MICRO COGENERATION

ENER·G

Affordable, efficient and innovative

A compact and efficient solution

Organisations are increasingly looking for environmentally friendly systems to supply their building energy needs. By generating electrical power on-site, losses associated with electrical power transmission are reduced and the waste heat energy produced can be used for heating or cooling. This is micro cogeneration.

Micro cogeneration or combined heat and power (CHP) technology converts natural gas into both electricity and heat in a single process on site. The natural gas fuel is more beneficial to the environment than other fossil fuels, as the emissions, such as CO_2, NOx and SOx are comparatively smaller.

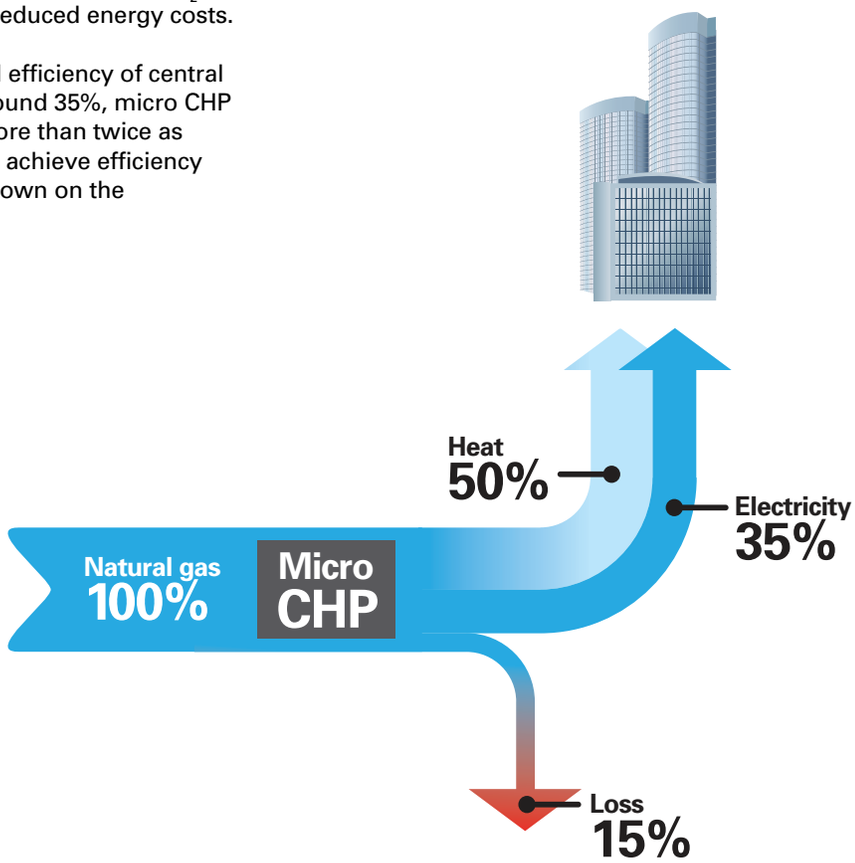
Micro cogeneration systems offer a higher overall efficiency than typical conventional electrical power generation, achieving reduced energy consumption, reduced CO_2 emissions, and reduced energy costs.

While the typical efficiency of central generation is around 35%, micro CHP technology is more than twice as efficient and can achieve efficiency up to 85% (as shown on the graph below).

ENER·G's experience in the cogeneration market dates back to the 1980s when we began to design, manufacture, install and maintain cogeneration systems. From smaller systems to large, complex heating solutions, between 4kW and 10MW we deliver the best fit to all requirements.

The micro series are the most recent addition to our product portfolio, as a result of a technology partnership with Yanmar, a leading Japanese manufacturer. This allows us to offer this both environmentally and economically beneficial energy technology to small and micro applications, in the 4-25kW range.

The compact Japanese design can benefit the residential, health, retail, leisure, commercial, industrial and public sectors.



Benefits and applications

Benefits

Micro cogeneration is highly energy efficient and as well as supplying a business with power and heat, it can deliver a number of positive financial and environmental benefits.

