 and 22, qualifies as an "insignificant source" of air emissions and consequently does not require an air permit.

This verification project primarily involved the evaluation of company literature and a third party laboratory test report to verify that the Capstone C200 MicroTurbine satisfies the performance claim made by Capstone Turbine Corporation.

1.3 Applicant Profile

Founded in 1988, Capstone Turbine Corporation is the world's leading producer of low-emission microturbine systems and was the first to market with commercially viable microturbine energy products. Capstone Turbine has earned industry recognition in the research, development, and field applications of advanced gas turbine-driven generator technology. The company's flagship product is the Capstone MicroTurbine power generation system. Capstone Turbine Corporation has shipped thousands of Capstone MicroTurbine systems to customers worldwide. These systems have logged millions of documented runtime operating hours.

Capstone Turbine is a member of the U.S. Environmental Protection Agency's Combined Heat and Power Partnership which is committed to improving the efficiency of the nation's energy infrastructure and reducing emissions of pollutants and greenhouse gases.

Capstone Turbine is a UL-Certified ISO 9001:2000 and ISO 14001:2004 certified company.

Key managers of Capstone Management Team are: Darren Jamison, President and Chief Executive Officer; Edward Reich, Executive Vice-President and Chief Financial Officer; Mark Gilbreth, Executive Vice-President and Chief Technology Officer; James Crouse, Executive Vice-President of Sales; and Shelby Ahmann, Senior Vice-President, Customer Service.

Capstone has six national and international offices that service their customers.

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2. The Capstone Model C200 MicroTurbine

2.1 Technology Description

The Capstone MicroTurbine™ is a compact, turbine generator that delivers electricity onsite, or close to the point where it is needed. Capstone MicroTurbines are designed to operate on a variety of gaseous and liquid fuels and emit very low emissions; they are available in three sizes: 30kW (C30), 65kW (C65) and 200kW (C200). Products based on the 200kW turbine are also available in 600kW, 800kW and 1MW configurations.

The C200 Microturbine System is a gas turbine generator that provides electric power and clean process heat. The C200 is an integrated product that uses advanced solid-state power electronics to produce utility grade 3-phase electrical power at 400/480 VAC and 50/60 Hz. The integrated microelectronic controllers synchronize with the electric utility and provide utility protection, thereby eliminating the need for additional third party protective equipment.

The key mechanical components that make up the Capstone MicroTurbine are shown in Figure 1.

