Award Number:	DE-EE0002794
Project Title:	Recovery Act: Johnston Rhode Island Combined Cycle Electric Generating Plant Fueled by Waste Landfill Gas
Project Period:	1/14/2010 – 6/30/2013
Recipient Organization:	Rhode Island LFG Genco, LLC
Project Director	Stephen Galowitz
Partners:	DCO Energy

A. Executive Summary

The primary objective of the Project was to maximize the productive use of the substantial quantities of waste landfill gas generated and collected at the Central Landfill in Johnston, Rhode Island. An extensive analysis was conducted and it was determined that utilization of the waste gas for power generation in a combustion turbine combined cycle facility was the highest and best use. The resulting project reflected a cost effective balance of the following specific sub-objectives. 1) Meet environmental and regulatory requirements, particularly the compliance obligations imposed on the landfill to collect, process and destroy landfill gas. 2) Utilize proven and reliable technology and equipment. 3) Maximize electrical efficiency. 4) Maximize electric generating capacity, consistent with the anticipated quantities of landfill gas generated and collected at the Central Landfill. 5) Maximize equipment uptime. 6) Minimize water consumption. 7) Minimize post-combustion emissions.

To achieve the Project Objective the project consisted of several components. 1) The landfill gas collection system was modified and upgraded. 2) A State-of-the Art gas clean up and compression facility was constructed. 3) A high pressure pipeline was constructed to convey cleaned landfill gas from the clean-up and compression facility to the power plant. 4) A combined cycle electric generating facility was constructed consisting of combustion turbine generator sets, heat recovery steam generators and a steam turbine. 5) The voltage of the electricity produced was increased at a newly constructed transformer/substation and the electricity was delivered to the local transmission system.

The Project produced a myriad of beneficial impacts. 1) The Project created 453 FTE construction and manufacturing jobs and 25 FTE permanent jobs associated with the operation and maintenance of the plant and equipment. 2) By combining state-of-the-art gas clean up systems with post combustion emissions control systems, the Project established new national standards for best available control technology (BACT). 3) The Project will annually produce 365,292 MWh's of clean energy. 4) By destroying the methane in the landfill gas, the Project will generate CO2 equivalent reductions of 164,938 tons annually.

The completed facility produces 28.3 MWnet and operates 24 hours a day, seven days a week.

B. Project Timeline

March 14, 2010	Kickoff Meeting
December 1, 2010	Construction Mobilization
February 29, 2012	Final Design Complete
September 1, 2012	Permit Approvals Complete
November 1, 2012	Construction Complete
January 12, 2013	Commissioning Complete
March 31, 2013	Facility Performance Testing Complete
June 30, 2013	Project completed

C. Facility Description

The facility is comprised of two different sites, the Gas Collection and Clean-up site (GCC site) and the Combustion Turbine Generator site (CTG site). Both sites are located on Shun Pike in Town of Johnston, Rhode Island. The two sites are approximately ¾ miles apart.

Major systems located on the GCC site are the LFG Collection Blowers, H2S Removal system, LFG Chilling System, Gas Compression systems, Siloxane Removal and Polishing system, and the backup flare. Major systems on the CTG site include CTG's, Heat Recovery Steam Generators (HRSG's) with integral Selective Catalytic Reduction units (SCR's), the Steam Turbine Generator (STG), Inlet Air Chilling systems, Condenser and Cooling Water systems, Boiler Feed-Water and Steam Condensate systems, and the Switchyard.

The facility will also include a LFG pipeline to convey landfill gas to the CTG site.

The Johnston Combined Cycle LFG Plant consists of four (4) LFG fired, Solar Taurus 60 CTG's mated to dedicated, single pressure HRSG's. The four (4) trains are capable of producing approximately 93,588 PPH of 425 psig superheated steam at a temperature of 750°F to drive a single STG. The four (4) trains, in combination with the STG are capable of generating nominally 33.3 (gross) MW of electrical power in combined-cycle operation at the average annual ambient conditions.

