CHP / Renewable CHP

Combined heat and power (CHP) units are an efficient way to generate both electricity and heat simultaneously. There are different methods of creating both heat and electricity using internal combustion engines, external combustion engines, steam turbines and fuel cells.

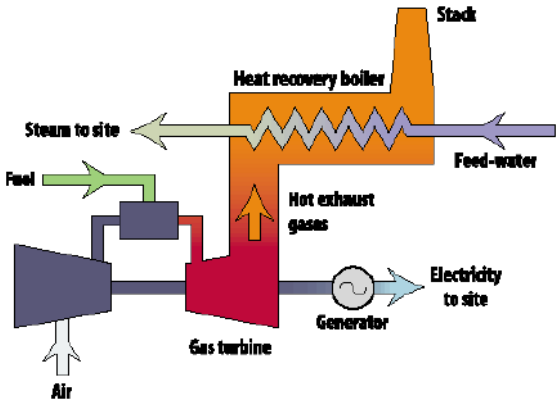
Basic working principles and construction

Centralised power generation in the UK has an average delivered efficiency of only around 40%; in other words, far less than half is supplied as electricity to the point of use. The remainder of the energy in the fuel is dissipated as heat via power station cooling towers and from the electricity transmission and distribution systems. Modern combined cycle gas turbine stations only achieve a delivered efficiency of about 45-50%. By contrast, CHP plant generates useful energy, at the point of use, in the form of both electricity and heat, with an overall efficiency of typically up to 80%.

CHP plant involves several components working together to achieve the optimal efficiency from the system:

- A prime mover - i.e. an engine to drive the generator. A fuel supply needs to be set up whether this is supplying gas, biomass, diesel etc
- A generator to produce electricity, which is fed into the building's power distribution system
- A heat recovery system is essential to recover usable heat from the engine thus beginning the CHP process as opposed to simply a generator
- A cooling system, to dissipate heat rejected from the engine that cannot be recovered
- combustion and ventilation air systems to supply fresh air to, and carry exhaust gases away from, the engine
- The control system is extremely important to ensure safe and efficient operation.
- Finally an enclosure of some sort usually similar to that found enclosing a generator to achieve both physical and environmental protection for the engine and its operators.

CHP can utilise either an internal or external combustion engine for co-generation. The external combustion engine is based on the Stirling engine and more can be read in the micro CHP fact sheet. Using an internal combustion engine is akin to taking the engine out of a car and using it to drive an alternator, but rather than dissipating all of the heat to atmosphere it is recovered and used as a source for hot water and heating.



On large scale projects i.e. CHP power plants steam turbines are used, the

All the advice and information provided is free and impartial and while every effort is made to ensure that the information given herein is accurate, no responsibility is accepted for any errors, omissions or misleading statements and no responsibility is accepted in regard to the standing of firms, companies or individuals mentioned.
Cornwall Energy Efficiency Advice Centre, South Crofty House, 1 South Crofty, Tolvaddon Energy Park, Camborne, Cornwall, TR14 0HX.
Telephone - Advice: 0800 512012. Office: 01209 614975

simplest cogeneration power plant is the so-called backpressure power plant, where CHP electricity and heat is generated in a steam turbine. Another main component of the backpressure power plant is the steam boiler, which can be designed to fire solid, liquid or gaseous fuels. In gas turbine heat recovery boiler power plants, heat is generated with hot flue gases of the turbine. The fuel used in most cases is natural gas, oil, or a combination of these. Gas turbines can even be fired with gasified solid or liquid fuels. Recently, natural gas fired combined cycle power plants consisting of one or more gas turbines, heat recovery boilers, and a steam turbine have become quite common.

Types of system

The type of system selected will depend on the intended usage, Known applications in the UK currently include; leisure centres, hospitals, schools, universities, community centres, district heating systems, colleges, industrial applications. The type of system will also depend on the fuel which is going to be used, for example gas turbines would be the optimal solution for a district heating system which has access to the gas network, whereas if there was no gas in the area then diesel may be used.