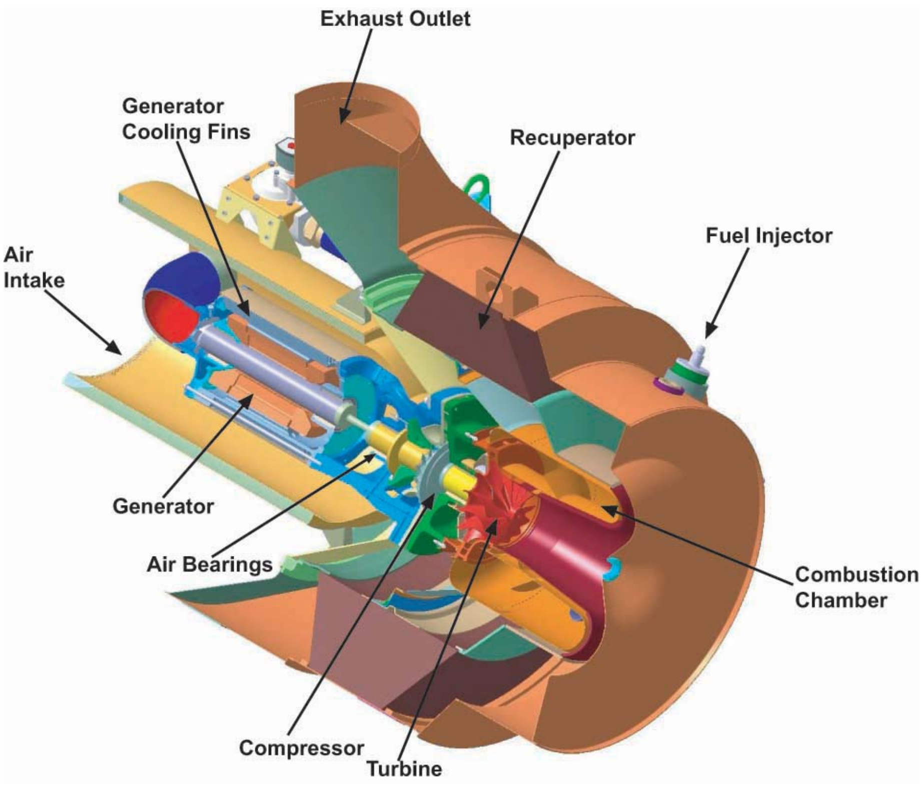

Figure 1 Typical Capstone C200 MicroTurbine Engine Construction

The microturbine engine is a combustion turbine that includes a compressor, combustor, turbine, generator, and a recuperator. The rotating components are mounted on a single shaft supported by patented air bearings and spin at a maximum speed of 60,000 RPM. The permanent magnet generator is cooled by the airflow into the microturbine. The output of the generator is variable voltage, variable frequency AC. The generator is used as a motor during start-up and cooldown cycles.

The microturbine can efficiently use a wide range of approved hydrocarbon-based gaseous fuels, depending on the model. The microturbine includes an integral fuel delivery and control system. The standard system is designed for pressurized hydrocarbon-based gaseous fuels. Other models are available for low-pressure gaseous fuels, gaseous fuels with lower heat content, gaseous fuels with corrosive components, and biogas (landfill and digester gas) fuels.

Digital power electronics control and condition the microturbine electrical output. The digital power electronics change the variable frequency AC power from the generator to DC voltage, and then to constant frequency AC voltage. During start-up, the digital power electronics operate as a variable frequency drive, and motor the generator until the microturbine has reached ignition and power is available from the microturbine. The digital power electronics again operate as a drive during cooldown to remove heat stored in the recuperator and within the microturbine engine in order to protect the system components.

Clean hot exhaust air can be used for process heating or cooling and can increase the overall efficiency of the system. This exhaust may be directed to an optional air to water heat exchanger. Alternately, the exhaust may be directed to customer provided devices, such as absorption chillers, which can generate cold water from the hot exhaust.

The C200 MicroTurbine System requires little maintenance due to its use of air bearings. The use of air bearings, coupled with the fact that the microturbine system does not incorporate a mechanical transmission, means that no lubricants or coolants need to be periodically replaced or disposed of.

Capstone MicroTurbines incorporate advanced engineering, based on more than 100 patents, and integrate an aero-based turbine engine, a magnetic generator, advanced power electronics and air bearings technology. All Capstone MicroTurbines operate:

- Continuously or On-Demand
- Stand alone or Grid Connected
- Individually or Multi-pack
- On a variety of fuels

Key features of the Capstone MicroTurbine System include:

- Air cooled design: no cooling system maintenance or coolant disposal issues
- Patented air bearings: no lubrication system maintenance or oil disposal issues
- Advanced combustion control: eliminates the need for ceramics or for other costly materials or for catalytic combustion
- Oxygen rich exhaust with ultra low NO_x and CO emission levels
- Integral annular recuperator (heat exchanger) doubles electrical efficiency

- UL certified
- Quiet operation (65 dB at 10 meters)
- Modular design permits scalability
- Multi-fuel capability
- Remote Monitoring
- Lightweight and compact design
- High efficiency design

Capstone MicroTurbine products are commonly deployed in one or a combination of several of the following energy efficient solutions:

- CHP: Combined Heat & Power – CHP systems conserve energy and cut operational costs by creating both electricity and heat.
- CHHP: Combined Cooling, Heating & Power – The heat output can be used to both heat and air condition your facility via absorption cooling, while also producing electricity.
- Secure Power: Capstone MicroTurbines can operate connected to a utility grid or provide stand alone power to critical loads.
- Resource Recovery: Biogas Capstone MicroTurbines can cleanly burn waste gases to create renewable electrical power and heat.
- Resource Recovery: Oil and Gas Capstone MicroTurbines power onshore and offshore operations using unprocessed wellhead gas.