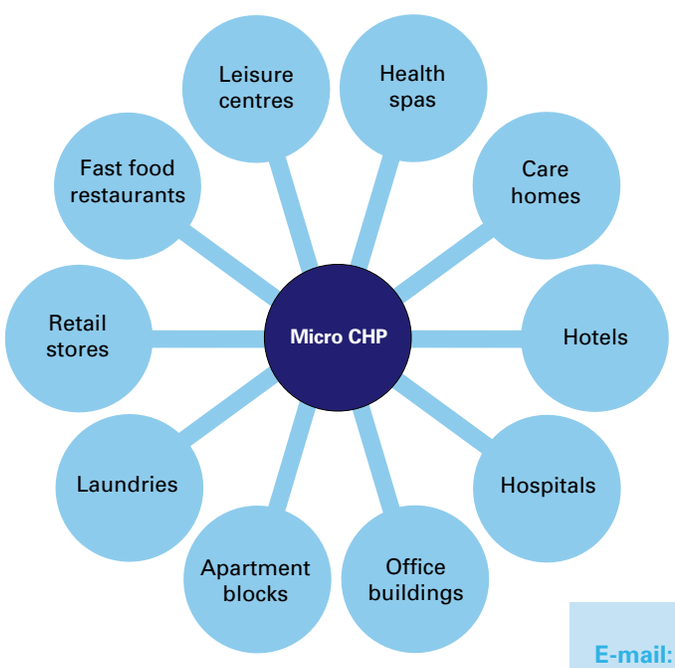
Operational benefits	Environmental benefits
• High availability • Ease of use by automatic operation • Minimal service requirement with long service intervals (10,000 hours) • Acts as a backup supply for non-essential heat and power • Piece of mind with optional remote monitoring	• Reduced primary energy use • Reduced building carbon footprint (lower CO_2 emissions) • Reduced transmission losses • Low noise design: ENER·G 4Y: 53 dBA at 1m ENER·G 10Y: 56 dBA at 1m ENER·G 25Y: 64 dBA at 1m • Low NOx exhaust
Financial benefits	**UK Legislative benefits**
• Reduced energy cost by up to 40% • Reduced life cycle cost by long service intervals • Can reduce the cost impact of the Carbon Reduction Commitment (CRC) • Good quality CHP can attract enhanced capital allowances for eligible organisations (ECA's)	• Helps in meeting Carbon Reduction Commitment (CRC) targets, with the useful heat from micro CHP being zero rated • Helps to meet carbon footprint targets for new and redeveloped buildings under the Part L of the Building Regulations • Under the 2008 Energy Act micro CHP up to 50kWe qualifies for the Feed-in Tariff (FIT) system for renewable electricity technologies More information www.decc.gov.uk

Applications

This low carbon technology is suitable for organisations with smaller buildings that need to use electricity and heat for long periods (see chart).

Applying micro cogeneration can result in:

- Increased energy efficiency
- Reduced CO_2 emissions
- Reduced energy costs
- Peak energy demand reduction



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The technology

Gas engine

The heart of the unit is a Miller cycle, four stroke internal combustion engine. Engine features include lean burn combustion and power performance, generated by a special piston.

The system optimises ignition timing and matches the excess intake air. This increases the overall efficiency and reduces fuel consumption and NOx emissions. In addition, the engine maintenance interval is the longest for a cogeneration gas engine: 10,000 hours.

Generator

The ENER·G micro series have the lightest and most compact generators available built in. Compared to other generators these give a higher performance and realised a generating efficiency of 90%.

The micro CHP systems can be easily connected to the national grid by the application of the inverter. As an integral part of the system it coverts direct current to alternating current to allow the electricity generated to be fed back into the grid.

The application of the inverter reduces initial unit cost and makes it possible to achieve 100% utilisation of the units.

The system controller with constant monitoring of the unit operation achieves optimal balance between power demand and power output. The touch screen controller allows scheduled or manual operation and for the user to set up alarms.

