

## Combined Heat and Power (CHP) – Technology Fact Sheet

Installing CHP is a way of making savings when compared to traditional systems. Due to the high fuel efficiency of CHP plants, the carbon dioxide emissions per kWh of electricity or heat generated are relatively low. A well-designed and operated CHP plant will therefore improve energy efficiency and significantly reduce carbon dioxide emissions.

### About the Technology

CHP is a process in which both heat and electricity are produced simultaneously by an on-site prime mover. The heat generated when fuel is burnt to produce electricity is captured and utilised for some useful purpose such as space heating, water heating or refrigeration.

Typically this achieves a 35% reduction in energy use as well as ensuring a secure supply from having an independent source of power.

In a similar manner to most other means of generating electricity CHP plants use a prime mover to drive the electricity generator.

### Types of Technology Available

CHP units can be based on a variety of prime mover technologies.

- Gas turbines drive a turbine generator and produce exhaust gases at between 400 and 550°C. Gas turbines are typically available as 0.5 to 200MWe systems and produce high grade heat.
- Reciprocating engines are fuelled by gaseous fuels. Spark ignition engines are available up to 4MWe and compression ignition engines (diesel engines) up to 15MWe.
  - High-grade heat at about 400°C is available from the exhaust gases from reciprocating engines.
  - Low-grade heat at about 80°C is available from jacket cooling and lubricating/cooling systems.
  - Spark ignition engine based packaged CHP may be applicable to sites with a demand of less than 1MWe
- Steam turbines use any fuel to generate steam and systems and are available from 0.5MWe upwards. Steam turbines:
  - Are often used in conjunction with waste heat boilers and produce medium grade heat.
  - Can incorporate several pressure stages.
  - May be fully condensing or pass out intermediate pressure or low-pressure steam for process use.
- Combined cycle systems involve passing exhaust gases to a steam raising boiler and then to a steam turbine. Such systems are available from 10MWe upwards and produce medium grade heat.

### CHP Suitability

CHP is not an all-purpose solution and its suitability needs to be checked carefully. The suitability of CHP for a particular process or application requires a detailed appraisal of heat and electricity requirements, along with other factors. A feasibility study should be carried out on a site-by-site basis.

#### A Summary Table of the Outputs of CHP Prime Mover

Type of Prime Mover	Typical output	Typical fuels	Grade of heat output
Gas turbine	0.5MWe upwards	Natural gas, gas oil, landfill gas, biogas, mine gas/process gas	High
Spark ignition engine	Up to 4MVe	Natural gas, landfill gas, biogas, mine gas/process gas	Low and high

### A Summary Table of the Outputs of CHP Prime Mover

Type of Prime Mover	Typical output	Typical fuels	Grade of heat output
Compression ignition engine	2MWe upwards	Natural gas + 5% gas oil, Heavy fuel oil	Low and high
Steam turbine	0.5MVe upwards	Any but converted to steam	Medium
Combined cycle	10MVe upwards	Natural gas, gas oil, landfill gas, biogas, mine/process gas	Medium

### Installation

The key factors in the decision to install CHP include:

- Running time: in order to be cost effective the system ideally needs to run for a minimum of 4,500 hours/year.
- Total capital cost.
- The capital cost per kW of output.
- The ability to use the heat generated by the CHP system.
- Fuel price is critical to the economic viability of CHP.
- The relative price of the fuel used to the price of electricity and heat produced from other sources.

### Considering installing CHP?

- CHP is worth considering at a time of reinvestment or process change. Typically the payback on investment in CHP is more than five years.
- Consider installing CHP when the current market conditions favour investment in CHP, and the opportunities offered by CHP become financially attractive.

### Micro-CHP

A Micro-CHP unit is a miniature CHP unit designed to provide heat and power to a small building in place of a conventional boiler. Most Micro-CHP sites use Stirling engines to operate.

### Suitability

For a site to benefit, it will usually need to meet certain criteria:

- CHP is only cost-effective with long operating hours (i.e. ideally for at least 12 hours/day, 7 days/week) but in general, the greater the annual period of demand, the higher the cost savings.
- There should be reasonable confidence in the future demand for heat and power over the lifetime of the CHP plant, typically 10-15 years. However, packaged Micro-CHP units can usually be relocated.
- There must be an adequate supply of a suitable fuel.

### Benefits of Micro-CHP

- It's a low carbon technology.
- Providing the site energy usage is sufficient, generating electricity locally using a CHP plant will normally be a cheaper than purchasing electricity from a conventional supplier.
- It increases security of supply, especially in remote locations or where the power supply can be interrupted.

## Fact Sheet for choosing your CHP system

### Find out your Annual heat and power requirement

CHP is ideal for buildings requiring heat and power together for more than 4,000 hours a year.

### Know your electrical load profile

It's more important to understand the base load profile rather than the mean or peak. This will ensure that the system will run efficiently.

### Know your heat demand in kW and degrees C

CHP configurations vary widely according to the amount of heat required – and the temperature it is required at. Some engine manufacturers will offer engines with much higher jacket heat recovery temperatures than others.

### Know how much you currently pay for heat generation

By knowing your current billing figures, you can produce a precise costs comparison demonstrating the potential savings to be made from each CHP system

### If in doubt - go small

A CHP that is too large for the application won't save, whereas a CHP that is too small will, although slightly less than it otherwise would.

### Understand lifecycle cost

The cheapest CHP solution identified during the procurement process will not necessarily be the cheapest to run over a period of time.

### Track record

There are many existing CHP systems that under perform - so look for a supplier with a good track record.

### Purchase an operations and maintenance service contract

Buy an Operation and Maintenance contract at the same time as the installation; this will guarantee the systems performance.

### Listen to the supplier

Understand where money needs to be spent – and where to economise – to offer a product, which performs and is cost effective. Beware specifications prepared by anyone who does not own, operate or manage CHP's.

### Reference:

[www.carbontrust.co.uk/energy/startsaving/tech\\_chp\\_about\\_the\\_technology.htm](http://www.carbontrust.co.uk/energy/startsaving/tech_chp_about_the_technology.htm)