

# **Equipment Offering**

## **Solar Taurus 60 Turbine Generators Sets**

### **Generation One**

**Dual fuel piped / Natural gas fired**

## SCOPE OF EQUIPMENT

# Generation One

The following turbine generating equipment is offering for your consideration:

Solar Taurus 60.

This offer includes for each turbine:

11. Enclosed skid mounted Taurus 60 units (operating on natural gas)
12. Dual fuel option: Units are piped for liquid fuel but do not have the injection nozels. Units are currently set up for natural gas operation. Dual fuel option includes all liquid piping installed with booster pump, **adding the D-2 fuel injectors and liquid fuel manifold. SoLoNox reduction systems do not reduce emissions when operating on liquid fuel.**
13. SoLoNOx dry low-NOx combustion system. (On natural gas)
14. Each Taurus 60 turbine generator package is capable of producing a nominal 5,200 kW at 13,800 volts in peaking service, subject to site conditions.
15. Complete with all associated turbine inlet and exhaust systems, transformer, fire suppression systems, ladders, gangways and related operational ancillary support items.
16. Each unit comes equipped with a Power Control Room (PCR) Building and the associated ancillary equipment.
17. Units are in excellent condition with very low runtime hours each. The units have been in minimal commercial operation. Re certified by Solar and ready for deployment.
18. Units have the wheels removed and the trailer deck lowered to the ground as shown in this picture. The turbine unit can be removed from the trailer deck by removing eight bolts from the base of the turbine housing and lifting the unit off of the trailer deck.
19. The trailer (detachable deck) is included in the price each of the Solar Taurus 60 unit. "T-60 is bolted down on each deck"
20. The double drop deck detachable trailer jeep and stinger come with every second unit bought
21. Each PCR building has its own tandem (extendable) drop deck trailer included.
22. Solar service and maintained.
23. Price quoted is loaded onto your trucks FOB Broken Arrow Oklahoma "all equipment"

11.

BASIC PACKAGE

## SCOPE OF EQUIPMENT

The Taurus 60 Industrial Power Generator (IPG) is a compact, rugged gas turbine generator set that has been designed to meet the requirements for industrial power generation applications. The unit is provided as a completely integrated module ready for installation. The gas turbine engine, gearbox, generator, control system, fuel system, lubrication system, start system, and ancillary equipment

Needed for site operation on natural gas are included with each unit. .

Each package includes a sound attenuated enclosure for the turbine generator and a PCR control building to house all generator and turbine control functions.

Approximate overall dimensions are: 32 feet, 0 inches (9753 mm) long 8 feet, 0 inches (2438 mm) wide

Approximate height of package is 10 feet, 8 1/4 inches (3258 mm) and may vary with ancillary equipment and generator selection. Four lifting gussets are provided on each section.

Drip pans are welded beneath the package frame to collect potential liquid spills. The drip pans also provide a tight seal for containment of fire suppression agent for packages supplied with an enclosure.

Tube Fittings. All tube connections use compression fittings. Tubing and fittings are 316 stainless steel.

Piping. Package piping is designed and fabricated to ANSI B31.3.

Electrical System.

The Taurus 60 IPG generator set is designed to comply with the requirements of the National Electrical Code and is intended to be installed in a non-hazardous location per the NEC.

Unless otherwise noted package motors and heaters are rated for 460 VAC, 60 Hertz, 3 phase. Motor space heaters are provided for motors over 5 hp (3.75 kW) and are rated for 120 VAC, 60 Hertz, 1 phase.

Fire Detection and Suppression System. The gas turbine enclosure will be provided with ultra violet fire detectors and fire monitoring system. The fire suppression system agent is CO<sub>2</sub>. In the event of a fire being detected within the unit, the unit will shutdown, the enclosure ventilator louvers will close, and horns will sound.

Gas Detection System. Gas detection monitors are provided in the turbine enclosure. Upon detection of 20% LEL, alarms will sound. Upon detection of 75% LEL, the unit will shut down and all louvers will open, and all ventilator fans will activate.

## II. GAS TURBINE ENGINE

1. The Taurus 60 gas turbine engine is a single shaft axial flow engine. The output gearbox, including accessory drive pads, is a separate, close-coupled unit located at the inlet end of the turbine.
2. The engine assembly consists of:
3. Gear unit with accessory drive pads
4. Air inlet collector with flexible flange connection
5. Axially split case in the vertical plane, eleven-stage axial flow compressor with variable temperatures.
6. Geometry control on inlet guide vanes and first two rows of stators

## SCOPE OF EQUIPMENT

7. Annular Sol
8. SoLoNox combustor with 12 lean premix fuel injectors
9. Three-stage turbine assembly
10. Turbine exhaust collector
11. The components of the Taurus 60 engine are maintained in accurate alignment by mating flanges with pilot surfaces and are bolted together to form a rigid assembly. The speed-reducing gearbox is driven by the compressor rotor shaft. Accessory pads drive the main lube oil pump and other accessories, depending on the application, and support the starter motor.
12. The gas turbine output shaft is mechanically connected to both the compressor and turbine sections of the engine to form a "solid" or "single" shaft configuration. This feature enhances speed stability and response under constant and varying load conditions -- a highly desirable feature in generator applications requiring precise frequency control.

### III. SPEED REDUCING GEARBOX

- A. The speed-reducing gearbox is an industrial design manufactured by Solar specifically for the Taurus 60 IPG generator set. The gearbox mounts directly on the Taurus 60 gas turbine to reduce engine speed to 1800 rpm (60 Hz).