The HRSG's includes SCR units to reduce NOx emissions including an upstream catalyst guard bed to further reduce siloxane levels. The HRSG includes space provisions for a future CO catalyst section, if required. The SCR is an aqueous ammonia-based system.

The CTG's and HRSG's are located outdoors and enclosed in weather proof and sound mitigating enclosures as required. The STG as well as Balance of Plant systems such as the deaerator, feed-water pumps, condenser, etc. are enclosed in a pre-engineered building.

The GCC site LFG treatment and compression systems are installed inside a new building and existing Building 73. Air cooled after coolers, oil coolers and heat exchangers are installed outside.

The Plant includes, but is not be limited to, the following major systems:

- LFG Collection Blowers
- LFG Collection After Cooler
- Hydrogen Sulfide Removal System
- LFG Chilling System
- 1st Stage Compression System
- 1st Stage Aftercooler
- Siloxane Removal System and Polishing System
- Siloxane Removal System for Existing CAT Plant
- 2nd Stage Compression System
- Swing Compression System
- Backup and Regen Flares
- Combustion Turbine Generators
- Heat Recovery Steam Generators
- Selective Catalytic Reduction and Aqueous Ammonia Systems
- CTG Inlet Air Chilling System
- Steam Turbine Generator
- STG Exhaust Condenser
- Steam Dump Condenser
- Deaerator
- Boiler Feed-Water and Steam Condensate Systems
- Cooling Towers
- Condenser Cooling Water System
- Chiller/Lube Oil Cooling Water Systems
- Steam Cycle Make-up Water and Reverse Osmosis System
- Steam and Cooling Water Chemical Treatment Systems
- GCC and CTG Site Compressed Air Systems
- GCC and CTG Site Oil Water Separation Systems
- Building HVAC Systems
- Storm Drainage System
- Fire Protection Systems
- Sanitary Sewer System
- Potable and Utility Water Systems
- Transformers and Electrical Distribution Systems
- Grounding and Lightning Protection Systems
- Building Lighting and Utility Power Systems
- Uninterruptible Power Supply (UPS) System
- Instrumentation and Plant Control Systems
- Emissions Monitoring Systems (EMS)
- Information Transport System

D. Facility Performance

Emissions and Performance Tests

Emissions and Performance tests were conducted to confirm that the following project performance guarantees were met:

Performance Metric	Units	Guaranteed	
Design Fuel Conditions			
LFG Heating Value on a dry basis at STP conditions of 32F and 1 atmosphere.	BTU/SCF, LHV		469.2
Gas Flow Requirements to the Gas Turbines	SCFM		9,140
Gas quality			-Maximum H2S Concentration: 2500 ppm with CO241% and CH4-51.4% NMOC ≤1500 ppmv as Toluene -Sum of Siloxanes: ≤ 156 mg/m3
DCO Guarantees			
Project Emissions Guarantee @ Full Load	Limits as defined in the Permit to Construct		Limits as defined in the Permit to Construct
Project Noise Level Guarantee			Noise levels will meet all local, state and federal requirements. Provided that existing boundary noise levels do not currently exceed these requirements
Power Generation Peformance			
Gross Project Output	**kW**		**33,056**
Fuel Input (LHV)	MMBtu/hr		257.32
Gross Project Heat Rate			**7,784**
Net Project Capacity	**kW**		**28,236**

Availability Test

Availability testing focused on accurately determining the Equivalent Availability corrected to Contractual Reference Conditions. Satisfactory completion of the tests demonstrated compliance with the Project Availability Contractual guarantees.