ENER·G also offers remote monitoring for the micro CHP units. The system monitors and manages the unit and can be programmed to optimise its operation to suit the demand of the site. Linked to the ENER·G Head Office, the system daily uploads recorded operating data and in the event of a problem automatically takes corrective actions.

Compact and high-performance

Compared to existing generators, the ENER·G Micro series gives higher performance and has an operational efficiency of up to 85%. Yanmar, ENER·G's technology partner, has succeeded in making one of the lightest and most compact micro CHP units available.

The design incorporates a fully packaged solution including built-in heat recovery, exhaust silencing and heat rejection for ease of installation.

The micro series have several important features:

- Outstanding overall efficiency with a heat to power ratio of 2:1
- Effective heat recovery system
- Ease of installation and commissioning
- Units are for external installation, which allows for easy planning process
- Small footprint requires limited external space
- CO_2 savings achievable up to 30%
- Potential multiple unit operation
- Low NOx exhaust
- Low noise design

Correct unit selection and operation

The technology offered provides efficient energy in the ratio of approximately 2:1 heat to electricity, with the potential for significant benefits for the user. For these benefits to be fully realised it is important the user carefully assesses the site's heat and electrical demand profiles to optimise the unit size selection and operational regime. Thermal storage may be required to optimise the system.

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ENER·G micro series

					
			ENER·G 4Y	**ENER·G 10Y**	**ENER·G 25Y**
Output	Rated output[1]	kW	3.87	10	25
	Frequency	Hz	50	50	50
	Voltage	V	230	400	400
	Heat recovery	kW	8.38	17.3	38.4
Electrical generation efficiency		%	26.7	30.7	33.5
Exhaust heat recovery		%	57.8	53.5	51.5
Total efficiency		%	84.5	84.2	85
Exhaust heat recovery temperature		°C	65	70 (max 78)	80 (max 85)
Transmission method		-	Inverter	Inverter	Inverter
Number of phase / wires		-	Single phase / two wires	Three phases / four wires	Three phases / four wires
Power control	Reverse power type	-	Standard	Standard	Standard
Multiple unit operation		-	3 units schedule by group/schedule rotation by unit	3 units schedule by group/schedule rotation by unit	3 units schedule by group/schedule rotation by unit
Gas type		-	Natural gas	Natural gas	Natural gas
Maintenance interval		Hours	10,000	10,000	10,000
Remote monitoring system		-	Option	Option	Option
Ambient temperature	-5 to +40 °C	-	Standard	Standard	Standard

[1] Power consumption by the unit is included

ENER·G 4Y - Technical details

General description	
Fuel type	Natural gas
Electrical output	3.87kWe[1]
Heat output	8.38kWh
Fuel input LHV	14.5 kWg[2]
Gas pressure	20mbar
Hot water flow rate	24.3 L/min[3]
Heating water temperature in / out	60°C / 65°C[4]
Min methane no of gas	80
Width	1,100mm
Depth	570mm
Height	1,555mm
Weight (operating)	410kg
Enclosure Standard	External (IP44)

Engine	
Type - reciprocating	Yanmar CP4
Combustion cycle	4 stroke spark ignition
Cylinders	3 in line
Speed	2,000 rpm
Aspiration	Natural
Acoustic enclosure	53 dBA @ 1m std.

Generator	
Type	HF Inverter
Frequency	50Hz single phase
Voltage / PF	230V / 0.97
Full load current	16 A
Efficiency	84.5%

Heat recovery system (integral to unit)
Fully closed single primary water circuit
Exhaust gas heat exchanger in primary circuit
PHE between primary and secondary circuits
Auto heat output modulation
Auto heat rejection through vent fan

Control and protection
On-board computer control, protection and monitoring
Engine stop/start, synchronising, modulation
Mechanical, electrical and thermal protection
Optional communication between unit and ENER·G Head Office

Optional equipment
Gas / fire detection systems
Heat and gas metering
Export control panel

Further information

(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
(2) The operating sound levels are maximum values measured in 4 directions at a point 1m from the side of the unit and 1.2m above the ground in an anechoic room simulation. The sound levels during actual operation are usually higher than the simulated values due to ambient noise and echoes.
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
(5) As for G83, the examination was carried out by New and Renewable Energy Centre (NaREC) in the UK.