## IV. GENERATOR

Generator Rating. Generator nameplate rating per NEMA standards is 6,625 Kva at 0.8 power factor (5,300kw) 13,800 volts at 104°F (40°C), 3281 ft (1000 m) elevation for continuous duty. The generator is rated so that the generator will not limit turbine performance over the range of site ambient temperatures.

- Generator Standard Features
- Sleeve Bearings with pressure fed sumps
- Six-lead WYE connection
- Terminal box
- Form wound stator windings
- Damper windings
- Rotor balance to 125% rated speed
- Permanent magnet pilot exciter
- Anti-condensation space heaters
- 300% short circuit capability for 10 seconds

Overload capacity per NEMA:

- 150% rated current for 1 minute (b) 110% for 2 hours
- Voltage Regulator Characteristics
- Solid state
- Single-phase sensing
- $\pm 10\%$  voltage adjustment range
- 0.5% steady state voltage regulation
- Reactive load sharing to within 5% nameplate rating
- Crosscurrent compensation capability
- Wave Form Characteristics

## SCOPE OF EQUIPMENT

Deviation Factor
Harmonic Content [maximum]
Telephone Interference Factor
Balanced Residual

**Voltage Drift.** The change in voltage will not exceed 1.0% over a 30-minute period when the generator is operating at rated voltage and 0.8 to 1.0 power factor and with a constant load between no load and full rated load.

Generator Voltage. The generator output is 13,800 Volt, 3 phase, 60 Hz.

Insulation conforms to NEMA class F with class F (105C°) temperature rise.

### **V. TURBINE START SYSTEM**

A direct drive AC motor is provided to start the Taurus 60 engine. A variable frequency drive [VFD] motor controller is included for installation in the motor control center [MCC]. 3 phase AC power is required at 460VAC, 60Hz, 250 Amperes. The control system provides all required sequencing to quickly and reliably start the turbine.

## VI. FUEL SYSTEM

The fuel system, in conjunction with the electrical control system, includes all necessary components to control the fuel pressure, to schedule fuel flow during start-up, and to modulate fuel flow during operation.

**Natural Gas Fuel.** A natural gas fuel system is provided with all components necessary to maintain turbine speed to provide a constant generator output frequency and/or load depending on the generator set mode of operation. Solar's Specification ES 9-98 contains the specific fuel requirements.

The natural gas fuel system includes: Primary fuel shutoff valve, Pilot-operated secondary fuel shutoff valve

- Electronic fuel actuator
- 10-micron pilot gas filter
- 2 fuel injector assemblies
- Valve check pressure switch
- High gas fuel pressure shutdown switch

Gas strainer System requirements for the natural gas fuel are as follows:

Requires a constant supply of gas at a maximum flow demand rate of 32.2 nm<sup>3</sup>/min (1200 scfm) at 1725-kpa-gauge (225 psig) minimum pressure. Gas fuel pressure is used to operate the fuel system pilot valve.

The gas fuel should be free of sulfur, contaminants, entrained water, and liquid hydrocarbons  
Gas fuel must conform to Solar's Specification ES 9-98

### **VII. LUBE OIL SYSTEM**

A complete lube oil system suitable for operation with lube oil conforming to Solar's Specification ES 9-224 is included. The lube oil system provides oil to the bearings in the Taurus 60 gas turbine engine, gearbox and generator. Instrumentation, flow control and on frame piping are included.

**Main Lube Oil Pump.** An engine driven lube oil pump is provided with suction strainer. Post Lube Backup Pump. A 1.5hp (1.1 kW) AC motor driven pump is provided to supply post operation lube oil flow in the event of power failure. Power is provided by a 24 VDC battery system through a VFD/ inverter.

## **SCOPE OF EQUIPMENT**

**Drain Line Sight Glasses.** Sight glasses are provided on the drain lines from all gas turbine, generator and gearbox bearings. Note that some of the gas turbine bearings have a common drain line.

**Lube Oil Tank.** A 420-gallon operating capacity carbon steel lube oil tank is provided. The lube oil tank is integral with the package frame. Lube oil level indicator, fill connection with inlet strainer and drain connections are included.

**Lube Oil Tank Heater.** A thermostatically controlled 4.5 kW lube oil tank heater is provided. Electric power requirements are 460 V, 60 Hz, three phase.

**Lube Oil Vent Separator.** An off skid mechanical coalescer element is provided to remove oil vapor from the lube oil tank vent. Recovered oil drains back to the lube oil tank. Interconnect piping between the frame flanges and the vent separator is not included in Solar's scope. The vent separator is nominally rated for less than 0.2 gallons/day (0.76 L/day) oil loss.

**Lube Oil Cooler.** An air/oil lube oil cooler is provided. The fan is driven by a 3.7 kW AC motor. The lube oil cooler is designed for off skid installation. Interconnect piping between the frame flanges and the lube oil cooler is included according to current design.

**Lube Oil Type.** Lube oil is not included. The lube oil supplied must be consistent with the requirements of Solar specification ES 9-224.

**Lube Oil Filter.** Single 5-micron oil filter units are provided with drain, fill and vent valves.

## **VIII. CONTROL SYSTEM**

**Solar Control System.**

The Turbotronic control system is provided and is a highly integrated programmable logic controller [PLC] based control system. The control system is installed on the package frame to minimize interconnect wiring.

The control system includes a microprocessor, remote communications modules; chassis based and flex input/output modules, line synchronization module, power supplies and a hardware backup shutdown system.

The control system provides for control of all phases of package operation to include start and shutdown sequencing, normal operation, and malfunction shutdown.