The results of these Emissions and Performance Tests are summarized in the following Attachments:

Attachment 1 – Combustion Turbine #1 Emissions
Attachment 2 - Combustion Turbine #2 Emissions
Attachment 3 – Combustion Turbine #3 Emissions
Attachment 4 – Combustion Turbine #4 Emissions
Attachment 5 – Regeneration Flare Emissions
Attachment 6 – Main Enclosed Flare Emissions
Attachment 7 – Reliability Test Results
Attachment 8 – Capacity and Heat Rate Test Results

E. Conclusion

All Project Objectives were achieved by the 1) Modifying and upgrading of the landfill gas collection system. 2) Construction of a State-of-the Art gas clean up and compression facility. 3) Construction of a high pressure pipeline to convey cleaned landfill gas from the clean-up and compression facility to the power plant. 4) Construction of a combined cycle electric generating facility consisting of combustion turbine generator sets, heat recovery steam generators and a steam turbine. 5) Increase of the voltage of the electricity produced at a newly constructed transformer/substation and delivery of the electricity to the local transmission system. 6) The creation of construction, manufacturing and permanent full time employees.

ATTACHMENT 1

Unit 1 Emissions

TABLE 2-1

CTG # 1 FULL LOAD
SUMMARY OF AMMONIA, CO, NOx, and NMHC EMISSIONS
EPA Methods 7E, 10, 25A, and CTM027

DCO Energy
Johnston, Rhode Island

Test Number Time Date	1 10:35-11:40 1/29/13	2 11:58-13:04 1/29/13	3 13:28-14:34 1/29/13	Average	Permit Limit
Operating Conditions					
Turbine Output (Gross KW)	6436	6416	6396	6416	
Fuel Flow (scfm @ 60 °F)	2689	2686	2685	2687	
Higher Heating Value (@ 60 °F)	493.9	493.9	493.9	493.9	
Ambient Temperature (°F)	33	35	32	33	
Fuel Total Sulfer Concentrations (ppmv)	13.5	13.5	13.5	13.5	
Total Sulfer Emissions (lb/hr as SO_2)	0.4	0.4	0.4	0.4	2.7
Total Sulfer Emissions (lb/MMBtu)	0.0045	0.0045	0.0045	0.0045	0.034
Stack Conditions					
Stack Temperature (°F)	307	306	309	307	
CO_2 (%)	5.5	5.5	5.5	5.5	
O_2 (%)	14.5	14.5	14.5	14.5	
Moisture (%)	7.03	7.23	7.07	7.11	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	40947	40793	40798	40846	
Sampling Data					
Total Ammonia Catch (mg)	<0.03	<0.03	<0.03	<0.03	
Sample Volume Dry (dscf)	52.88	51.92	51.93	52.24	
Isokinetic Ratio (%)	97.9	96.5	96.5	96.9	
Ammonia Emissions					
Concentration (ppm)	<0.02	<0.02	<0.02	<0.02	
Concentration (ppmd @ 15% O_2)	<0.02	<0.02	<0.02	<0.02	20
Mass Emission Rate (lb/hr)	<0.002	<0.002	<0.002	<0.002	2.35
CO Emissions					
Concentration (ppmd)	19.4	18.7	17.1	18.4	
Concentration (ppmd @ 15% O2)	17.9	17.2	15.7	17.0	100.0
Mass Emission Rate (lb/hr)	3.47	3.33	3.04	3.28	34.86
NOx Emissions					
Concentration (ppmd)	18.4	19.1	18.8	18.7	
Concentration (ppmd @ 15% O_2)	16.9	17.6	17.3	17.2	25.0
Mass Emission Rate (lb/hr)	5.39	5.58	5.49	5.48	7.95
NMHC Emissions					
Concentration (ppmd)	1.0	1.2	2.0	1.38	
Concentration (ppmd @ 15% O_2)	0.9	1.1	1.8	1.27	10.0
Mass Emission Rate (lb/hr)	0.10	0.12	0.20	0.14	1.99

