From: David Ayers
To: Wilson, Aimee
Cc: Andrew Chartrand
Subject: Sinton GHG SOB and PSD Edits and Backup Info
Date: Friday, January 17, 2014 3:18:39 PM
Attachments:
Copy of CO2 Rates_Solar_Dec13_rev4_DFA (2).xlsx
EMD vs GTD.docx
T130-20502S 75 85 full load at 40F.pdf
T130-20502S 75 85 full load at 100F.pdf

Aimee,

Please see the attached latest edits to the GHG Permit and SOB for Sinton. Please note I did not remove some of the edits in the standard language that per our phone conversation earlier this week, but did make the additional edits and comments we discussed. Also please see the attached back-up information, including the Providences' updated Titan calculations, backup simulations from Solar and the EDM related info.

We lowered the CO2 annual emissions on the Titans (from the latest draft) but kept the previously proposed hourly rate as we are concerned about demonstrating compliance in the warmer summer months in cases where reduced loads may be required. As per our comments in the SOB we believe this rate is consistent with other single cycle turbines, particular in the Titan class.

Please call me or Andrew if you have any questions or additional comments.

Thanks again for your help on this project.

Regards,

David

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	Amb Temp	40	70	71	90	95	100	Units	
	Date Run	1/16/2014	1/16/2014	1/15/2014	12/23/2013	12/23/2013	12/23/2013		
	RH	75	75	70	70	70	70		
	Inlet Losses	4	4	4	4	4	4	in H2O	
	Exh Losses	4	4	4	4	4	4	in H2O	
	Elevation	25	25	40	40	40	40	ft	
	HP	15,128	13,943	13,884	12,592	12,215	11,849		
	heatrate	8,753	8,912	8,919	9,279	9,404	9,538	Btu/hp-hr	
	Fuel Flow	132.42	124.26	123.84	116.84	114.87	113.01	MMBtu/hr	
Load 75%	CO2	16,802.0	15,642.0	15,595.0	14,566.0	14,268.0	13,978.0	lb CO2/hr	(Provided by Solar)
	Eff	29.068	28.551	28.527	27.42	27.06	26.68		
	lb CO2/hp-hr	1.11	1.122	1.123	1.16	1.17	1.18		
	CO2 TPY	73,592.8	68,512.0	68,306.1	63,799.1	62,493.8	61,223.6		
	CH4 TPY	1.28	1.20	1.20	1.13	1.11	1.09		
	N2O TPY	0.13	0.12	0.12	0.11	0.11	0.11		
	CO2E TPY	73,659.3	68,574.4	68,368.3	63,857.7	62,551.5	61,280.4		

Draft Limits:	
0.91	lbs CO2/HP-HR - Draft Permit
75,005	TPY CO2E - Draft Permit
20,794	HP - Application
146.36	MMBtu-hr - Application
7,039	Heat Rate - Application

8760	hours per year
1	CO2 GWP
21	CH4 GWP
310	N20 GWP
2.20E-03	CH4 Rate (lb/MMBtu) - 40 CFR 60 Part 98, Subpart C
2.20E-04	N20 Rate (lb/MMBtu) - 40 CFR 60 Part 98, Subpart C
116.887892	CO2 Rate (lb/MMBtu) - 40 CFR 60 Part 98, Subpart C

	Amb Temp	40	70	71	Units		
	Date Run	1/16/2014	1/16/2014	1/15/2014			
	RH	75	75	70			
	Inlet Losses	4	4	4	in H2O		
	Exh Losses	4	4	4	in H2O		
	Elevation	25	25	40	ft		
	HP	17,145	15,802	15,736			
	heatrate	8,066	8,181	8,187	Btu/hp-hr		
	Fuel Flow	138.28	129.29	128.83	MMBtu/hr		
Load 85%	CO2	17,712.0	16,428.0	16,376.0	lb CO2/hr	(Provided by Solar)	23795.31057
	Eff	31.546	31.1	31.079			
	lb CO2/hp-hr	1.03	1.04	1.04			
	CO2 TPY	77,578.6	71,954.6	71,726.9			
	CH4 TPY	1.34	1.25	1.24			
	N2O TPY	0.13	0.12	0.12			
	CO2E TPY	77,648.0	72,019.6	71,791.6			