**Vibration Monitoring.** Vibration monitoring is provided to include three proximity probes, one per bearing, on the Taurus 60 engine. One accelerometer is provided with the gearbox. Two velocity transducers, one per bearing is provided with the generator. Preset warning indications and malfunction shutdown initiation are provided.

**Temperature Monitoring.** Temperature monitoring is provided to include the Taurus 60 engine thrust bearing, lube oil drains, and lube oil header and the generator bearings and stator windings. Preset warning indications and malfunction shutdown initiation are provided. Ambient, lube oil tank and enclosure temperatures are also monitored.

**Audible Alarm.** An audible alarm horn is provided to sound whenever the unit has an alarm or shutdown condition. A horn silence push button is mounted on the face of the control panel.

**Local Display.** The control system is installed on the package frame in weatherproof enclosures. A digital control panel [DCP] with all of the necessary switches and indicators is provided. In addition to display of "first out" malfunctions, the DCP can display:

System summary/normal running data o System status

Digital display of engine and generator parameters

Alarms and Shutdowns

**Engineering Units.** Temperature data is displayed in °F. Pressure data is displayed in pounds per square inch [psi].

**Language.** Package labels and screen displays are in English.

**Supervisory Interface.** An RS 232C/422-interface module is provided to give the user's supervisory computer access to the Turbotronic control system data. Limited control capability is provided to allow the supervisory computer to start and stop the unit, reset alarms, and



## **SCOPE OF EQUIPMENT**

raise/lower speed and load set points. The communications protocol is Allen Bradley's DF1. The interface module may be located up to 10,000 feet (3,048 meters) from the turbine control system and located up to 50 feet (15 meters) from the supervisory computer for the RS 232C module or 4,000 feet (1,219 meters) for the RS 422 module. The modules are "table top" units and require 120 Vac, 50/60 Hz power.

### **IX. GENERATOR CONTROL AND MONITORING**

Integrated monitoring and control of the generator is provided using a specially designed module in the PLC to receive input data from potential and current transformers. The system calculates real and reactive power, power factor and the variables required for synchronization. Automatic Synchronizing. An automatic synchronizer is provided with the control system to automatically synchronize the unit to the bus through push-button control on the digital control panel [DCP] or by receipt of an appropriate remote signal. A synch check relay is provided as an additional permissive and for backup protection.

Motorized Voltage Adjust. Raise/lower voltage push button control is provided on the digital control panel to control a motorized potentiometer for voltage control. An additional raise/lower switch, supplied by others, may be used to control voltage from a remote location.

KW Controller. A kW import controller is provided to control the real load (kW) on the generator set while operating in parallel with a utility or other large source. The kW controller monitors the load imported from the utility source and adjusts the generator set fuel flow to maintain a pre-set level of imported power on the utility at all times. This control mode is for applications where it is desired to prevent any power from being exported to the utility. Protection against excessive kW load while in parallel with a large source is provided by the control system "T5" temperature limiter. The kilowatt load level select switch and adjustment is located on the digital control panel.

KVAR/Power Factor Controller. A kvar/power factor controller is provided to maintain a constant reactive load (WAR) output or constant power factor (pf) on the generator set while the unit is operating in parallel with a utility or other large source. The controller applies a signal directly to the voltage regulator adjust circuit to maintain a constant reactive load or power factor with changes in the infinite bus voltage level. The system incorporates a set point adjust rheostat to set the desired WAR or pf, a selector switch to choose WAR or pf control mode, and a switch to turn the controller on and off.

### **X. ADDITIONAL ANCILLARY EQUIPMENT**

The following additional ancillary equipment is also provided for the turbine-generating package:

- (a) Neutral Ground Resistor
- (b) (b) Auxiliary Load Transformer (13.8 kv:480 V, 60 Hz). This transformer eliminates the requirement for an alternate 480VAC shore power supply.
- (c) (C) Liquid Fuel Boost Pump (with dual fuel option)
- (d) XI. DRAWINGS
- (e) One set of standard drawings is provided with each turbo machinery package.
- (f) XII. OPERATION AND MAINTENANCE MANUALS
- (g) One set of operation and maintenance manuals are provided with each turbo machinery package.

### **SECTION 3**

**POWER CONTROL ROOM (PCR) BUILDING FOR A SOLAR TAURUS 60 POWER GENERATOR SET:**

Utility Grade 15KV class metal clad paralleling switchgear:

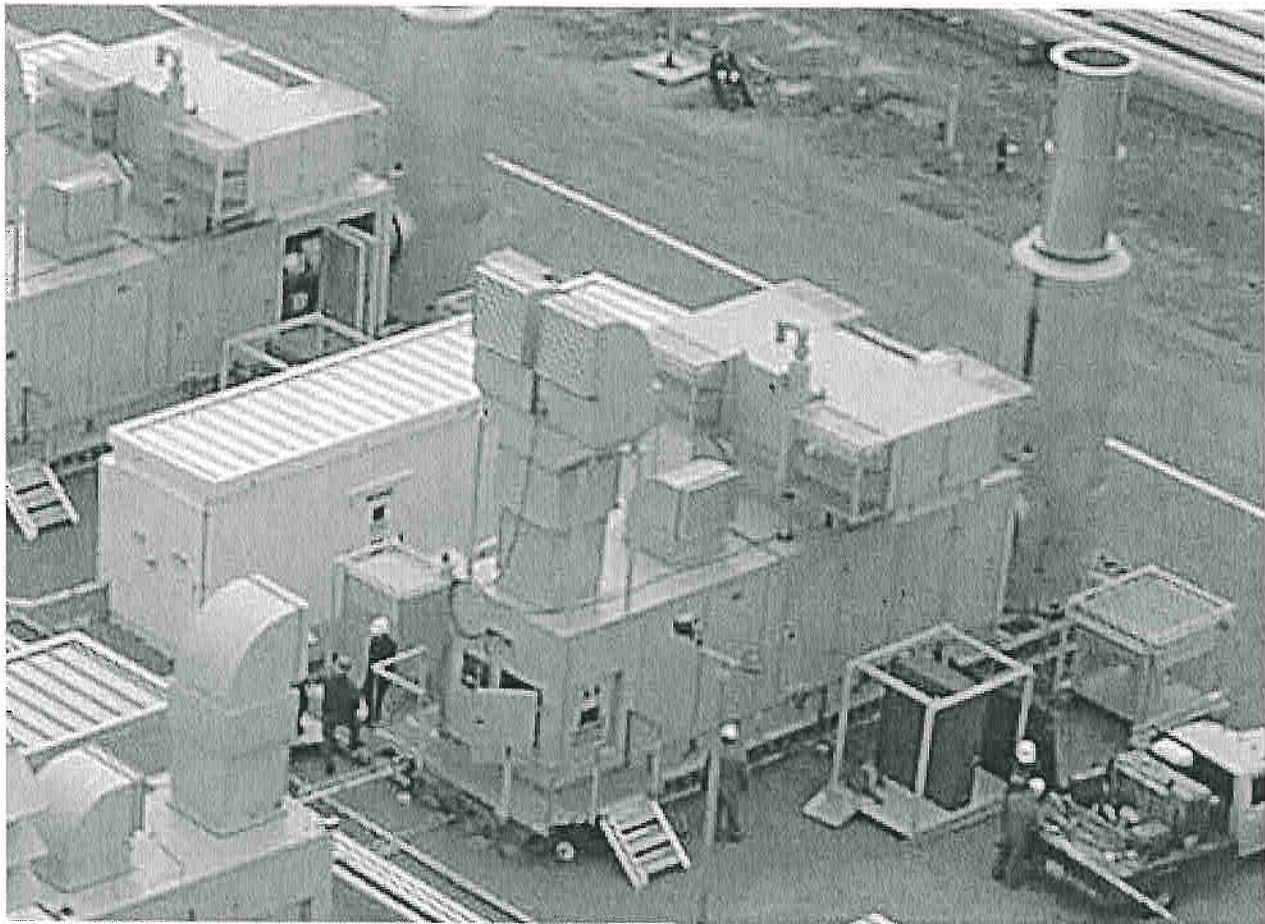
## SCOPE OF EQUIPMENT

- The Power Control Room Building contains the following equipment:
- PCR HVAC system
- Generator Main Circuit Breaker 15KV
- Auxiliary Transformer Feeder Circuit Breaker
- Bus pts, Feeder cts, Metering cts and pts, and Protective Relay Module
- Lightning Arrestor and Surge Capacitor
- Motor Control Center (Serves Turbine Generator 480VAC Auxiliary Loads)
- 120VDC Turbine Generator Battery System with Charger
- Dedicated 120VDC Switchgear Battery System with Charger

12.

13.

14.





**Table 1. Performance Data ISO\*, XQ5200 Mobile Power Unit**

	English	Metric
<b>Power Output</b>	5,200 kWe	5,200 kWe
<b>Heat Rate</b>	11,263 Btu/Kwe-hr	11,900 kJ/Kwe-hr
<b>Fuel Flow (LHV)</b>	59.8 mmBTU/hr	59.8 mmBTU/hr
<b>Emissions, NOX</b>	25 PPMvd	25 PPMvd
	5.84 LBM/Hr	2.65 kG/Hr
<b>CO</b>	50 PPM vd	50 PPM vd
	7.1 LBM/Hr	7.1 LBM/Hr
<b>Gen. Voltage</b>	12.47or 13.8 kV	3.22 kG/Hr
<b>Gen. Frequency</b>	60 Hz	60 Hz
<b>Voltage Steady State</b>	0.5%	0.5%
<b>Short Circuit</b>	300% for 10 sec.	300% for 10 sec.

\* ISO, Sea Level. 60% relative humidity, Natural Gas Fuel, No inlet or exhaust losses.

**Table 2. Dimensional Data & Weights, Installed, XQ5200 Mobile Power Unit**

	English	Metric
<b>Length</b>	48 ft.	14.6 meters
<b>Width</b>	21 ft.	6.4 meters
<b>Height</b>	26.6 ft.	8.1 meters
<b>Installed Weights</b>		
<b>Turbine Section</b>	118,000 lbs	54 M tons
<b>PCR Trailer</b>	55,000 lbs	25 M tons

**Table 3. Dimensional Data & Weights, Installed, XQ5200 Mobile Power Unit**

	English	Metric
<b><u>Natural Gas Fueled</u></b>		
Gas Pres.	250 PSIG	172 KPAG
Max. Gas Demand	1,400 SCFM	39.6 M <sup>3</sup> /Min
<b><u>Foundation</u></b>		
Gravel Compacted to	2,500 lbs/ft <sup>2</sup>	120 kPA
<b><u>Fuel Quality</u></b>		
Clean Dry Fuel Per Solar		
Spec ES 9-98		