1 Power consumption is included.
2 Tolerance +5% is not included.
3 Max of +5%, 25.5 L/min.
4 Max return water is 60°C.

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ENER·G 10Y - Technical details

General description	
Fuel type	Natural gas
Electrical output	10kWe[1]
Heat output	17.3kWh
Fuel input LHV	32.6 kWg[2]
Gas pressure	20mbar
Hot water flow rate	48.2 L/min[3]
Heating water temperature in / out	65°C / 70°C (max 78°C)[4]
Min methane no of gas	80
Width	1,470mm
Depth	900mm
Height	1,790mm
Weight (operating)	790kg
Enclosure standard	External (IP44)

Engine	
Type - reciprocating	Yanmar CP10
Combustion cycle	4 stroke spark ignition
Cylinders	3 in line
Speed	1,700 rpm
Aspiration	Natural
Acoustic enclosure	56 dBA @ 1m std.

Generator	
Type	HF Inverter
Frequency	50Hz three phase
Voltage / PF	400V / 0.97
Full load current	14 A
Efficiency	84 %

Heat recovery system (integral to unit)

Fully closed single primary water circuit
Exhaust gas heat exchanger in primary circuit
PHE between primary and secondary circuits
Auto heat output modulation
Auto heat rejection through vent fan

Control and protection

On-board computer control, protection and monitoring
Engine stop/start, synchronising, modulation
Mechanical, electrical and thermal protection
Optional communication between unit and ENER·G Head Office

Optional equipment

Gas / fire detection systems
Heat and gas metering
Export control panel

Further information

(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
(2) The operating sound levels are maximum values measured in 4 directions at a point 1m from the side of the unit and 1.2m above the ground in an anechoic room simulation. The sound levels during actual operation are usually higher than the simulated values due to ambient noise and echoes.
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
(5) As for G83, the examination was carried out by New and Renewable Energy Centre (NaREC) in the UK.

1 Power consumption is included.
2 Tolerance +5% is not included.
3 Max of +5%, 50.6 L/min.
4 Max return water is 65°C.

ENER·G 25Y - Technical details

General description	
Fuel type	Natural gas
Electrical output	25kWe[1]
Heat output	38.4kWh
Fuel input LHV	74.6kWg[2]
Gas pressure	25mbar
Hot water flow rate	110 L/min[3]
Heating water temperature in / out	80°C / 85°C[4]
Min methane no of gas	80
Width	2,150mm
Depth	900mm
Height	2,060mm
Weight (operating)	1,320kg
Enclosure standard	External (IP44)

Engine	
Type - reciprocating	Yanmar CP25
Combustion cycle	4 stroke spark ignition
Cylinders	4 in line
Speed	1,900 rpm
Aspiration	Natural
Acoustic enclosure	64 dBA @ 1m std.

Generator	
Type	HF Inverter
Frequency	50Hz three phase
Voltage / PF	400V / 0.97
Full load current	35.4 A
Efficiency	85%

Heat recovery system (integral to unit)

Fully closed single primary water circuit
Exhaust gas heat exchanger in primary circuit
PHE between primary and secondary circuits
Auto heat output modulation
Auto heat rejection through vent fan

Control and protection

On-board computer control, protection and monitoring
Engine stop/start, synchronising, modulation
Mechanical, electrical and thermal protection
Optional communication between unit and ENER·G Head Office

Optional equipment

Gas / fire detection systems
Heat and gas metering
Export control panel

Further information

(1) The heat recovery and efficiency values are those for rated output in standard atmospheric conditions.
(2) The operating sound levels are maximum values measured in 4 directions at a point 1m from the side of the unit and 1.2m above the ground in an anechoic room simulation. The sound levels during actual operation are usually higher than the simulated values due to ambient noise and echoes.
(3) The values for the external dimensions do not include piping, piping connections, or protruding parts.
(4) The amount of fuel consumption is based on lower calorific values.
(5) As for G59, the examination was carried out by New and Renewable Energy Centre (NaREC) in the UK.