	Amb Temp	40	70	71	100	Units
	Date Run	1/16/2014	1/16/2014	1/15/2014	Oct-11	
	RH	75	75	70	75	
	Inlet Losses	4	4	4	4	in H2O
	Exh Losses	4	4	4	4	in H2O
	Elevation	25	25	40	25	ft
	HP	20,170	18,591	18,513	16,249	
	heatrate	7,256.00	7,414.00	7,423.00	7,706.00	Btu/hp-hr
	Fuel Flow	146.36	137.84	137.41	125.21	MMBtu/hr
Full Load	CO2	19,069.00	17,818.00	17,770.00		
	Eff	35.07	34.32	34.28	33.02	
	lb CO2/hp-hr	0.95	0.96	0.96		
	CO2 TPY	83,522	78,043	77,833	64,104	
	CH4 TPY	1.41	1.33	1.33	1.21	
	N2O TPY	0.14	0.13	0.13	0.12	
	CO2E TPY	83,596	78,112	77,902	64,167	

Cost of Gas Turbines Drivers vs. Electric Motor Drivers

Cheniere Corpus Christi Pipeline, L.P. (CCCP) performed a cursory evaluation of the costs of utilizing Gas Turbine Drivers (GTD) vs. Electric Motor Drivers (EMD) to assist in the selection of drivers for the Sinton Compressor Station. CCCP established that the capital cost for an indicative EMD was $38.2 million vs. $35.0 million for GTD for a delta of 9% savings for GTD.

CCCP calculated preliminary fuel costs for similar indicative units. These preliminary costs indicated a 175% premium for the cost of EMD vs. GTD assuming $0.08/Kwh and $4.00/MMBtu.

	EMD	GTD
Avg. Horsepower	16,245	16,245
Avg. Station drive eff.	94%	82%
Fuel Gas Consumed - MMBtu/month		98,824
Avg. Electric Power/Month - KWh	8,725,514	
Annual Fuel Cost	$8,376,494	$4,743,540

Based upon the anticipated increased capital and fuel costs associated with EMD and based upon the experience of CCCP's parent company with GTD, GTD was selected over EMD for use at the Sinton Compressor Station.

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: SInton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 1

HP=15128, %Full Load= 75.0, Elev= 25ft, %RH= 75.0, Temperature= 40.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0039	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

6424.	lbm/hr	FUEL FLOW
2349.79	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
83452.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
224245.	Acfm	ACTUAL EXHAUST FLOW CFm
376665.	lbm/hr	EXHAUST GAS FLOW
4596.3	deg R	ADIA STOICH FLAME TEMP, SDNG
28.55	---	MOLECULAR WEIGHT OF EXHAUST GAS
59.44	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	2.89	6.13	75.45	14.62	VOLUME PERCENT WET
0.96	3.08	0.00	80.38	15.57	VOLUME PERCENT DRY
4754.	16802.	14573.	278822.	61707.	lbm/hr
0.76	2.69	2.33	44.59	9.87	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: SInton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 2

HP=17145, %Full Load= 85.0, Elev= 25ft, %RH= 75.0, Temperature= 40.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0039	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

6709.	lbm/hr	FUEL FLOW
2453.91	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
86721.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
231529.	Acfm	ACTUAL EXHAUST FLOW CFm
391356.	lbm/hr	EXHAUST GAS FLOW
4616.7	deg R	ADIA STOICH FLAME TEMP, SDNG
28.55	---	MOLECULAR WEIGHT OF EXHAUST GAS
58.56	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	2.94	6.21	75.42	14.53	VOLUME PERCENT WET
0.96	3.13	0.00	80.41	15.49	VOLUME PERCENT DRY
4938.	17712.	15341.	289627.	63730.	lbm/hr
0.75	2.69	2.33	43.93	9.67	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: SInton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 3

