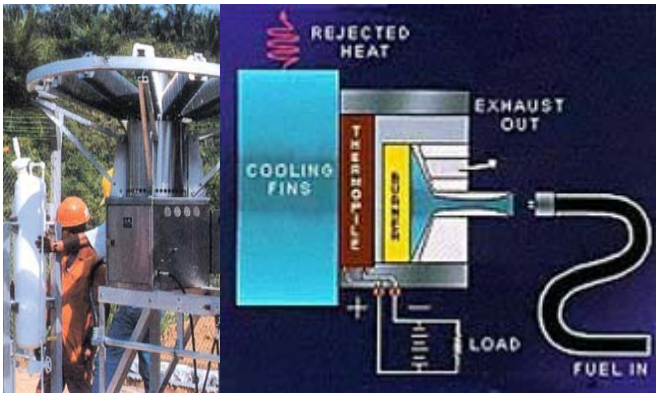
PSE ENGINEERING GMBH

Thermo electric generators produce power by the direct conversion of heat into electricity.

The heart of a thermoelectric generator is a hermetically sealed thermoelectric module (thermopile) which contains an array of lead-tin-telluride semiconductor elements. This durable module provides a chemically stable environment for the thermoelectric materials which ensures a long service life. On one side of the thermopile, a gas burner is installed, while the opposite side is kept cool by aluminium cooling fins or a heat pipe assembly. An operating generator maintains a temperature of approximately 540°C on the hot side and 140°C on the cold side. The heat flow through the thermopile creates steady DC electricity with no moving parts.

Propane, butane or natural gas can be used as fuel in a burner which is specially designed to operate with a minimum maintenance. Air intakes and exhausts are protected against rain, dust and strong winds.



Natural gas pipelines are often protected with current supplied from thermoelectrically generators fuelled with natural gas tapped from the pipeline via suitable pressure reducing and valve arrangements.

Solid state DC-DC converters are used to control the output of the generators to give constant current, constant voltage or constant pipe-to-soil potential, using a permanent reference electrode to provide feedback signal.

Model	Power specifications	Electrical	Fuel		Environmental
5030	Power ratings @ 20 °C 21 W @ 12 V 21 W @ 24 V	Adjustment 12 V 12 - 18 V 24 V 24 - 30 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	2.1 m³/day	Ambient operation temperature Max. 55 °C Min. -55 °C
			Propane	3.0 l/day	
			Maximum supply pressure	1724 kPa (250 psi)	
			Minimum supply pressure	103 kPa (15 psi)	
5060	Power ratings @ 20 °C 60 W @ 6.7 V 54 W @ 12 V 54 W @ 24 V 54 W @ 48 V	Adjustment 6.7 V 6.7 - 11 V 12 V 12 - 18 V 24 V 24 - 30 V 48 V 48 - 60 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	4.4 m³/day	Ambient operation temperature Max. 55 °C Min. -55 °C
			Propane	5.7 l/day	
			Maximum supply pressure	1724 kPa (250 psi)	
			Minimum supply pressure	103 kPa (15 psi)	
5120	Power ratings @ 20 °C 120 W @ 6.7 V 108 W @ 12 V 108 W @ 24 V 108 W @ 48 V	Adjustment 6.7 V 6.7 - 11 V 12 V 12 - 18 V 24 V 24 - 30 V 48 V 48 - 60 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	8.8 m³/day	Ambient operation temperature Max. 55 °C Min. -55 °C
			Propane	11.4 l/day	
			Maximum supply pressure	1724 kPa (250 psi)	
			Minimum supply pressure	103 kPa (15 psi)	
5220	Power ratings @ 20 °C 220 W @ 12 V 176 W @ 24 V	Adjustment 12 V 12 - 18 V 24 V 24 - 30 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	19.7 m³/day	Ambient operation temperature Max. 55 °C Min. -55 °C
			Propane	28.0 l/day	
			Maximum supply pressure	1724 kPa (250 psi)	
			Minimum supply pressure	241 kPa (35 psi)	
1500	Power ratings @ 20 °C 500 W @ 24 V	Adjustment 24 V 24 - 30 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	48.0 m³/day	Ambient operation temperature
			Propane	n/a at this time	Max. 50 °C
			Maximum supply pressure	410 kPa (60 psi)	Min. -50 °C
			Minimum supply pressure	207 kPa (30 psi)	
8550	Power ratings @ 20 °C 480 W @ 12 V 550 W @ 24 V 480 W @ 48 V	Adjustment 12 V 12 - 18 V 24 V 24 - 30 V 48 V 47 - 57 V	Natural gas 1000 BTU/SCF (37.7 MJ/SM³) gas	48.0 m³/day	Ambient operation temperature
			Propane	76.0 l/day	Max. 50 °C
			Ethylene	29.9 m³/day	Min. -50 °C
			Maximum supply pressure	1724 kPa (250 psi)	
			Minimum supply pressure	207 kPa (15 psi)	

Models shown are for standard configurations. The engineering department is available to design installations meeting different specifications, including custom voltages, fuel supply systems and non-standard operating temperatures.