Generally speaking CHP plants operate on a heat to electricity ratio of 2:1. Due to this CHP is said to be thermally led, meaning that for it to be of any benefit there needs to be a constant heat demand. If a large house or leisure centre had a swimming pool this would be the ideal use for a CHP as all excess heat can be dissipated into the pool keeping it heated to a satisfactory level.

Renewable CHP

This is a relatively new development in the CHP field where rather than traditional fuels being used; biomass is being burnt to produce the electrical and heat energy. Currently this technology is quite young so there are no known applications as yet. It is possible to develop gas from wood to run reciprocating engines or gas turbines, but this technology (gasification) is currently at an earlier stage of development and therefore lower reliability.

Bio diesel could also be a fuel used for CHP plant simply by replacing traditional diesel.

Size / noise

The size and noise is dependant on the size of the plant. Micro CHP is relatively silent whereas large scale systems in use for industrial processes can be extremely loud, although noise reduction elements can be put in place to attenuate the sound. Complete silence is not possible as the generator has to be rotating to produce the electricity.

The size of the plant is again dependant on the energy requirements of the application. CHP plants can vary massively in size from the size of a household dishwasher to the size of a small house and in some cases even larger.

Is my house/business suitable?

Most houses will be suitable for micro CHP when it achieves full market roll out in 2009. If your house has a swimming pool then it would be ideal for a CHP installation as there is a constant heat demand for the heating of the pool.

If you have a business which has a large heat demand for industrial processes or ambient heating then CHP should be a

All the advice and information provided is free and impartial and while every effort is made to ensure that the information given herein is accurate, no responsibility is accepted for any errors, omissions or misleading statements and no responsibility is accepted in regard to the standing of firms, companies or individuals mentioned.
Cornwall Energy Efficiency Advice Centre, South Crofty House, 1 South Crofty, Tolvaddon Energy Park, Camborne, Cornwall, TR14 0HX.
Telephone - Advice: 0800 512012. Office: 01209 614975

consideration. Any application which has a constant heat demand will benefit with cost savings and a reduction in their carbon footprint.

Environmental benefits

CHP plant increases the overall efficiency of combustion to 75% in comparison to around 50% efficiency which is achieved via conventional electricity generation. As the supply of electricity is being generated on site it also negates any losses through the transmission and distribution networks.

Availability

Currently some micro CHP technologies have been on trial in the UK in the North-West and other regions. Units are expected to be commercially available in early 2009.

Grants

Currently there are no grants available under the Low Carbon Buildings Programme.

All the advice and information provided is free and impartial and while every effort is made to ensure that the information given herein is accurate, no responsibility is accepted for any errors, omissions or misleading statements and no responsibility is accepted in regard to the standing of firms, companies or individuals mentioned.
Cornwall Energy Efficiency Advice Centre, South Crofty House, 1 South Crofty, Tolvaddon Energy Park, Camborne, Cornwall, TR14 0HX.
Telephone - Advice: 0800 512012. Office: 01209 614975

More Information

Installers

No accredited installers currently available please refer to the Low Carbon Buildings Programme's approved installer list for grant-funded installations, This will be updated as and when installers become available. You can call them on 0800 9150990 or go to www.lowcarbonbuildings.org

Some installers located in Cornwall:

No installers currently listed

For up to date lists of local installers visit: http://www.csep.co.uk/page140g.html

We advise that you obtain at least 2 comparable written quotes from different installers and check the VAT discount for renewable technologies has been applied. For more information on VAT discounts, please see: http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageVAT_ShowContent&id=HMCE_CL_000514&propertyType=document#downloadopt

Other information:

Cornwall Energy Efficiency Advice Centre	0800 512012	www.cep.co.uk
Energy Saving Trust		www.energysavingtrust.co.uk
Bio-Energy – Manufacturers of renewable CHP		www.bioenergy.org
Powergen – likely to be the first company to mass launch micro CHP systems		www.powergen.co.uk/At-Home/Products/Technology-And-Initiatives

All the advice and information provided is free and impartial and while every effort is made to ensure that the information given herein is accurate, no responsibility is accepted for any errors, omissions or misleading statements and no responsibility is accepted in regard to the standing of firms, companies or individuals mentioned.