**TAURUS 60-T7300S****GSC STANDARD****Std. Natural Gas Fuel****Rel Humid, %**

85

**SITE ELEVATION:**

0 feet

**BAROMETRIC PRESSURE:**

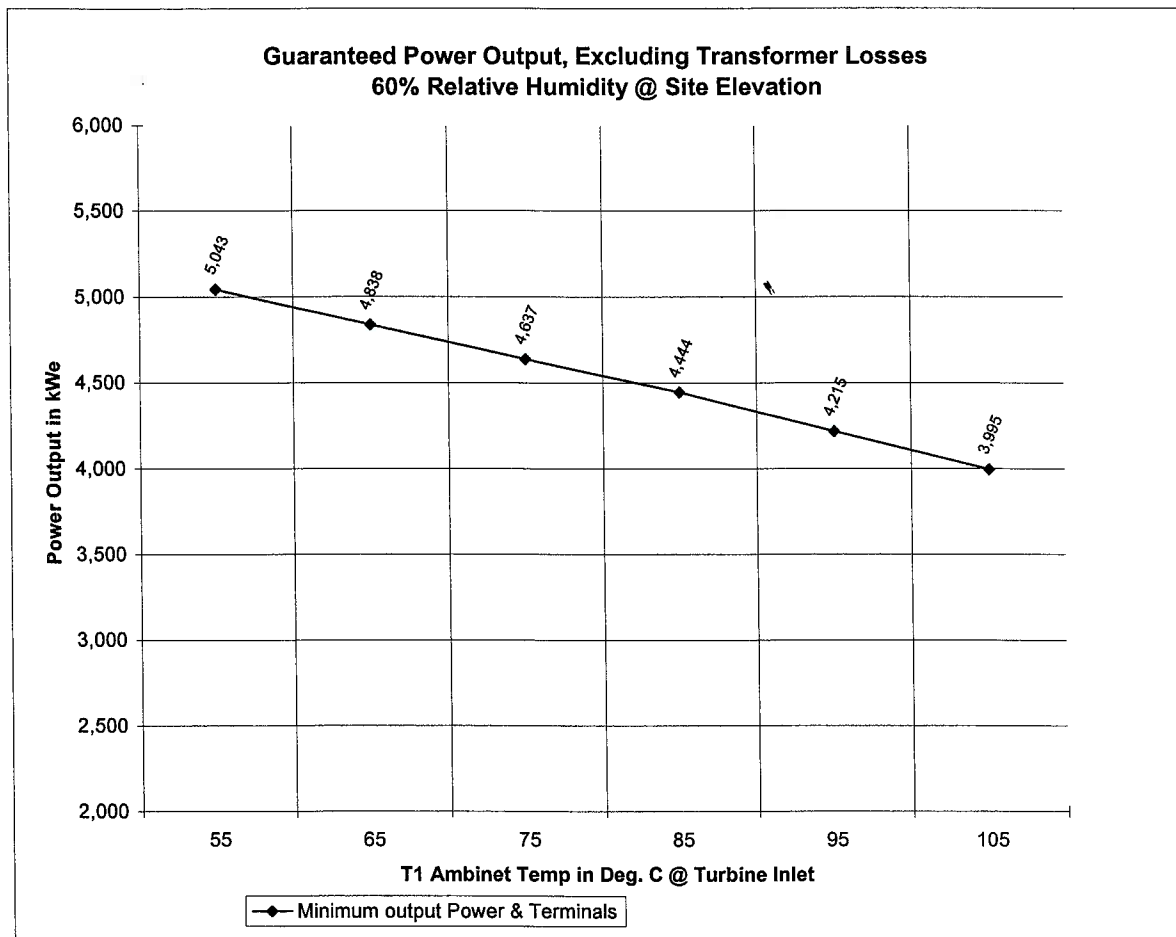
29.9 "Hg

**INLET DUCT LOSS:**3 "H<sub>2</sub>O**EXHAUST DUCT LOSS:**3 "H<sub>2</sub>O**Nominal Data**

AMBIENT AIR TEMPERATURE (T1):	55	65	75	85	95	105 °F
PART POWER ( kWe), % LOAD, or 0 for MAX:	100%	100%	100%	100%	100%	100% kWe
Nominal OUTPUT POWER: (@terminals)	5,172	4,963	4,758	4,561	4,327	4,103 kWe
Nominal HEAT RATE: (@terminals)	11,365	11,494	11,649	11,825	12,071	12,343 BTU/kWe-hr

**Guaranteed Data**

Power Output Tolerance	2%					
Heat Rate Toleratnce	3%					
Instrumentation Tolerance Power Output	0%					
Instrumentation Tolerance Heat Rate	0%					
Auxiliary Load Losses, kW	25.7					
Quantity of units	1					
Ambient Temperature (T1)	55	65	75	85	95	105 °F
Minimum output Power & Terminals	5,043	4,838	4,637	4,444	4,215	3,995 kWe
Heat Rate	11,706	11,839	11,999	12,180	12,433	12,713 BTU/kWe-hr



# Solar Turbines

A Caterpillar Company

## PREDICTED ENGINE PERFORMANCE

Customer	
Job ID	
Run By	Date Run 29-AUG-02
Engine Performance Code REV. 2.88	Engine Performance Data REV. 0.2

Model <b>TAURUS 60-T7300S</b>
Package Type <b>GSC</b>
Match <b>STANDARD</b>
Fuel System <b>DUAL</b>
Fuel Type <b>DIESEL 2-D</b>