2.2 New Jersey Administrative Code

According to New Jersey Administrative Code (N.J.A.C.) section 7:27-8.2(c)1, a significant source of emissions is defined as "Commercial fuel burning equipment, except for a source listed in c(21) below, that has a maximum rated heat input of 1,000,000 BTU per hour or greater to the burning chamber, including emergency generators." The exception noted in c(21) is for reciprocating engines. The Capstone C200 operating at full power and International Standard Organization (ISO) conditions consumes 2,079,000 BTU per hour, so it meets the heat input criterion as a significant source. However, N.J.A.C. section 7:27-8.2(f)1.i provides for "A microturbine with less than 500 kilowatts generating capacity that is fueled by natural gas and that has been verified according to the requirements in (f)2 below to emit less than:

(1) 0.40 pounds of NO_x per megawatt hour; and
(2) 0.25 pounds of CO per megawatt hour,"

to not be classified as a significant source.

2.3 Technical Performance Claim

Claim – The Capstone C200 LP MicroTurbine fired with natural gas when operated at 40% or greater load has demonstrated by source emission testing that it emits less than 1) 0.40 pounds of NO_x per megawatt hour, and 2) 0.25 pounds of CO per megawatt hour, and, therefore, that it is not a significant source of NO_x and CO emissions in accordance with N.J.A.C. 7:27-8.2(f)1.i.

3. Technology Evaluation

3.1 Introduction

The New Jersey Army National Guard (NJARNG) contracted AirRECON, a division of LFR Inc., to perform an emission evaluation on the outlet stack of one Capstone C-200 LP Micro Turbine. The evaluation was performed to verify claims submitted to the New Jersey Department of Environmental Protection (NJDEP) and to the New Jersey Corporation for Advanced Technology (NJCAT) in the Verification Program Limited Preliminary Application (VPLPA) dated November 11, 2008. Verification tests were performed on the identical model microturbine that NJARNG intends to install at various locations throughout New Jersey.

A Certification Stack Test Protocol which defined the procedures and methodologies to be used to verify the above emissions was reviewed and approved by NJDEP and NJCAT prior to testing. Stack tests were conducted on July 13 through 16, 2009 by AirRECON with their subcontractor GE Energy at Capstone’s Van Nuys, California facility. Capstone provided a web cam to allow observation of the test program by NJDEP and NJCAT personnel. However, only onsite observations occurred since these were deemed sufficient to ensure third party independence.

As defined in the approved protocol, testing was performed at the following five operational loadings ($\pm$ 5%) on the micro turbine:

- 100% (Base) Load (Average Power Output 164 KW_e)
- 75% Load (Average Power Output 117 KW_e)
- 50% Load (Average Power Output 85 KW_e)
- 25% Load (Average Power Output 42 KW_e)
- 0% (Idle) Load (Average Power Output <1 KW_e)

3.2 Test Methodologies

The parameters and methods used for this proposed emission test program are specified in Table 1. Three tests of at least one hour will be performed for all parameters at the five operational loadings. All proposed test methods conform to Title 40, Code of Federal Regulations, Part 60, Appendix A test procedures or those of the NJDEP.

Table 1 Test Parameters and Test Methods

PARAMETER	METHOD
Flow rates	U.S. EPA Method 1, "Sample and Velocity Traverse for Stationary Sources" or U.S. EPA Method 1A, "Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts."
	U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)" and U.S. EPA Method 2C, "Determination of Stack Gas Velocity and Volumetric Flow Rate from Small Stacks or Ducts (Standard Pitot Tube)."
Oxygen, carbon dioxide	U.S. EPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emission from Stationary Sources." (Instrumental Analyzer Procedure)
Moisture	U.S. EPA Method 4, "Determination of Moisture Content in Stack Gases."
Nitrogen Oxides (No_x as NO_2) (Outlet Only)	U.S. EPA Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources." (Instrumental Analyzer Procedure)
Carbon monoxide (CO)	U.S. EPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources" (Instrumental Analyzer Procedure