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 2

Unit 2 Emissions

TABLE 2-3

CTG # 2 FULL LOAD
SUMMARY OF AMMONIA, CO, NOx, and NMHC EMISSIONS
EPA Methods 7E, 10, 25A, and CTM027

DCO Energy
Johnston, Rhode Island

Test Number	1	2	3	Average	Permit
Time	8:10-9:15	9:32-11:02	11:12-12:17		Limit
Date	1/29/13	1/29/13	1/29/13		
Operating Conditions					
Turbine Output (Gross KW)	6092	5996	5950	6013	
Fuel Flow (scfm @ 60°F)	2459	2390	2401	2417	
Higher Heating Value (@ 60°F)	493.9	493.9	493.9	493.9	
Ambient Temperature (°F)	46	45	45	45	
Fuel Total Sulfer Concentration (ppmv)	13.5	13.5	13.5	13.5	
Total Sulfer Emissions (lb/hr as SO_2)	0.3	0.3	0.3	0.3	2.7
Total Sulfer Emissions (lb/MMBtu)	0.0045	0.0045	0.0045	0.0045	0.034
Stack Conditions					
Stack Temperature (°F)	309	307	302	306	
CO_2 (%)	5.5	5.4	5.4	5.4	
O_2 (%)	14.5	14.5	14.4	14.5	
Moisture (%)	7.19	7.67	7.36	7.40	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	40138	38544	38764	39148	
Sampling Data					
Total Ammonia Catch (mg)	0.03	<0.03	<0.03	<0.03	
Sample Volume Dry (dscf)	51.65	48.76	49.19	49.87	
Isokinetic Ratio (%)	97.5	95.9	96.2	96.5	
Ammonia Emissions					
Concentration (ppm)	0.03	<0.02	<0.02	<0.03	
Concentration (ppmd @ 15% O_2)	0.03	<0.02	<0.02	<0.02	20
Mass Emission Rate (lb/hr)	0.003	<0.002	<0.002	<0.003	2.35
CO Emissions					
Concentration (ppmd)	17.9	16.4	15.6	16.6	
Concentration (ppmd @ 15% O2)	16.5	15.0	14.1	15.2	100.0
Mass Emission Rate (lb/hr)	3.13	2.75	2.63	2.84	34.86
NOx Emissions					
Concentration (ppmd)	17.1	18.5	18.1	17.9	
Concentration (ppmd @ 15% O_2)	15.8	17.0	16.3	16.4	25.0
Mass Emission Rate (lb/hr)	4.91	5.11	5.01	5.01	7.95
NMHC Emissions					
Concentration (ppmd)	1.0	1.5	1.7	1.40	
Concentration (ppmd @ 15% O_2)	0.9	1.4	1.5	1.28	10.0
Mass Emission Rate (lb/hr)	0.10	0.15	0.16	0.14	1.99