HP=20170, %Full Load=100.0, Elev= 25ft, %RH= 75.0, Temperature= 40.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0039	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

7101.	lbm/hr	FUEL FLOW
2597.28	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
90262.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
239314.	Acfm	ACTUAL EXHAUST FLOW CFm
407162.	lbm/hr	EXHAUST GAS FLOW
4650.6	deg R	ADIA STOICH FLAME TEMP, SDNG
28.54	---	MOLECULAR WEIGHT OF EXHAUST GAS
56.54	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.90	3.04	6.41	75.34	14.31	VOLUME PERCENT WET
0.96	3.24	0.00	80.50	15.29	VOLUME PERCENT DRY
5134.	19069.	16466.	301151.	65334.	lbm/hr
0.72	2.69	2.32	42.41	9.20	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: SInton CS
JOB ID: #12-218

TITAN 130-20502S
CS/MD
59F MATCH
GAS
TLA-2S REV. 1.1

DATA FOR MINIMUM PERFORMANCE

Fuel Type		SD NATURAL GAS			
Elevation	feet	25			
Inlet Loss	in H2O	4.0			
Exhaust Loss	in H2O	4.0			
Engine Inlet Temp.	deg F	40.0	40.0	40.0	
Relative Humidity	%	75.0	75.0	75.0	
Elevation Loss	HP	14	16	18	
Inlet Loss	HP	253	281	323	
Exhaust Loss	HP	102	111	123	
Driven Equipment Speed	RPM	7863	8084	8342	
Optimum Equipment Speed	RPM	7863	8084	8342	
Gas Generator Speed	RPM	10693	10868	11220	
Specified Load	HP	75.0%	85.0%	FULL	
Net Output Power	HP	15128	17145	20170	
Fuel Flow	mmBtu/hr	132.42	138.28	146.36	
Heat Rate	Btu/HP-hr	8753	8066	7256	
Therm Eff	%	29.068	31.546	35.065	
Inlet Air Flow	lbm/hr	371713	386114	401467	
Engine Exhaust Flow	lbm/hr	376665	391356	407162	
PCD	psiG	198.2	215.7	241.1	
Compensated PTIT	deg F	1370	1370	1373	
PT Exit Temperature	deg F	960	939	917	
Exhaust Temperature	deg F	936	927	917	

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: Sinton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 1

HP=11821, %Full Load= 75.0, Elev= 25ft, %RH= 75.0, Temperature=100.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0320	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

5486.	lbm/hr	FUEL FLOW
2006.66	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
68310.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
194722.	Acfm	ACTUAL EXHAUST FLOW CFm
303367.	lbm/hr	EXHAUST GAS FLOW
4645.1	deg R	ADIA STOICH FLAME TEMP, SDNG
28.09	---	MOLECULAR WEIGHT OF EXHAUST GAS
56.00	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.86	2.94	10.36	72.18	13.65	VOLUME PERCENT WET
0.96	3.28	0.00	80.52	15.23	VOLUME PERCENT DRY
3722.	13957.	20156.	218344.	47182.	lbm/hr
0.70	2.61	3.77	40.88	8.83	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: Sinton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 2

HP=13397, %Full Load= 85.0, Elev= 25ft, %RH= 75.0, Temperature=100.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0320	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

5724.	lbm/hr	FUEL FLOW
2093.76	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
71594.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
201606.	Acfm	ACTUAL EXHAUST FLOW CFm
317929.	lbm/hr	EXHAUST GAS FLOW
4660.1	deg R	ADIA STOICH FLAME TEMP, SDNG
28.09	---	MOLECULAR WEIGHT OF EXHAUST GAS
55.71	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.86	2.95	10.39	72.17	13.62	VOLUME PERCENT WET
0.96	3.29	0.00	80.54	15.20	VOLUME PERCENT DRY
3901.	14701.	21181.	228805.	49335.	lbm/hr
0.69	2.61	3.77	40.67	8.77	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: Sinton CS
JOB ID: #12-218