In accordance with the approved stack test protocol, the micro turbine was tested without a heat recovery system. Useful thermal energy was calculated and added to electrical power to provide a net power output for the calculation of pounds per megawatt hour. Stack temperatures were measured every 10 minutes from a thermocouple that was installed in the exhaust duct upstream from the sample test ports. These temperature measurements were used to calculate useful thermal energy (based on a heat recovery system final temperature of 282 ^{o}F as agreed by NJDEP during protocol review) and were recorded on the field data sheets. Stack temperatures were also measured during flow traverses at the beginning and end of each test run in accordance with USEPA Methodology. These measurements were also recorded on the field data sheets, along with differential pressures and other information used to calculate volumetric flow rates. Appendix A indicates the stack conditions for the five operational loads tested.

Ambient air temperatures were recorded during the test runs to provide intake air temperatures to the micro turbine. These temperatures were used to determine the ambient temperature/pressure de-rated base load (KW) from Figure 7-2 of Capstone's Technical Reference Manual (Page 7-8). The de-rated base load was used to determine the set point for power output (KWe) of the engine based on targeted percent load.

4. Verification Procedures: Technology System Performance

4.1 Data Analysis

In accordance with USEPA test methodology, calibration responses recorded before and after each test run were used to bias correct the average stack gas responses. Bias corrected concentrations are used to calculate mass emission rates in pounds per hour (Lb/Hr), pounds per million British thermal unit (Lb/MMBtu) and pounds per megawatt-hour (Lb/MW-Hr). Mass emission rates are calculated using flow and F-factor based equations. The flow based calculated results are included in the emissions summary tables of this report (Section 4.2) as that is the generally accepted calculation procedure by NJDEP.

Fuel flow and power output were monitored using metering systems installed by Capstone. Data were recorded from these meters at 1 second intervals over the course of each test run. The raw data were averaged for each test period and were provided in Process Summary Sheets provided by AirRECON. Electronic copies of the raw data are available from AirRECON's network computer drive.

4.2 Test Results

Emissions data from the five operational loads tested are shown in Tables 2, 3, 4, 5 and 6. The data are also displayed in Figures 2 and 3.

Table 2 - Capstone C200 LP Natural Gas Fired 100 Percent Load

RUN	1	2	3	ALLOWABLE
DATE	07/15/09	07/15/09	07/15/09	
TIME	0905-1005	1045-1145	1210-1310	
NET POWER OUTPUT (KW)[1]	276	272	267	
NITROGEN OXIDES (as NO_2)				
PPMV (dry)	1.31	1.35	1.28	-----
POUNDS/Hr	0.021	0.022	0.020	-----
POUNDS/MW-Hr[2]	0.077	0.079	0.076	0.4
CARBON MONOXIDE (as CO)				
PPMV (dry)	<0.1	<0.1	<0.1	-----
POUNDS/Hr	<0.001	<0.001	<0.001	-----
POUNDS/MW-Hr[2]	<0.004	<0.004	<0.004	0.25

Table 3 - Capstone C200 LP Natural Gas Fired 75 Percent Load

RUN	1	2	3	ALLOWABLE
DATE	07/15/09	07/15/09	07/15/09	
TIME	1400-1500	1515-1615	1637-1737	
NET POWER OUTPUT (KW)[1]	200	200	200	
NITROGEN OXIDES (as NO_2)				
PPMV (dry)	1.64	1.65	1.76	-----
POUNDS/Hr	0.022	0.023	0.025	-----
POUNDS/MW-Hr[2]	0.111	0.113	0.123	0.4
CARBON MONOXIDE (as CO)				
PPMV (dry)	<0.10	<0.10	0.11	-----
POUNDS/Hr	<0.0008	<0.0008	0.0009	-----
POUNDS/MW-Hr[2]	<0.004	<0.004	0.005	0.25

