

# 12.5 MW Gas Fired Power Plant Project Economic Analysis

April 2013



# A. General

## 1.0 Back Ground

The Company owned 1 (one) existing 15 MW (ISO)Titan 130 dual fuel unit and it is available for immediate use (with guaranteed output of 12.5 MW), the unit is installed and commissioned in 2010 using 100% natural gas in Tangerang, Banten, Indonesia.

Actual condition is zero hours

Beside the GTG, the company is also have Steam Unit which can be modified to run the additional steam turbine with capacity of 2.3 MW

The total Combine Cycle Unit will produce 14.8 MW of electricity

## 2.0 Objective

The Company like to sell the Gas Turbine Titan 130 Turbomach, with condition Zero Hour include Spare parts and accessories transferable maintenance contract from Turbomach. For HRSG boiler 50 tons 1 unit manufacturing in 2012 complete set with accessories. Exclude Water treatment supply system. All price is Exclude Mom D e Mom, Exclude any Tax, Exclude reinstall. The payment terms is fully paid against Sell contract signed.

h  
h  
h  
h  
h

T  
h  
h  
h h  
h  
h  
h  
h  
h h

# Solar Turbines

*A Caterpillar Company*

September 6, 2012

To:

Contract No.: LTSA 932-C-01

To Whom It May Concern:

With reference to our recent discussions that took place on August 28, 2012 concerning the possibility of transferring the current Full Maintenance Contract (LTSA 932-C-01) to another user should elect to sell its Gas Turbine package, we can confirm that such transfer is possible under the general conditions set by Solar Turbines / Turbomach SA for entering into a contractual relation.

Kind Regards,

**Kristel Gordon**  
Customer Services Account Manager  
Power Generation Asia

# Attachments

Pictures



# Solar Turbines

A Caterpillar Company

## PREDICTED ENGINE PERFORMANCE

Customer	
Job ID	
Run By <b>Umberto Vecchio</b>	Date Run <b>16-May-12</b>
Engine Performance Code <b>REV. 3.54</b>	Engine Performance Data <b>REV. 0.3</b>

Model <b>TITAN 130-20501 Axial</b>
Package Type <b>GSC 50 Hz</b>
Match <b>STANDARD</b>
Fuel System <b>GAS</b>
Fuel Type <b>CHOICE GAS</b>

### DATA FOR NOMINAL PERFORMANCE

Elevation	metres	10
Inlet Loss	mm H2O	100.0
Exhaust Loss	mm H2O	250.0

		1	2	3
Engine Inlet Temperature	deg C	30.0	30.0	30.0
Relative Humidity	%	80.0	80.0	80.0
Gearbox Efficiency		0.9850	0.9850	0.9850
Generator Efficiency		0.9800	0.9800	0.9800

Based On 1.0 Power Factor

		FULL	5000	4500
Specified Load*	kW	FULL	5000	4500
Net Output Power*	kW	12966	5000	4500
Fuel Flow	MW	39.24	22.09	21.04
Heat Rate*	kJ/kW-hr	10892	15904	16830
Therm Eff*	%	33.047	22.632	21.387

Engine Exhaust Flow	kg/hr	166134	164884	164804
PT Exit Temperature	deg C	517	364	354
Exhaust Temperature	deg C	517	364	354

Fuel Gas Composition (Volume Percent)	
Methane (CH4)	96.08
Ethane (C2H6)	1.06
Propane (C3H8)	1.18
I-Butane (C4H10)	0.07
N-Butane (C4H10)	0.09
I-Pentane (C5H12)	0.03
N-Pentane (C5H12)	0.02
Hexane (C6H14)	0.02
Heptane (C7H16)	0.0100
Carbon Dioxide (CO2)	0.36
Nitrogen (N2)	1.08
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties	LHV (kJ/Nm3)	36446.3	Specific Gravity	0.5824	Wobbe Index at 60F	1213.6
---------------------	--------------	---------	------------------	--------	--------------------	--------

\*Electric power measured at the generator terminals.

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.