1 Power consumption is included.
2 Tolerance +5% is not included.
3 Max of +5%.
4 Max return water temperature of 80°C.

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Operation and maintenance

Long-term care

ENER·G has 25 years of experience in operating and maintaining cogeneration systems around Europe. Our Service department coordinates our engineering teams 7 days a week throughout the year.

Our range of service packages available for the micro CHP systems are detailed in the below table.

Service packages can also be offered independently of ENER·G installations, as our service technicians are fully trained in all aspects of engine maintenance, including complete engine overhauls.

The micro CHP technology is designed to accommodate long service intervals reducing equipment downtime and increasing client savings.

Service packages

Name	Included	Contract period
Premier	• Annual inspection and servicing including engine overhauls • All repairs chargeable	Nominal service interval - 10,000 hours[1]
Premier +	• Annual inspection and servicing including engine overhauls • All repairs included	Nominal service interval - 10,000 hours[1]
Monitoring and reporting	• Remote monitoring and reporting • Providing alarms to service provider and customer • Monthly reports • Optional extras to all above contract types	

[1] Nominal service intervals are based on operating at standard operating conditions. Non standard operating conditions may require differing service intervals.

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Case study

Tyneside Cyrenians Charity, Newcastle upon Tyne

Tyneside Cyrenians, a North East based charity, which provides support and shelter for homeless people, has long recognised the importance of efficiently managing resources, particularly energy – to improve its cost and environmental performance.

The charity is aiming to establish best practice in the field of energy efficiency, therefore selected ENER·G's pioneering micro CHP technology to achieve significant energy and carbon savings at its Newcastle-based premises.

The charity has installed an ENER·G 10Y micro CHP technology – providing 10kWe power to generate an energy efficient supply of electricity and hot water.

Suitable for external installation, the unit met all planning requirements and was installed in a conservation area adjacent to a listed building.

The micro CHP unit has proven ultra low noise levels, therefore could be positioned less than two meters from the bedroom accommodation. The ENER·G system is designed to integrate with the existing boiler plant to reduce its load. The heat captured from the micro CHP unit is used to generate domestic hot water and meet base heating loads of approximately 17kW.

The unit is connected into the site's electrical distribution, becoming the primary source of power by meeting the base load power demand, whilst also generating up to 15,000kWh electricity every year for export to the national grid. This generates significant income for the charity.

The modern, practically designed unit uses natural gas to generate power locally, hence displacing the need for carbon intensive grid based electricity.

Its efficiency is around 84%, which is some 50% higher than grid electricity, and guarantees 10,000 running hours between servicing. The financial savings are predicted to be around £10,000 per year, without considering the offset of potential penalties, such as from the new Carbon Reduction Commitment (CRC).

Subject to government approval, from April 2010, additional income will be generated under the government's Renewable Energy Strategy, whereby gas fired micro CHP technology will receive a Feed in Tariff (FiT) for all electricity generated, even if it is all used in-house.

The design, installation and project management was completed was completed by UK Biomass Ltd of Newcastle in May 2009.

ABOUT ENER·G

ENER·G provides customers with a variety of technologies ranging from the generation of energy to the management of energy use, delivering sustainable energy solutions and technologies on a business-to-business basis worldwide.

Established in Salford, Greater Manchester in the 1980s, the company offers a 'one-stop-shop' for all commercial and industrial energy requirements, from the efficient generation of energy to the equally efficient control of consumption. The company has partners across the globe.

Our solutions include combined heat and power (CHP), biogas utilisation, ground source heat pumps, efficient lighting, controls, metering and data solutions and energy from waste. This is accompanied by our wide range of energy and water consultancy and procurement services.

ENER·G is 100% dedicated to the development of its products and markets, and over the years has seen rapid growth, both organically and through acquisition to achieve a strong global presence within the energy industry. Currently ENER·G operates in the UK, the Netherlands, Norway, Poland, Hungary, Lithuania, Spain, Mexico and South Africa.

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