Table 4 - Capstone C200 LP Natural Gas Fired 50 Percent Load

RUN	1	2	3	ALLOWABLE
DATE	07/16/09	07/16/09	07/16/09	
TIME	0915-1015	1040-1140	1200-1300	
NET POWER OUTPUT (KW)[1]	146	148	149	
NITROGEN OXIDES (as NO_2)				
PPMV (dry)	3.14	3.33	3.45	-----
POUNDS/Hr	0.037	0.039	0.041	-----
POUNDS/MW-Hr[2]	0.255	0.266	0.273	0.4
CARBON MONOXIDE (as CO)				
PPMV (dry)	1.27	1.23	1.01	-----
POUNDS/Hr	0.009	0.009	0.007	-----
POUNDS/MW-Hr[2]	0.063	0.060	0.048	0.25

Table 5 - Capstone C200 LP Natural Gas Fired 25 Percent Load

RUN	1	2	3	ALLOWABLE
DATE	07/16/09	07/16/09	07/16/09	
TIME	1325-1425	1450-1550	1610-1710	
NET POWER OUTPUT (KW)[1]	83	83	83	
NITROGEN OXIDES (as NO_2)				
PPMV (dry)	7.00	7.05	7.07	-----
POUNDS/Hr	0.064	0.064	0.065	-----
POUNDS/MW-Hr[2]	0.769	0.774	0.784	0.4
CARBON MONOXIDE (as CO)				
PPMV (dry)	0.26	0.23	0.20	-----
POUNDS/Hr	0.001	0.001	0.001	-----
POUNDS/MW-Hr[2]	0.017	0.016	0.013	0.25

Table 6 - Capstone C200 LP Natural Gas Fired 0 Percent (Idle) Load

RUN	1	2	3	ALLOWABLE
DATE	07/14/09	07/14/09	07/14/09	
TIME	1450-1550	1620-1720	1740-1840	
NET POWER OUTPUT (KW)[1]	15	18	18	
NITROGEN OXIDES (as NO_2)				
PPMV (dry)	9.48	9.91	10.14	-----
POUNDS/Hr	0.058	0.062	0.062	-----
POUNDS/MW-Hr[2]	3.83	3.34	3.43	0.4
CARBON MONOXIDE (as CO)				
PPMV (dry)	<0.10	<0.10	<0.10	-----
POUNDS/Hr	<0.0004	<0.0004	<0.0004	-----
POUNDS/MW-Hr[2]	<0.025	<0.021	<0.021	0.25

[1]Net power output includes exhausted thermal energy per calculation agreed to in verification stack test protocol.
[2] Determined from lb/hr and net power output.