# Turbomach

A Caterpillar Company

Process Steam Flow : 40'000 kg/h

Thermal Power Available : 27'426 kW

8 barG / Saturated Steam

Cond : 34'364 kg/h / 80°C

Make-up : 6'064 kg/h / 32°C

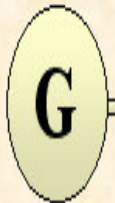
LHV Fuel : 47'940 kJ/kg

Std. Natural Gas : 38'017 kW

Air : 35°C

Evap. Cooler  
(Not Applied)

35°C



12'264 kWe

TITAN 130

523 °C  
0.23 kg/s

44.8 kg/s

523°C

Firing Temp.: 1'690°C

Std. Natural Gas : 9'061 kW

Waste Heat  
Recovery Boiler

105°C

44.99 kg/s

153°C

Blowdown : 428 kg/h

72°C

2'355 kg/h

42'355 kg/h

44.99 kg/s

105°C

44.99 kg/s

153°C

428 kg/h

72°C

105°C

153°C

428 kg/h

72°C

105°C

153°C

428 kg/h

Nominal Plant Efficiency : 84.3 %

Site Conditions : Std. Natural Gas, 10 m a.s.l., Inlet Duct Loss : 100mmH2O, Exhaust Duct Loss : 250mmH2O

FOR INFORMATION ONLY

Date

Project no.

ID08-1040

Drawing

Expected Nominal Performance

Turbomach

A Caterpillar Company

## Unit Specifications | Spesifikasi Mesin

### Gas turbine specification

Manufacturer	SOLAR (TURBOMACH Company)
Model	titan 130 (T-20501)
Operation	continuous
Turbine design	open cycle, single shaft, cold-end drive
Compressor	14 stage, axial
Compression ratio	16:1
Combustion chamber	annular with 21 injector
Turbine	3 stage, axial-reaction
Turbine speed	11197 rpm
Nominal shaft power rating	15587 kW
Heat input	42613 kJ/s
Turbine air inlet flow	48.9 kg/s
Exhaust gas temperature	496°C
Exhaust gas mass flow	49.7 kg/s
Thrust bearing	tilting pad type

### *All performance data at ISO conditions*

#### Miscellaneous

Compressor air inlet plenum including horizontal flange and flexible bellows

Insulating mats, covered by aluminum metal sheet

Gas turbine overall dimensions (including gearbox)	L =	7277 mm
	W =	1770 mm
	H =	1880 mm

Gas turbine weight	approx.	9600 kg
--------------------	---------	---------

#### Nominal performance data

Gas turbine load	base load
Barometric pressure	1012 bar
Relative air humidity	80 %
Inlet duct pressure loss	100 mm H <sub>2</sub> O
Exhaust duct pressure loss	150 mm H <sub>2</sub> O
Fuel type	natural gas & diesel #2

## Unit Specifications

### TRAFINDO Transformer

Phase	: 3	type of cooling	: ONAN
Frequency	: 50 Hz	vector group	: YNd - 5
KVA	: 16500	temp rise oil / winding °C	: 60/65
Volt HV	: 20000	Transformer oil - liter	: 8080
LV	: 11000	Transformer weight	: 27500
Ampere HV	: 476,31	Impedance %	: 10
LV	: 866,03	Insulation class	: A
order No	: 09-0223	BIL (KV) HV LI 125 AC 50 / LI 75 AC 28	
serial No	: 091 300783		
year of manufacture	: 2009		
standard	: IEC 6007		

## Spesifikasi Mesin

### UNINDO

Transformer No. 84069 Year 2008	: 3 phase 50 Hz
Nominal rating (KVA)	: 2000 2000
	Primary secondary
Victory group	: D Yn 5
Nominal voltage volt	: 21000
	20500
	20000 400
	19500
	19000
Nominal current (Amp)	: 57,7 2886,8
Impedance voltage	: 7 %
Cooling ONAN, type of oil	: mineral oil
Temp rise °C oil	: 60
Winding	: 65
Insulation Level	: 125 KV
Total weight	: 4395 kg
Oil weight	: 1155 kg



## Unit Specifications

### Air compressor

Product type	: GA 37 + PA 10
Serial no	: WUX 305645
Max working pressure	: 10 bar
Free air delivery	: 95,1 L/s
Nominal shaft power	: 37 KW
Nominal rotation shaft speed	: 2960 r/min
Gross weight	: 1000 kg
Year of construction	: 2009 . 4 .