### DATA FOR NOMINAL PERFORMANCE

Specific Gravity of Fuel		0.850					
Elevation	Feet	100					
Inlet Loss	in. H2O	4.0					
Exhaust Loss	in. H2O	4.0					
		1	2	3	4	5	6
Engine Inlet Temperature	Deg. F	50.0	59.0	68.0	77.0	86.0	95.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Specified Load	kW	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power	kW	5122	4952	4761	4585	4406	4198
Fuel Flow	MMBtu/hr	58.60	57.13	55.57	54.22	52.85	51.37
Heat Rate	Btu/kW-hr	11439	11537	11672	11825	11995	12236
Engine Exhaust Flow	lbm/hr	176008	173160	169467	165739	161860	157485
Exhaust Temperature	Deg. F	910	912	917	924	931	938

#### Notes

Fuel must comply with Solar Specification ES9-98  
The following is Expected Performance not Guaranteed

# Solar Turbines

A Caterpillar Company

## Gas Turbine Generator Systems



*Complete Solutions for Your Power Needs*





# Global Experience

A leading supplier in mid-range industrial gas turbines and gas turbine-driven generator sets from 1 to 20 MW, Solar Turbines designs and manufactures rugged, reliable products using quality systems certified to ISO 9001 standards. Solar offers complete solutions - from engineering specification to asset management - for industrial power generation applications from 1 to 50 MW.

A wholly owned subsidiary of Caterpillar Inc., Solar Turbines Incorporated has a fleet of more than 11,200 gas turbine units--with over 1,000,000,000 operating hours--installed in 90 nations.

Solar's unrivalled level of experience and worldwide Customer Services network are among the key reasons why customers continue to make *Solar*® gas turbines and generator sets the first choice to meet their energy requirements in a variety of cogeneration, base-load, peak shaving, distributed power and standby duty applications such as:

## Industrial/Processing Facilities

- chemicals
- pharmaceuticals
- foods and ingredients
- dairies and dairy products
- beverages
- breweries

- grain processors
- ceramics
- cement
- gypsum
- paper and paper products
- wood products
- plastics
- tires and rubber products
- refineries
- manufacturing

## Buildings/Institutions

- district heating and cooling plants
- universities
- hospitals
- resorts and hotels
- commercial buildings
- telecommunications complexes
- computer centers

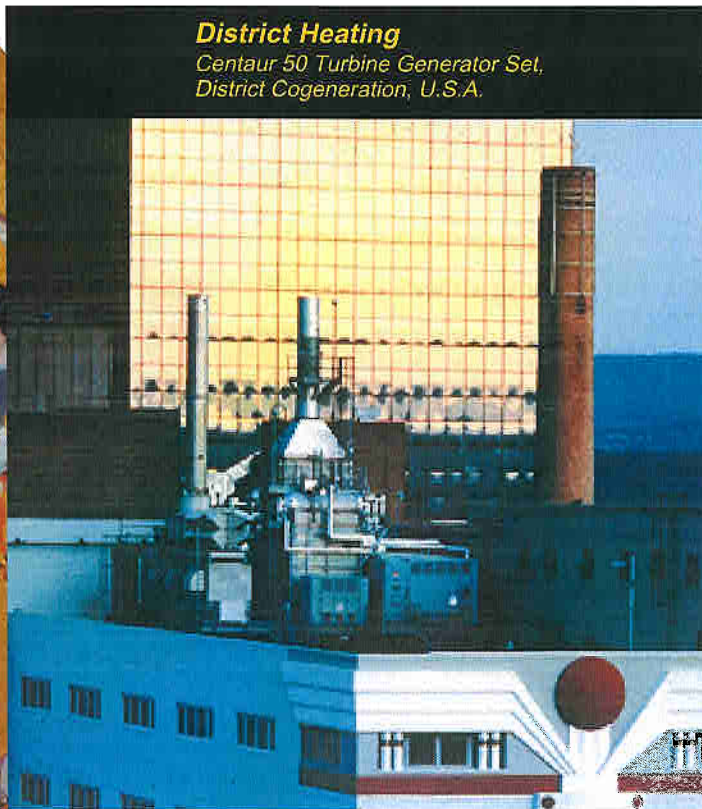
## Distributed Power

- remote locales
- small utilities
- load management
- areas with rapid demand growth



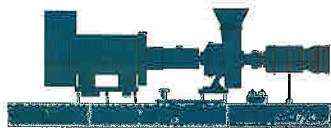
## District Heating

*Centaur 50 Turbine Generator Set,  
District Cogeneration, U.S.A.*

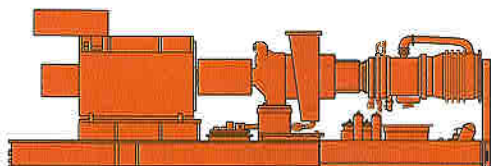




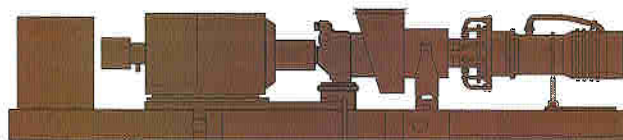
# Solar Gas Turbine Generator Sets



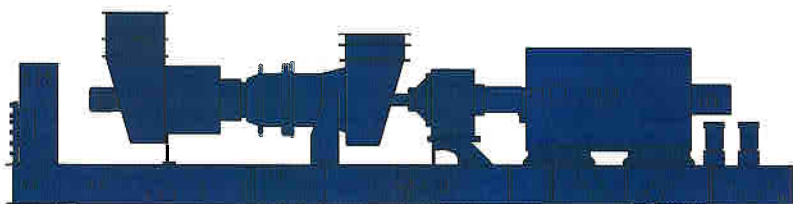
**Saturn 20 Generator Set**



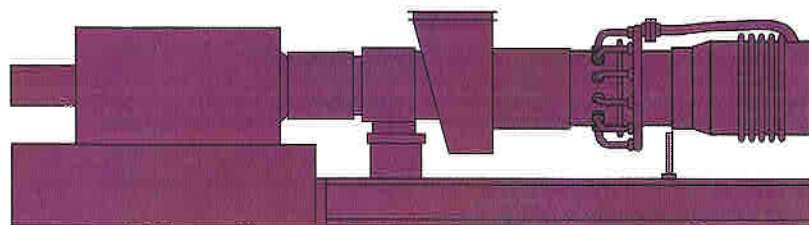
**Centaur 40 and Centaur 50 Generator Sets**