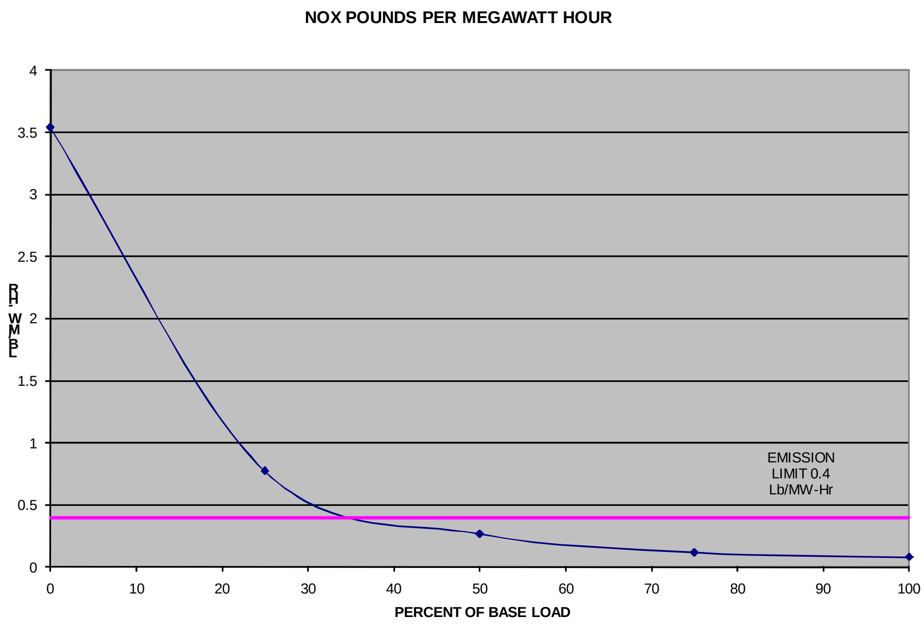

Figure 2 Capstone C200 NOx Emissions vs. Operational Load

Clearly, the C200 LP natural gas fired microturbine NOx emissions are below the emission limit of 0.4 Lb/KW-Hr at operational loads above 40%.

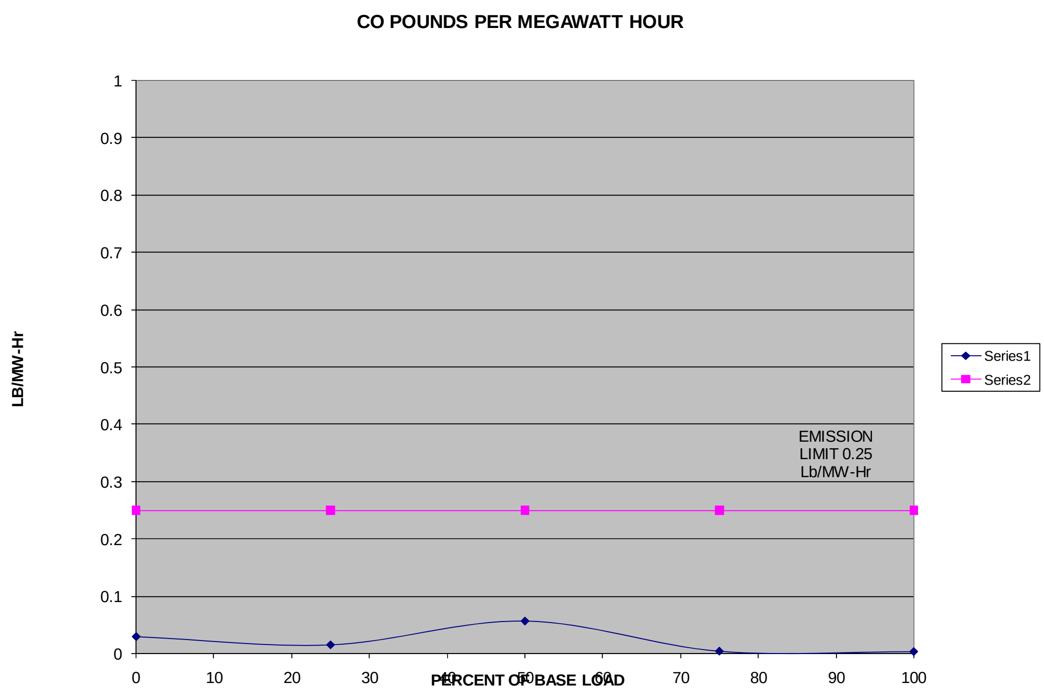

Figure 3 Capstone C200 CO Emissions vs. Operational Load

Carbon monoxide emissions are consistently well below the emission limit of 0.25 Lb/MW-Hr at all five operational load conditions and will not be discussed further.

Test results for the NOx emissions are summarized in Table 7 below for each of the three test runs at the five operating points. In this table, the raw pounds per hour emissions are provided, and a pounds per megawatt hour is calculated by dividing the pounds per hour values by the total output of the C200, including electrical and useful thermal energy. The power levels of 25% through 100% are referenced to the electrical output only. A pound per megawatt hour value was able to be calculated at idle (zero electrical output) only because a small amount of useful thermal output was measured.