--- SUMMARY OF ENGINE EXHAUST ANALYSIS ---
POINT NUMBER 3

HP=15761, %Full Load=100.0, Elev= 25ft, %RH= 75.0, Temperature=100.0F

GENERAL INPUT SPECIFICATIONS

ENGINE FUEL: SD NATURAL GAS

29.90	in Hg	AMBIENT PRESSURE
75.0	percent	RELATIVE HUMIDITY
0.0320	---	SP. HUMIDITY (LBM H2O/LBM DRY AIR)

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

GENERAL OUTPUT DATA

6074.	lbm/hr	FUEL FLOW
2221.86	Scfm	FUEL FLOW
20612.	Btu/lbm	LOWER HEATING VALUE
939.	Btu/Scf	LOWER HEATING VALUE
76293.	Scfm	EXHAUST FLOW @ 14.7 PSIA & 60F
213265.	Acfm	ACTUAL EXHAUST FLOW CFm
338745.	lbm/hr	EXHAUST GAS FLOW
4681.4	deg R	ADIA STOICH FLAME TEMP, SDNG
28.09	---	MOLECULAR WEIGHT OF EXHAUST GAS
54.96	---	AIR/FUEL RATIO

EXHAUST GAS ANALYSIS

ARGON	CO2	H2O	N2	O2	
0.86	2.99	10.46	72.14	13.54	VOLUME PERCENT WET
0.96	3.34	0.00	80.57	15.12	VOLUME PERCENT DRY
4155.	15872.	22731.	243730.	52250.	lbm/hr
0.68	2.61	3.74	40.12	8.60	g/(g FUEL)

SOLAR TURBINES INCORPORATED DATE RUN: 16-Jan-14
ENGINE PERFORMANCE CODE REV. 4.10.1.11.5 RUN BY: Leslie Witherspoon
CUSTOMER: Sinton CS
JOB ID: #12-218

TITAN 130-20502S
CS/MD
59F MATCH
GAS
TLA-2S REV. 1.1

DATA FOR MINIMUM PERFORMANCE

Fuel Type	SD NATURAL GAS			
Elevation	feet	25		
Inlet Loss	in H2O	4.0		
Exhaust Loss	in H2O	4.0		
Engine Inlet Temp.	deg F	100.0	100.0	100.0
Relative Humidity	%	75.0	75.0	75.0
Elevation Loss	HP	11	12	14
Inlet Loss	HP	210	232	266
Exhaust Loss	HP	93	99	109
Driven Equipment Speed	RPM	7428	7675	8029
Optimum Equipment Speed	RPM	7428	7675	8029
Gas Generator Speed	RPM	10823	10988	11220
Specified Load	HP	75.0%	85.0%	FULL
Net Output Power	HP	11821	13397	15761
Fuel Flow	mmBtu/hr	113.08	117.99	125.21
Heat Rate	Btu/HP-hr	9566	8807	7944
Therm Eff	%	26.599	28.891	32.030
Inlet Air Flow	lbm/hr	299073	313401	333839
Engine Exhaust Flow	lbm/hr	303367	317929	338745
PCD	psiG	167.9	181.9	201.4
Compensated PTIT	deg F	1382	1379	1395
PT Exit Temperature	deg F	1033	1008	992
Exhaust Temperature	deg F	1020	1002	992

FUEL GAS COMPOSITION (VOLUME PERCENT)
LHV (Btu/Scf) = 939.2 SG = 0.5970 W.I. @60F (Btu/Scf) = 1215.6

Methane (CH4)	= 92.7899
Ethane (C2H6)	= 4.1600
Propane (C3H8)	= 0.8400
N-Butane (C4H10)	= 0.1800
N-Pentane (C5H12)	= 0.0400
Hexane (C6H14)	= 0.0400
Carbon Dioxide (CO2)	= 0.4400
Hydrogen Sulfide (H2S)	= 0.0001
Nitrogen (N2)	= 1.5100

STANDARD CONDITIONS FOR GAS VOLUMES: Temperature: 60 deg F Pressure: 29.92 in Hg
NORMAL CONDITIONS FOR GAS VOLUMES: Temperature: 32 deg F Pressure: 29.92 in Hg

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.