**Taurus 60 and Taurus 70 Generator Sets**



**Mars 90 and Mars 100 Generator Sets**



**Titan 130 Generator Set**



**Industrial Cogeneration**  
Taurus 60 Turbine Generator Set,  
Food Processing, Canada



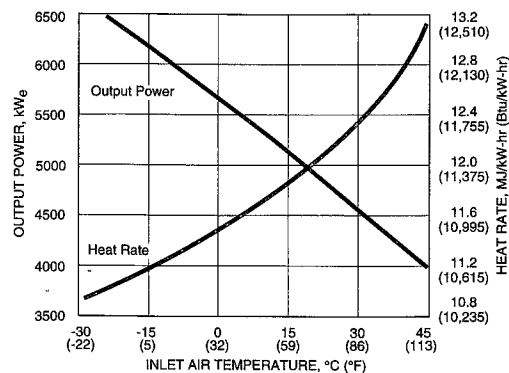
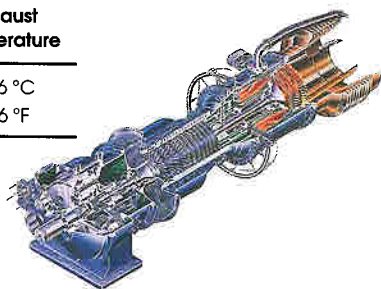
**Peaking Power**  
Taurus 60 Turbine Generator Sets,  
Rural Electric Coop, U.S.A



**Institutional Cogeneration**  
Mars 100 Turbine Generator Set, Tri-Fuel  
Paper Plant, Turkey

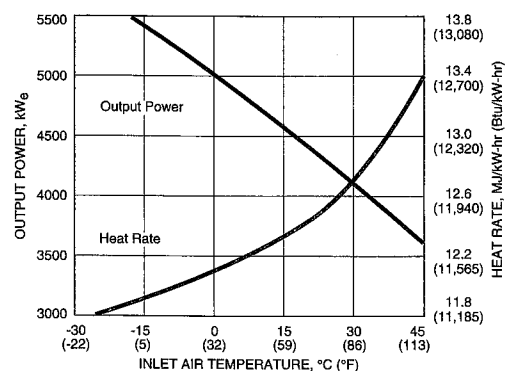
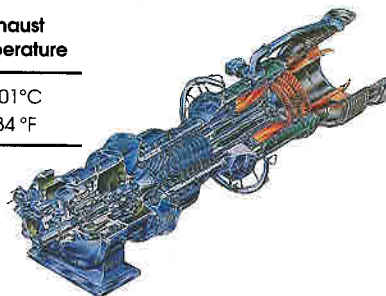
### Taurus 60 Generator Set Performance

ISO Continuous Duty Output	Heat Rate	Exhaust Flow	Exhaust Temperature
5200 kWe	11 883 kJ/kW-hr	79 296 kg/hr	486 °C
	11,263 Btu/kW-hr	174,797 lb/hr	906 °F



### Centaur 50 Generator Set Performance

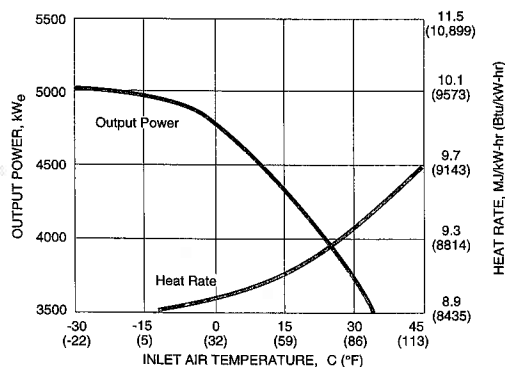
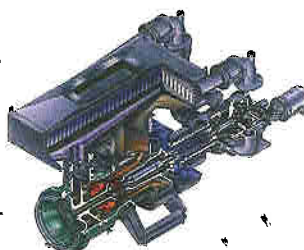
ISO Continuous Duty Output	Heat Rate	Exhaust Flow	Exhaust Temperature
4600 kWe	12 315 kJ/kW-hr	68 448 kg/hr	501 °C
	11,672 Btu/kW-hr	150,900 lb/hr	934 °F



### Mercury 50 Generator Set Performance

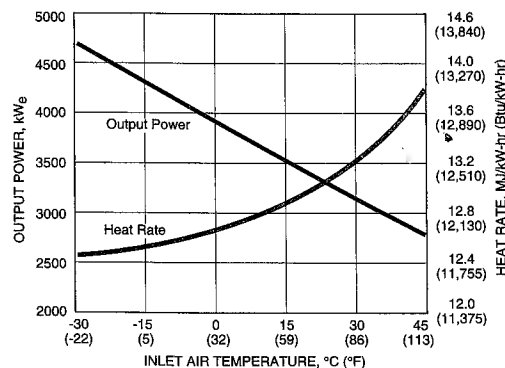
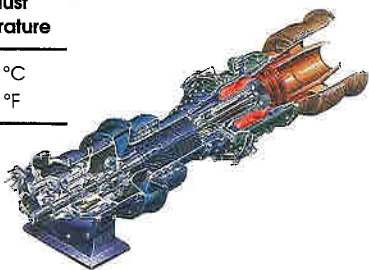
ISO Continuous Duty Output	Heat Rate	Exhaust Flow	Exhaust Temperature
4200 kWe	8683 kJ/kW-hr	60 601 kg/hr	351 °C
	8230 Btu/kW-hr	133,600 lb/hr	663 °F