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 3

Unit 3 Emissions

TABLE 2-5

CTG # 3 FULL LOAD
SUMMARY OF AMMONIA, CO, NOx, and NMHC EMISSIONS
EPA Methods 7E, 10, 25A, and CTM027

DCO Energy
Johnston, Rhode Island

Test Number	1	2	3	Average	Permit
Time	950-1055	1102-1207	1215-1320		Limit
Date	1/31/13	1/31/13	1/31/13		
Operating Conditions					
Turbine Output (Gross KW)	5845	5872	5928	5882	
Fuel Flow (scfm @ 60°F)	2251	2275	2304	2277	
Higher Heating Value (@ 60°F)	493.9	493.9	493.9	493.9	
Ambient Temperature (°F)	48	40	38	42	
Fuel Total Sulfer Conentration (ppmv)	13.5	13.5	13.5	13.5	
Total Sulfer Emissions (lb/hr as SO_2)	0.3	0.3	0.3	0.3	2.7
total Sulfer Emissions (lb/MMBtu)	0.0045	0.0045	0.0045	0.0045	0.034
Stack Conditions					
Stack Temperature (°F)	302	303	303	303	
CO_2 (%)	5.4	5.4	5.4	5.4	
O_2 (%)	14.4	14.5	14.5	14.5	
Moisture (%)	7.41	6.78	7.44	7.21	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	38062	38237	38207	38169	
Sampling Data					
Total Ammonia Catch (mg)	<0.03	<0.03	<0.03	<0.03	
Sample Volume Dry (dscf)	48.78	48.54	48.63	48.65	
Isokinetic Ratio (%)	97.1	96.2	96.5	96.6	
Ammonia Emissions					
Concentration (ppm)	<0.02	<0.02	<0.02	<0.02	
Concentration (ppmd @ 15% O_2)	<0.02	<0.02	<0.02	<0.02	20
Mass Emission Rate (lb/hr)	<0.002	<0.002	<0.002	<0.002	2.35
CO Emissions					
Concentration (ppmd)	14.2	13.5	13.4	13.7	
Concentration (ppmd @ 15% O2)	12.9	12.4	12.3	12.5	100.0
Mass Emission Rate (lb/hr)	2.36	2.25	2.23	2.28	34.86
NOx Emissions					
Concentration (ppmd)	23.0	22.8	22.0	22.6	
Concentration (ppmd @ 15% O_2)	20.8	21.0	20.2	20.7	25.0
Mass Emission Rate (lb/hr)	6.27	6.26	6.01	6.18	7.95
NMHC Emissions					
Concentration (ppmd)	0.4	0.5	0.7	0.55	
Concentration (ppmd @ 15% O_2)	0.4	0.5	0.6	0.50	10.0
Mass Emission Rate (lb/hr)	0.04	0.05	0.07	0.05	1.99

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 4

Unit 4 Emissions

TABLE 2-7

CTG # 4 FULL LOAD
SUMMARY OF AMMONIA, CO, NOx, and NMHC EMISSIONS
EPA Methods 7E, 10, 25A, and CTM027

DCO Energy
Johnston, Rhode Island

Test Number Time Date	1 11:58-13:03 2/1/13	2 13:11-14:16 2/1/13	3 14:23-15:28 2/1/13	Average	Permit Limit
Operating Conditions					
Turbine Output (Gross KW)	6451	6477	6501	6476	
Fuel Flow (scfm @ 60°F)	2607	2663	2680	2650	
Higher Heating Value (@ 60°F)	493.9	493.9	493.9	493.9	
Ambient Temperature (°F)	32	32	31	32	
Fuel Total Sulfer Concentration (ppmv)	13.5	13.5	13.5	13.5	
Total Sulfer Emissions (lb/hr as SO_2)	0.4	0.4	0.4	0.4	2.7
Total Sulfer Emissions (lb/MMBtu)	0.0045	0.0045	0.0045	0.0045	0.034
Stack Conditions					
Stack Temperature (°F)	313	310	305	309	
CO_2 (%)	5.7	5.7	5.7	5.7	
O_2 (%)	14.3	14.3	14.2	14.3	
Moisture (%)	6.39	6.29	6.96	6.55	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	40522	40632	40372	40509	
Sampling Data					
Total Ammonia Catch (mg)	<0.03	<0.03	<0.03	<0.03	
Sample Volume Dry (dscf)	53.77	52.57	52.20	52.85	
Isokinetic Ratio (%)	100.6	98.1	98.0	98.9	
Ammonia Emissions					
Concentration (ppm)	<0.02	<0.02	<0.02	<0.02	
Concentration (ppmd @ 15% O_2)	<0.02	<0.02	<0.02	<0.02	20
Mass Emission Rate (lb/hr)	<0.002	<0.002	<0.002	<0.002	2.35
CO Emissions					
Concentration (ppmd)	14.7	14.1	14.9	14.6	
Concentration (ppmd @ 15% O2)	13.1	12.5	13.2	12.9	100.0
Mass Emission Rate (lb/hr)	2.60	2.50	2.63	2.57	34.86
NOx Emissions					
Concentration (ppmd)	21.0	20.6	20.9	20.8	
Concentration (ppmd @ 15% O_2)	18.7	18.3	18.5	18.5	25.0
Mass Emission Rate (lb/hr)	6.10	6.01	6.04	6.05	7.95
NMHC Emissions					
Concentration (ppmd)	0.3	0.2	0.3	0.28	
Concentration (ppmd @ 15% O_2)	0.3	0.2	0.2	0.25	10.0
Mass Emission Rate (lb/hr)	0.03	0.02	0.03	0.03	1.99