Made by ATLAS COPCO compressor. Co Ltd

Comp air P Max	: 13 bar (e)
Ambient max	: 50 °C
Refrig type	: R410A
Refr P. Max Height	: 43 bar °C

Made by ATLAS COPCO. Co Ltd

### AIR TANK

Air receiver tank type	: cylindrical – vertical
Volume	: 5000 liter
Serial Number	: 001/DPT/VII/2009
Working pressure	: 10 kg/cm <sup>2</sup>

### Air dryer

Type	: FD 120
Year	: 2009
Weight	: 157 kg

### BOILER HRSG (Optional)

Manufactured by Mackenzie industries SDN. BHD

Design code ASME SEC 1-2007. ADDENDA 2009 B

Design pressure	: 3000 KPa
Design temp	: 262.5 deg C
Hydro-test pressure	: 4500 KPa
Boiler capacity	: 50000 kg/hr
Approval no	:
Year build	: 2011
Boiler serial no	: 110063
Manufacture no	: MB 10009
Inspection authority	: LLOYD'D REGISTER VERIFICATION
Hydro-test no	: 11/036

**Activity**

Tanggal : 28/11/2012										Hari : Rabu
Jam	Turbine Generator Running Load (MW)		Gas Compressor Running Press (Bar)		Air Compressor		Air Dry (°C)	TI (°C)	Keterangan	
					Pressure	Temperature				
<b>Shift I ( Wahyu &amp; Deni )</b>										
08	9,9	mw	23,3	Baru	7,5	98 °C	2,3	34	Turbine status running	
09	10	mw	23,3	Baru	7,4	93	2,1	35		
10	9,9	mw	23,2	Baru	7,1	75	1,8	34	* Drain oil filter Gas Compressor.	
11	9,9	mw	23,3	Baru	7,2	83	2,3	35	* Drain Air Comp & Air Dryer.	
12	9,9	mw	23,2	Baru	7,5	97	2,1	36	* Cleaning Area Room Control turbine & HRS.	
13	9,7	mw	23,3	Baru	7,5	96	2,3	36	* Shower out cooler turbine.	
14	10,2	mw	23,2	Baru	7,4	94	2,3	36,8	* Cleaning dari gangguan Ar.d. Area Turbine & HRS.	
15	9,7	mw	23,3	Baru	7,2	82	2,1	35		
<b>Shift II ( Wahyudeni &amp; Heri &amp; MUCIM ) longshift.</b>										
16	9,9	mw	23,3	Baru	7,4	90	2,1	35		
17	9,9	mw	23,3	Baru	7,3	89	2,1	33		
18	9,7	mw	23,3	Baru	7,4	93	2,1	33		
19	9,9	mw	23,3	Baru	7,2	77	2,1	33		
20	9,9	mw	23,3	Baru	7,2	80	2,1	33	- Turbine status Running	
21	10,1	mw	23,3	Baru	7,5	93	2,1	31		
22	10	mw	23,3	Baru	7,6	107	2,3	31	-	
23	9,8	mw	23,3	Baru	7,5	9,3	2,1	31	-	
<b>Shift III ( Hanradi &amp; MUCIM )</b>										
24	9,8	mw	23,3	Baru	7,5	85	2,1	31	Turbine Status Running	
01	10,1	mw	23,3	Baru	7,2	81	2,1	31		
02	10,2	mw	23,3	Baru	7,2	80	1,8	31	* Shower out cooler turbine.	
03	10	mw	23,3	Baru	7,3	80	2,1	31	* Drain Oil Filter Gas Turbine.	
04	10	mw	23,3	Baru	7,1	73	1,8	31	* Cleaning Filter karcher	
05	9,8	mw	23,3	Baru	7,2	80	1,8	31	* cek Drain Air Comp & Air Dryer.	
06	9,9	mw	23,3	Baru	7,2	78	1,8	31	* cleaning filter karcher.	
07	9,9	mw	23,3	Baru	7,1	77	1,8	31		

NB :	Shift I	11:29	power	10,1 mw	T <sub>5</sub> = 711 °C
			"	10,2 mw	T <sub>5</sub> = 717 °C
			"	10,1 mw	T <sub>5</sub> = 710 °C
			"	10,1 mw	T <sub>5</sub> = 718 °C
			"	10,2 mw	T <sub>5</sub> = 723 °C
			"	10,2 mw	T <sub>5</sub> = 720 °C
			"	10,3 mw	T <sub>5</sub> = 724 °C
			"	10,3 mw	T <sub>5</sub> = 725 °C
			"	10,3 mw	T <sub>5</sub> = 726 °C
Shift II					
04:03					
→ 9,7 mw → power increase 10 mw → Gas fuel press = 22,9 Bar.					