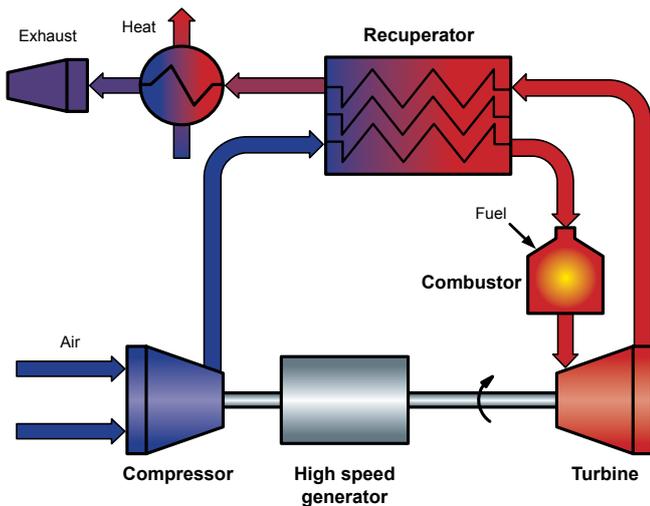## Combined Heat and Power (CHP)

The objective of Combined Heat Power (CHP) is to generate electric power at locations where also a heat demand is present for either domestic or industrial heating. This way, CHP saves energy as the heat and transportation losses by large electric power stations are avoided.

Recuperated micro turbine in a CHP configuration

EnerTwin micro-CHP system

Micro gas turbines

The EnerTwin CHP system generates electric power using a 4 kW micro turbine. Gas turbines are known for their high power to weight ratio and low maintenance costs. Using off-the-shelf turbocharger technology leads to low production costs. The turbomachinery components are optimized for the turbogenerator application.

Driving a high-speed generator at 240,000 rpm, the EnerTwin micro CHP system has a net electric efficiency of >16% (20% shaft power efficiency on the turbogenerator). The limited turbo-machinery cost and their very low maintenance requirements offer great potential for cost effective micro-CHP systems. The generator is coupled to the micro turbine by a unique in-house developed compact rotor concept. Due to the recuperator, part load efficiency can be kept close to the design point maximum.

Recuperator

The recuperator is an advanced heat exchanger recovering exhaust heat into the gas turbine working cycle, saving almost 50% of fuel compared to a system without a recuperator and providing a substantial increase in efficiency.

Generator

An efficient high-speed permanent magnet generator converts the mechanical power from the micro turbine into electric power. The generator is fully integrated in the micro turbine rotor system, avoiding costs and losses of additional bearings and couplings.

Heat exchanger

The efficient heat exchanger transfers heat from the micro turbine exhaust to the micro-CHP heating system circuits.

Operation profile

The EnerTwin has a rapid (< 2mins) start-up capability. Moreover, power can be modulated down to about 30% without significant loss of efficiency.

Monitoring and control

The EnerTwin micro-CHP system has an on-line control and monitoring capability for remote operation, Virtual Power Plant and smart grid applications. This offers excellent installation and operation flexibility in cascade and other configurations.

Noise

Micro turbines emit only high frequency noise that can effectively be damped. Compared to alternative concepts, the EnerTwin has very low noise emissions.

Benefits for the environment

The EnerTwin micro-CHP system offers a substantial contribution to CO_2 emission reduction. With MTT's clean low-NO_x combustor, other exhaust gas emissions levels are minimal.

Specifications

		Max.	Min.	
Performance at ISA *	Net electric power	3.2	1.0	kW
	Net thermal power	15,6 **	6.0	kW
	Power to heat ratio at max power	20		%
	Net grid output efficiency (electrical)	16		%
	Total efficiency	> 94 **		%
	iaw EcoDesign (EU 813/2013)	> 110		%
	Rotor speed	240,000	180,000	rpm
	Fuel flow (H gas, 38.5 MJ/nm^3)	1.87	0.84	nm^3/h
Fuel	Natural gas H, E and L			
Operating conditions	Ambient air pressure	0.8 .. 1.1		bar
	Inlet air temperature	-20 .. 40		^{0}C
	System room temperature	5 .. 40		^{0}C
Heating system	Water flow rate	3 .. 21		l/min
	Water return temperature	5 .. 60		^{0}C
	Water out/buffer vessel temperature	5 .. 80		^{0}C
	Water pressure	0,7 .. 4		bar
Maintenance	Service interval	> 5000		hours
Emissions	NO$_x$	< 27		ppm @ 15% O$_2$
	CO	< 50		ppm @ 15% O$_2$
	CO$_2$ savings	3 – 6 ***		tons/year
	Noise	55		dB(A) 1m
Control	OpenTherm heating control interface			
	RS-485 Modbus remote control interface			
	0-10V building management system interface			
	MTT proprietary cascade operation control interface			
Installation	Dimensions (h x w x d)	995 x 600 x 1170		mm
	Weight (empty/with water/oil)	205 / 215		kg
	Natural gas connector	¾"		
	Water connector	¾"		
	Inlet air and flue gas pipes	DN 100 (parallel)		
	Grid connection	230 / 50		VAC / Hz

*   ISA conditions are 15 ^{0}C and 1.01325 bar dry air.
**   Depending on heating system operating conditions such as water return temperature.
***   Depending on operating profile.

Iris Hellas
Technology Innovations
www.irishellas.com