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 5

Regeneration Flare Emissions

TABLE 2-10

REGEN FLARE
SUMMARY OF PM-10, CO, NOx and NMOC
EPA Methods 5/202, 7E, 10, and 25A

DCO Energy
Johnston, Rhode Island

Test Number	1	2	3	Average	Permit
Time	1457-1600	1620-1724	1740-1844		Limit
Date	1/28/2013	1/28/2013	1/28/2013		
Process Conditions					
Fuel Flow (scfm)	440	440	440	440	
Fd Factor, (dscf/mmBtu)	9378	9378	9378	9378	
Stack Conditions					
Stack Temperature (°F)	1594	1655	1656	1635.0	
CO_2 (%)	8.1	7.3	7.2	7.53	
O_2 (%)	12.3	12.3	12.5	12.34	
Moisture (%)	8.2	7.7	7.5	7.8	
Volumetric Flow Rate, Actual (acfm)	27283	31285	31348	29972	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	6524	7308	7333	7055	
Sample Conditions					
Sample Volume Dry (dscf)	32.68	36.82	36.57	35.36	
Isokinetic Ratio (%)	104.8	105.4	104.3	104.8	
PM (Filterable) Emissions					
Catch (mg)	<1.00	<1.00	<1.00	< 1.00	
Emission Concentration (mg/DSCF)	< 0.03	< 0.03	< 0.03	< 0.03	
Emission Concentration (grains/DSCF)	< 0.0005	< 0.0004	< 0.0004	< 0.0004	
Emission Rate (lb/hr)	< 0.03	< 0.03	< 0.03	< 0.03	
PM10 (Filterable and Condensable) Emissions					
Catch (mg)	< 17.2	< 21.2	< 4.5	< 14.30	
Emission Concentration (mg/DSCF)	< 0.53	< 0.58	< 0.12	< 0.41	
Emission Concentration (grains/DSCF)	< 0.0081	< 0.0089	< 0.0019	< 0.0063	
Emission Rate (lb/hr)	< 0.45	< 0.56	< 0.12	< 0.38	
CO Emissions					
Concentration (ppm)	1.6	1.9	0.5	1.33	
Mass Emission Rate (lb/MMBtu)	0.003	0.003	0.001	0.002	0.06
Mass Emission Rate (lb/hr)	0.05	0.06	0.02	0.04	1.25
NO_x Emissions					
Concentration (ppm)	5.3	6.8	5.7	5.93	
Mass Emission Rate (lb/MMBtu)	0.014	0.018	0.016	0.016	0.025
Mass Emission Rate (lb/hr)	0.25	0.35	0.30	0.30	0.52
NMOC					
Concentration (ppm as methane)	0.3	0.3	0.5	0.4	
Concentration (ppm @ 3% O2 as hexane)	0.6	0.5	0.9	0.7	5

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 6

Capacity and Heat Rate Test Results

TABLE 2-9

ENCLOSED FLARE
SUMMARY OF PM-10, CO, NOx and NMOC
EPA Methods 5/202, 7E, 10, and 25A