Sizing a wind generator system for a cathodic protection station means determining how much energy is required to operate the system continuously. A wind generator system must provide enough energy to replace that being consumed daily by the cathodic protection station.

Meteorological data from the proposed CP-location is analysed and computer design technique is used to optimise type of wind generator, battery storage capacity, external circuit and anode groundbed parameters.

Wind generator - WINDSEEKER 503

For a decade, Windseeker wind turbines have set the standard for affordable, reliable wind power. With their unique patented upward-furling design, they produce power year after year, dependably, in conditions from low wind to the extreme wind of stormy mountain tops.

Models available

- 3-bladed model - for smoother and quieter operation with glass reinforced polypropylene blades as standard
- Marine version - for coastal saltwater environments
- Industrial - for extreme conditions where winds are expected to exceed 120 mph

Features

- Double ball-bearing yaw shaft
- Durable powder coated finish
- Light weight, corrosion resistant cast aluminium and stainless steel construction
- Brushless neodymium permanent magnet alternator Precision, computer designed aircraft quality rotor
- Built in safety electronics in the “smart” voltage regulator restricts dangerous voltage surge
- Military specified safety protection electronics regulates voltage and rotor RPM
- Polyurethane UV prop tape protects leading edge
- Easy to erect, low cost tower designs available

Operation

The Windseeker has a permanent magnet brushless alternator that rectifies the voltage and controls the output internally. This allows better control of the alternator and minimizes connections to the battery. This is also a safety feature, preventing the turbine from damaging itself or harming the user due to excess voltage.

Regulation and Control Electronics

The electronics performs several functions to assure maximum output and safety. The control electronics maintain a load on the alternator at all times to make sure that turbine never over speeds, regardless of the condition of the battery. As the battery is charged, the sophisticated regulator periodically checks the line, correcting for voltage loss and monitoring charge rate. Once the battery has reached its optimum charge level the regulator shuts the current off, preventing the battery from being overcharged while maintaining a load on the alternator at all times to prevent over speeding.

Solid state DC-DC converters are used to control the output of the wind generator/battery system to give constant current, constant voltage or constant pipe-to-soil potential, using a permanent reference electrode to provide feedback signal.

CP-Output Regulator

CORROCONTROL OUTPUT REGULATOR (CCOR)
For technical details note Chapter 10 Document 10-100-R0

Mounting kits

Guyed tower kits, poles and achors are available on special request.

Specifications

Rotor diameter	1.52 m (60“)
Weight	9 kg (20 lbs)
Start-up wind speed	2 m/s (5 mph)
Voltage	12, 24, 48 V
Output	500 W
Output voltage (adjustable)	Preset 14.8 - 12 V model Preset 29.5 - 24 V model
Voltages available	12, 24, 48 V DC (standard)
Alternator	PM 3 phase brushless

* Generators with outputs > 500 W on special request.

Many renewable energy systems have matured into valuable alternatives to earlier technologies in particular applications and environments. Integrating solar and solar/ wind-hybrid technology into your existing industrial installations can result in higher efficiency, easier maintenance and increased reliability. Examples of applications are: stand-alone energy supply (off-grid, remote, onshore and offshore), cathodic protection e.g. of oil & gas pipelines, hazardous areas (ATEX compliant), telecommunications, signalling and warning, monitoring and instrumentation.

The advantage of a hybrid power system is that when one power source is at low levels the other source is usually at higher levels. On a cloudy, windy day when solar panels are producing lower levels, a wind generator may be producing a lot of energy. In contrast, on a bright cloudless day the solar panels will likely out-produce the wind generator. Naturally, to use a wind generator effectively requires a location which has a certain amount of wind on a regular basis.

Balancing the power sources to achieve the highest level of system performance takes some experience.

Each location must be assessed to determine sizing for optimized performance. Meteorological data from the proposed CP-location is analysed and computer design technology is used to optimize solar array, wind generator and battery storage capacity, external circuit and anode groundbed parameters.

The components

The main components which make up a hybrid power system for application in cathodic protection systems are the solar array, the wind generator, the battery charge controller, the battery storage and the output regulator.

The entire system is modular and can be adapted to specific requirements of customers.

- **Solar modules**
- **Module support structure**
- **Wind generator with support structure**
- **Charge controller**
- **Battery and battery housing CP-output regulator**

Advantages of hybrid power systems:

- **More consistent power supply**
- **Lower total system cost**
- **Smooths out seasonal weather fluctuations**
- **Reduced “deep-cycling” of batteries**
- **Extended battery life**

For technical data and description of the main components note:

Document No.: 03-100-R0 (Solar power units)
Document No.: 03-300-R0 (Wind generators)