



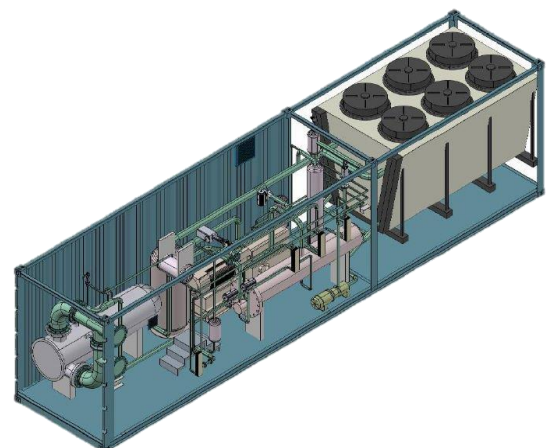
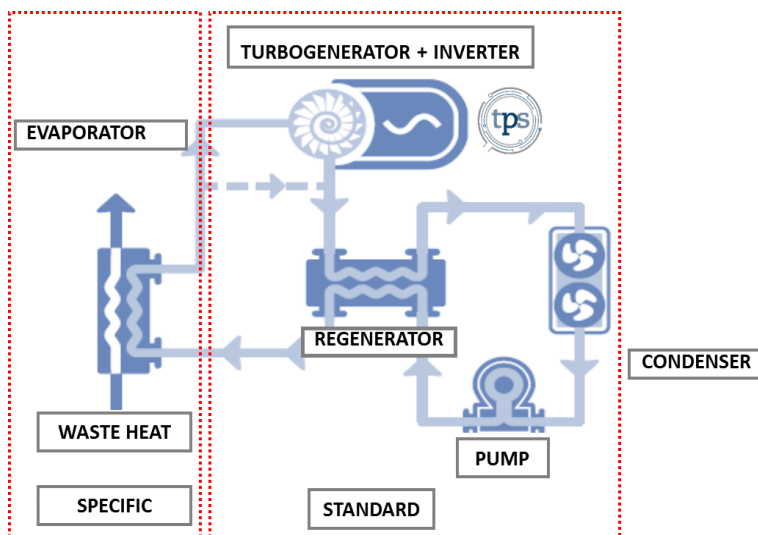
For Waste Heat Recovery & Organic Rankine Cycle Applications

400kW - 1.2MW High Speed Permanent Magnet Generators and Grid-Tied Inverters

Waste Heat is the World's most cost effective un-tapped renewable energy source where 90% waste heat stream is in less than 1MW range. Waste Heat Recovery (WHR) can be interpreted as recovery of rejected heat, typically from a facility or plant into the surrounding environment. The Organic Rankine Cycle (ORC) is named for its use of an organic, high molecular mass fluid with a liquid-vapour phase change, or boiling point, occurring at a lower temperature than the water-steam phase change. This fluid allows Rankine Cycle heat recovery from lower temperature sources. TPS' range of unique High Speed Generator and Inverter solutions enable highest efficiency recovery of this rejected heat as part of the WHR/ORC system, in order to reduce energy costs and improve profitability whilst providing a source of power with lowest carbon footprint.

Utilising a Permanent Magnet design with a carbon fibre retaining system, TPS Generators are designed to operate reliably when directly coupled to a turbine engine. The Generators employ active magnetic bearings to eliminate wear and thus provide maintenance free operation of the rotating machinery. The connection is made to the turbine using an infinite life flexible disk element coupling and a torque tube to provide accurate alignment. The output from the Generator is transferred to the grid via a Grid-Tied Inverter to provide mains quality electricity. TPS have the capability to develop a wide range of Grid-Tied Inverters to suit your individual plant needs. In addition, all necessary protections and filters are included to achieve a one box "Plug & Play" approach. There is a flexible range of control and monitoring options to achieve full turbine integration and its remote programming aids setup and upgrades. Furthermore, the advanced Smart Grid power control will help achieve the low carbon world vision.

Below is a diagram showing TPS Generator and Inverter fit into ORC applications:

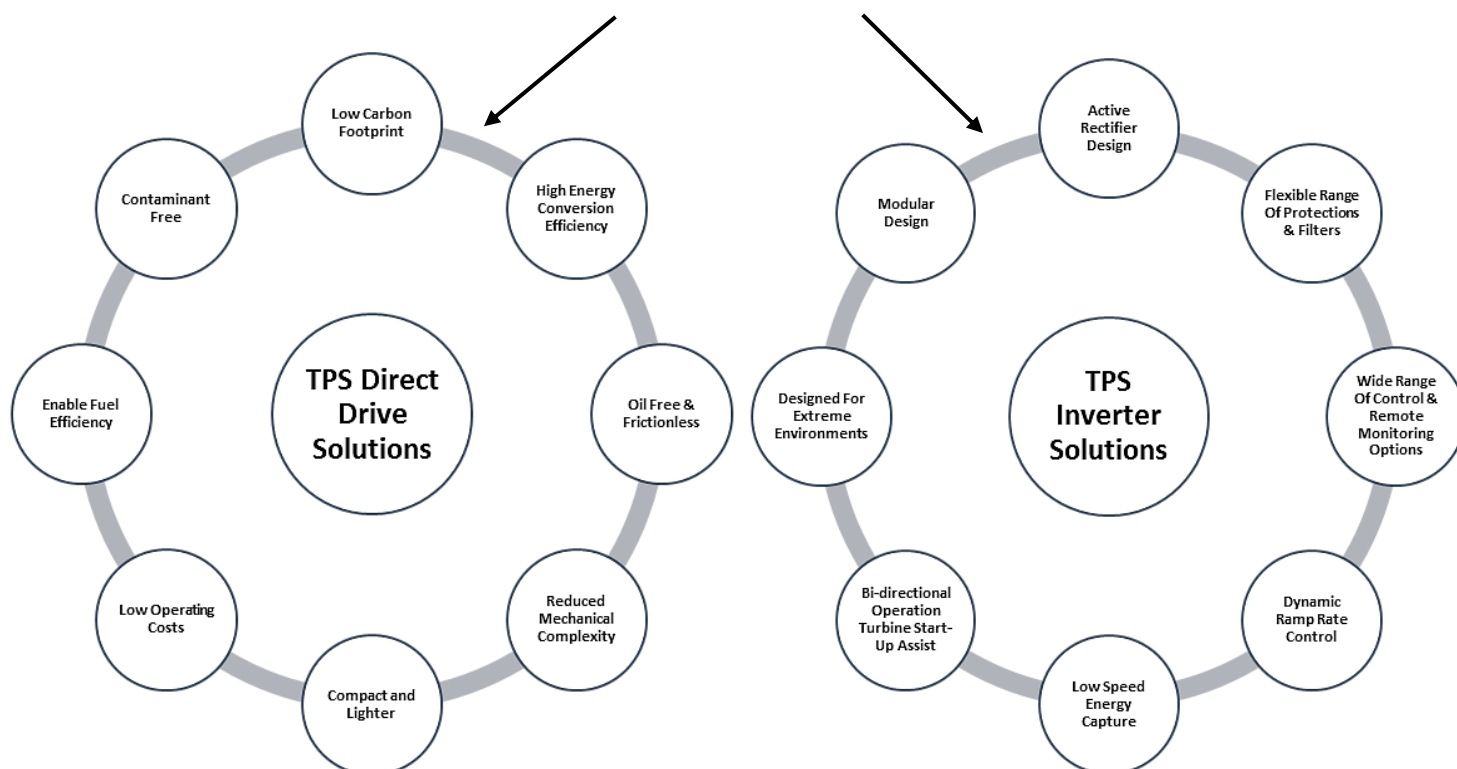


Performance Table

Standalone Generator	Generator 1 – 1.2MW	Generator 2 – 400kW/610kW	Generator 3 – 600kW/1MW
Nominal Operating Speed (rpm)	23,000	20,000	18,000
Over-speed Capability (rpm)	25,300	22,000	20,000
Output at full speed (kW)	1250	400/610	600/1000
Torque Rating (Nm)	519	191/286	329/548
Efficiency	98.3%	>96%	>97%
Phases	9	3/6	6/12
Output Frequency (Hz)	767	667/1000	600/600
Bearing Type	Active Magnetic	Active Magnetic	Active Magnetic
Shaft Output	Spline / High Speed Coupling	Stoffel Polygon	110mm Hirth
Stator Cooling	Water Glycol	R134a or Water Glycol ^[1]	Water Glycol
Rotor Cooling	Filtered Ambient Air	R134a or Filtered Ambient Air	Filtered Ambient Air
Cooling Temperatures (°C)	-20 to +40	-20 to +40	-20 to +40
Approximate Dimensions (H×W×L mm)	491 × 592 × 821	665 x 457 x 692	648 x 759 x 824 / 991
Approximate Mass (kg)	520	320	546/687

[1] Other fluid options are available.

Key benefits of our direct drive technology over conventional systems:



TPS are able to deliver a suite of Permanent Magnet based electric machines operating in the speed range of 16,000rpm to 23,000rpm. These utilise the latest in magnetic bearing technology to deliver oil free, frictionless and low vibration operation. Our systems will also work with other types of bearing technologies such as journal, foil and air bearings.

With over 40 years' experience, a team of highly skilled engineers and technicians, and a track record in creating world-class high speed machines why go anywhere else? To discuss your project or for any further information please contact our marketing department at marketing@turbopowersystems.com or +44 (0) 0191 482 9288.