Table 7 Capstone C200 LP Natural Gas Fired NOx Emissions

Load	Run	Power Output (KW)			NOx Lb/hr	NOx Lb/KWh
		Electrical	Thermal	Net		
100	1	170	106	276	0.021	0.077
	2	163	109	272	0.022	0.079
	3	158	109	267	0.020	0.076
75	1	117	83	200	0.022	0.111
	2	117	83	200	0.023	0.113
	3	117	83	200	0.025	0.123
50	1	85	61	146	0.037	0.255
	2	85	63	148	0.039	0.266
	3	85	64	149	0.041	0.273
25	1	42	41	83	0.064	0.769
	2	42	41	83	0.064	0.774
	3	42	41	83	0.065	0.784
0	1	1	14	15	0.058	3.827
	2	1	17	18	0.062	3.344
	3	1	17	18	0.062	3.433

5. Performance Claim Verification

The AirRECON testing has demonstrated that the Capstone C200 LP natural gas fired MicroTurbine has carbon monoxide emissions well below the emission limit of 0.25 Lb/MW-Hr at all five operational load conditions and has NOx emissions below the emission limit of 0.4 Lb/KW-Hr at operational loads above 40%. Hence Capstone's technical performance claim that **"The Capstone C200 LP MicroTurbine fired with natural gas when operated at 40% or greater load has demonstrated by source emission testing that it emits less than 1) 0.40 pounds of NO_x per megawatt hour, and 2) 0.25 pounds of CO per megawatt hour, and, therefore, that it is not a significant source of NO_x and CO emissions in accordance with N.J.A.C. 7:27-8.2(f)1.i"** has been verified.

6. Net Environmental Benefit

Microturbine generation equipment can provide a source of clean and reliable electricity and heat. Since buildings in the United States contribute 40% of the greenhouse gas annually emitted, they are the single largest target for possible reduction. By generating both electricity and heat at the point of use in a building, an increase in end use fuel efficiency (generally 30-40%) is achieved. The Capstone C200 LP natural gas fired can provide electricity and heat efficiently with insignificant emissions.

7. References

Capstone C200 MicroTurbine Technical Reference Manual, 410066 Rev A, Capstone Turbine Corporation, Chatsworth, CA (September 2008)

Environmental Technology Verification Report, Capstone C200 LP 200 KW MicroTurbine, prepared by AirRECON, a division of LFR, Inc., Branchburg, NJ (October 8, 2009)

NJCAT/NJDEP Certification Stack Test Protocol for Capstone C200 KW Natural gas Fired MicroTurbine, prepared by AirRECON, a division of LFR, Inc., Branchburg, NJ (November 11, 2008 with March 23, 2009 amendments)

APPENDIX A

Stack Conditions

100% Load

RUN	1	2	3
DATE	7/15/2009	7/15/2009	7/15/2009
TIME	0905-1005	1045-1145	1210-1310
STACK INSIDE DIAMETER (in)	12.0	12.0	12.0
STACK CROSS SECTION (sq ft)	0.79	0.79	0.79
BAROMETRIC PRESSURE	29.15	29.16	29.15
AVG. STACK TEMP (^oF)	556	561	562
STACK PRESSURE ("H_2O-gage)	-0.90	-1.00	-0.90
MOISTURE (% vol)	4.5	5.0	4.6
O_2 (% vol)	17.9	18.0	18.0
CO_2 (%vol)	1.8	1.8	1.8
N_2 (% vol by difference)	80.3	80.2	80.2
AVG. ACTUAL VELOCITY (ft/sec)	99.1	99.0	97.8
ACTUAL FLOW RATE (acfm)	4,670	4,660	4,610
STD FLOW RATE (scfm)	2,370	2,350	2,320
DRY STD FLOW RATE (dscfm)	2,260	2,240	2,220