DCO Energy
Johnston, Rhode Island

Test Number Time Date	1 810-942 1/28/2013	2 1010-1135 1/28/2013	3 1232-1349 1/28/2013	Average	Permit Limit
Process Conditions					
Fuel Flow (scfm)	5987	6006	5998	5997	
Fd Factor, (dscf/mmBtu)	9378	9378	9378	9378	
Stack Conditions					
Stack Temperature (°F)	1526	1577	1551	1551.0	
CO_2 (%)	7.20	7.82	7.52	7.51	
O_2 (%)	12.44	11.82	12.19	12.15	
Moisture (%)	7.4	7.7	8.5	7.9	
Volumetric Flow Rate, Actual (acfm)	184294	196382	170800	183825	
Volumetric Flow Rate, Dry Std. (dscfm)[1]	45964	47620	41560	45048	
Sampling Data					
Sample Volume Dry (dscf)	30.53	31.74	27.77	30.02	
Isokinetic Ratio (%)	102.4	102.7	103.0	102.7	
PM (Filterable) Emissions					
Catch (mg)	<2.10	<2.20	<1.80	< 2.03	
Emission Concentration (mg/DSCF)	< 0.07	< 0.07	< 0.06	< 0.07	
Emission Concentration (grains/DSCF)	< 0.001	< 0.001	< 0.001	< 0.001	
Emission Rate (lb/hr)	< 0.42	< 0.44	< 0.36	< 0.40	
PM10 (Filterable and Condensable) Emissions					
Catch (mg)	< 7.7	< 5.9	< 4.4	< 6.00	
Emission Concentration (mg/DSCF)	< 0.25	< 0.19	< 0.16	< 0.20	
Emission Concentration (grains/DSCF)	< 0.004	< 0.003	< 0.002	< 0.003	
Emission Rate (lb/hr)	< 1.53	< 1.17	< 0.87	< 1.19	
CO Emissions					
Concentration (ppm)	1.4	10.1	0.6	4.02	
Mass Emission Rate (lb/MMBtu)	0.002	0.016	0.001	0.006	0.20
Mass Emission Rate (lb/hr)	0.29	2.08	0.10	0.82	39.60
NO_x Emissions					
Concentration (ppm)	12.0	13.5	13.1	12.84	
Mass Emission Rate (lb/MMBtu)	0.03	0.03	0.04	0.03	0.06
Mass Emission Rate (lb/hr)	3.93	4.59	3.88	4.13	11.88
NMOC					
Concentration (ppm as methane)	0.9	0.5	0.1	0.5	
Concentration (ppm @ 3% O2 as hexane)	0.3	0.2	0.0	0.2	5

1. dscfm=dry standard cubic feet per minute at 68°F and 29.92 in. Hg.

ATTACHMENT 7

Availability Test Results

Johnston Landfill Gas to Energy
Project

Availability Test Results

Results of the Availability Test (Contract Methodology)

Total Net Electrical Energy Produced	kWh	9,729,397
Availability Test Duration	hours	504
Total Availability Test Correction Energy Adjustments	kWh	5,457,468
Equivalent Availability, EA	%	**110.9% - PASS**
Guaranteed Facility Net Electric Output	kW	28,236

ATTACHMENT 8

Heat Rate and Capacity Test Results

Corrected Performance Test Results Summary*

Corrected Performance Parameter	Units	Guarantee	Test Run #1	Test Run #2	Test Run #3	Average Test Runs 2 & 3
Corrected Net Project Capacity						
Measured Net Project Capacity[1]	kW	-	33,797	34,372	34,479	**34,426**
Corrected Net Project Capacity	kW	28,236	29,883	29,152	28,974	**29,063**
Margin from Guarantee	kW	-	1,647	916	738	**827**
Margin from Guarantee	%	-	5.83%	3.24%	2.61%	**2.93%**
Corrected Gross Project Heat Rate						
Measured Heat Input (LHV)	mmBTU/h	-	263.4	269.1	270.2	**269.7**
Measured Gross Project Electrical Output	kW	-	34,762	35,397	35,538	**35,468**
Corrected Gross Project Heat Rate (LHV)[2]	BTU/kWh	7,784	7,500	7,552	7,559	**7,556**
Margin from Guarantee	BTU/kWh	-	-284	-232	-225	**-228**
Margin from Guarantee	%	-	-3.65%	-2.98%	-2.89%	**-2.93%**

1. Measured Net Project Capacity is the net power output at the revenue meter on the high side of the GSU. This does not account for GCC power usage.
2. Calculated using the Measured Gross Electrical Output, not Net Electrical Power Output. See Section 5.3 of the Test Procedure.

* Average results are calculated using Test Runs 2 and 3 only. Test Run 1 is not included in the average results for plant performance.