Optional Ratings:  
4600 kWe - Intermediate  
4750 kWe - Peaking



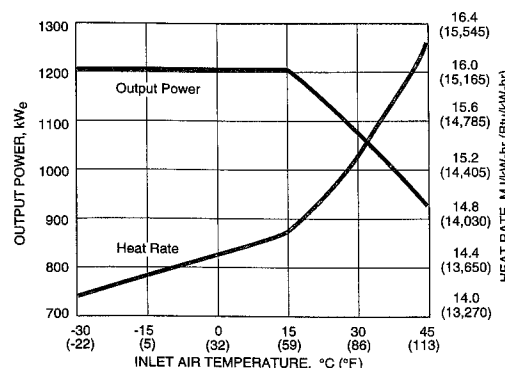
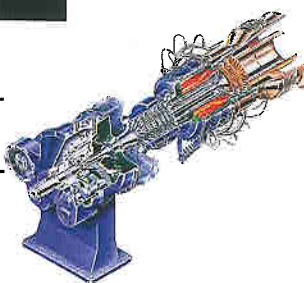
### Centaur 40 Generator Set Performance

ISO Continuous Duty Output	Heat Rate	Exhaust Flow	Exhaust Temperature
3515 kWe	12 914 kJ/kW-hr	67 006 kg/hr	437 °C
	12,240 Btu/kW-hr	147,720 lb/hr	819 °F



### Saturn 20 Generator Set Performance

ISO Continuous Duty Output	Heat Rate	Exhaust Flow	Exhaust Temperature
1210 kWe	14 678 kJ/kW-hr	23 231 kg/hr	516 °C
	13,912 Btu/kW-hr	51,215 lb/hr	960 °F





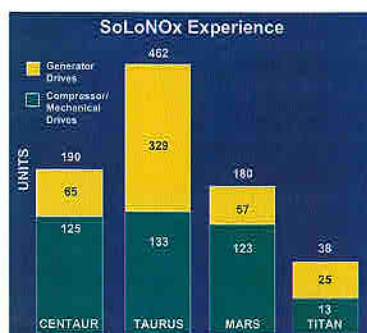
## Single-Source Advantages

Solar Turbines designs and manufactures its gas turbines and turbine generator sets to ensure maximum systems compatibility and integration, plus high performance, reliability, availability, efficiency, and long life in the most demanding applications. As the customer's single source, Solar Turbines also can provide:

- engineering, procurement and construction (EPC) services, including turnkey
- commissioning
- technical training
- field service
- certified parts
- repairs, overhauls, upgrades
- complete project operation and maintenance
- contract power and leasing
- financing packages

## SoLoNO<sub>x</sub> Pollution Prevention

*Solar* gas turbines have low exhaust emissions levels and can meet virtually any current clean air standard with *SoLoNO<sub>x</sub>* lean-premixed combustion technology.



## Outstanding Efficiency

*Solar* turbine generator sets are highly efficient simple-cycle units. When installed in combined cycle and combined heat and power applications, the efficiency is further enhanced. For example, in energy-saving cogeneration applications, overall system thermal efficiencies of 70-80% are common.

The gas turbine's clean, dry, oxygen-rich exhaust stream can be:

- used as a hot-air source for many drying applications
- ducted to an unfired heat recovery steam generator (HRSG)
- used as preheated combustion air for supplementary-fired HRSGs to produce high volumes of process steam
- used for direct heating in absorption chillers that provide chilled water

## Multi-Fuel Capability

*Solar* gas turbines operate on a wide variety of fuels:

- natural gas
- distillates
- natural gas liquids (NGLs)
- liquefied petroleum gases (LPGs)
- hydrogen
- medium-Btu gas (coal-bed methane, landfill gas)

Dual and tri-fuel systems can be configured for use with many models of *Solar* gas turbines.

## Fast Delivery

Modern, efficient manufacturing facilities and processes and skilled personnel enable Solar to quickly provide generator sets engineered and tested to fulfill specific customer requirements.

### **Institutional Cogeneration**

*Taurus 60 Turbine Generator Set,  
Hospital Cogeneration, U.S.A.*



### **Industrial Cogeneration**

*Taurus 60 Turbine Generator Set  
Industrial Process, Thailand*







### **Distributed Power**

Two Mars 100 Turbine Generator Sets,  
Combined-Cycle Utility Power, Australia



### **District Heating/Cooling**

Taurus 60 Turbine Generator Set  
STAC Unit, U.S.A.



### **Mobile Peaking Power**

Four Taurus 60 Turbine Generator Sets,  
Refinery, U.S.A.



### **Peaking Power**

Three Titan 130 Turbine Generator Sets  
Municipal Power, U.S.A.



### **District Heating**

Centaur 50 Turbine Dual-Fuel, SoLoNO<sub>x</sub>  
Cogeneration/District Heating, Germany



### **Industrial Cogeneration**

Mars 100 Turbine Generator Set,  
Heat Recovery, Paper Mill, U.S.A.