Standard Conditions are 70 °F, 29.92" Hg

75% Load

RUN	1	2	3
DATE	7/15/2009	7/15/2009	7/15/2009
TIME	1400-1500	1515-1615	1637-1737
STACK INSIDE DIAMETER (in)	12.0	12.0	12.0
STACK CROSS SECTION (sq ft)	0.79	0.79	0.79
BAROMETRIC PRESSURE	29.13	29.13	30
AVG. STACK TEMP (^oF)	530	527	522
STACK PRESSURE ("H_2O-gage)	-0.62	-0.62	-0.69
MOISTURE (% vol)	4.3	4.1	3.5
O_2 (% vol)	18.2	18.2	18.3
CO_2 (%vol)	1.7	1.7	1.7
N_2 (% vol by difference)	80.1	80.0	80.0
AVG. ACTUAL VELOCITY (ft/sec)	81.5	81.1	79.5
ACTUAL FLOW RATE (acfm)	3,840	3,820	3,750
STD FLOW RATE (scfm)	2,000	2,000	2,020
DRY STD FLOW RATE (dscfm)	1,910	1,910	1,950

Standard Conditions are 70 °F, 29.92" Hg

50% Load

RUN	1	2	3
DATE	7/16/2009	7/16/2009	7/16/2009
TIME	0915-1015	1040-1140	1200-1300
STACK INSIDE DIAMETER (in)	12.0	12.0	12.0
STACK CROSS SECTION (sq ft)	0.79	0.79	0.79
BAROMETRIC PRESSURE	29.19	29.2	29.18
AVG. STACK TEMP (^oF)	484	491	500
STACK PRESSURE ("H_2O-gage)	-0.44	-0.44	-0.44
MOISTURE (% vol)	4.0	4.1	4.0
O_2 (% vol)	18.6	18.6	18.5
CO_2 (%vol)	1.5	1.5	1.5
N_2 (% vol by difference)	79.9	79.9	80.0
AVG. ACTUAL VELOCITY (ft/sec)	67.2	67.6	68.0
ACTUAL FLOW RATE (acfm)	3,170	3,180	3,200
STD FLOW RATE (scfm)	1,730	1,730	1,720
DRY STD FLOW RATE (dscfm)	1,660	1,660	1,650

Standard Conditions are 70 °F, 29.92" Hg

25% Load

RUN	1	2	3
DATE	7/16/2009	7/16/2009	7/16/2009
TIME	1325-1425	1450-1550	1610-1710
STACK INSIDE DIAMETER (in)	12.0	12.0	12.0
STACK CROSS SECTION (sq ft)	0.79	0.79	0.79
BAROMETRIC PRESSURE	29.17	29.15	29.13
AVG. STACK TEMP (^oF)	449	448	448
STACK PRESSURE ("H_2O-gage)	-0.45	-0.45	-0.45
MOISTURE (% vol)	3.6	3.6	3.2
O_2 (% vol)	19.0	18.9	18.9
CO_2 (%vol)	1.4	1.4	1.4
N_2 (% vol by difference)	79.6	79.7	79.7
AVG. ACTUAL VELOCITY (ft/sec)	49.6	49.5	49.9
ACTUAL FLOW RATE (acfm)	2,340	2,330	2,350
STD FLOW RATE (scfm)	1,330	1,320	1,330
DRY STD FLOW RATE (dscfm)	1,280	1,280	1,290

Standard Conditions are 70 °F, 29.92" Hg

0% (Idle) Load

RUN	1	2	3
DATE	7/14/2009	7/14/2009	7/14/2009
TIME	1450-1550	1620-1720	1740-1840
STACK INSIDE DIAMETER (in)	12.0	12.0	12.0
STACK CROSS SECTION (sq ft)	0.79	0.79	0.79
BAROMETRIC PRESSURE	29.03	29.02	29.01
AVG. STACK TEMP (^oF)	373	377	374
STACK PRESSURE ("H_2O-gage)	-0.10	-0.09	-0.10
MOISTURE (% vol)	3.3	2.9	2.8
O_2 (% vol)	19.8	19.3	19.3
CO_2 (%vol)	1.2	1.2	1.2
N_2 (% vol by difference)	79.0	79.5	79.5
AVG. ACTUAL VELOCITY (ft/sec)	30.5	30.9	30.5
ACTUAL FLOW RATE (acfm)	1,440	1,460	1,440
STD FLOW RATE (scfm)	890	890	890
DRY STD FLOW RATE (dscfm)	860	870	860

Standard Conditions are 70 °F, 29.92" Hg