CLASP. Climate Change Local Area Support Programme

Planners' reference guide no. 13: Gas CHP

Introduction

Combined Heat and Power (CHP) systems combust a fuel source (typically gas but could also be biomass or other solid fuels) and generate electricity while recovering useful heat. This approach maximises the useful output available from combusting a fuel through off-setting high-carbon grid electricity while also producing useful heat output.

Carbon savings are achieved over conventional heating systems through the offset of high carbon electricity while producing useful heat. This approach results in a very low carbon burden of heat, with particularly low carbon burdens achievable where the system has a high electrical efficiency.

CHP systems are commercially available from as low as approx 5kW$_{elec}$ output, right through to large systems of greater than 1MW$_{elec}$ output. Systems are generally rated by their electrical output and their thermal output, with each particular system having its own characteristics of electrical and thermal efficiency. A higher electrical efficiency is more attractive in carbon and cost saving terms because of the higher carbon content and higher fuel cost of electricity compared to heat.

Rating & output

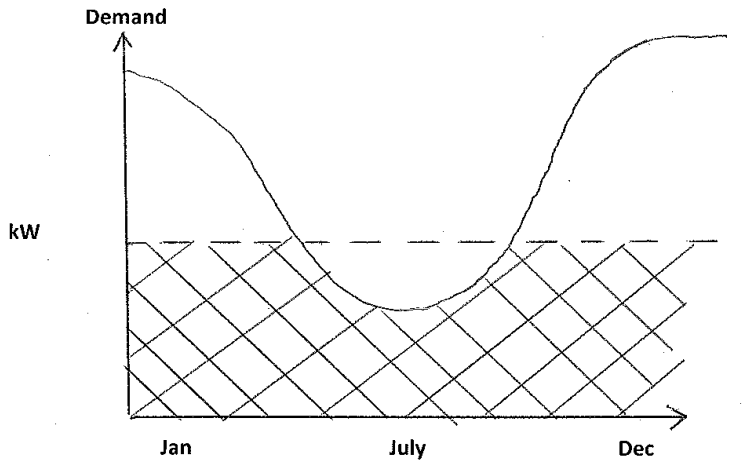
Gas CHP systems come in a variety of sizes and can be as small as 5kW$_{elec}$, right through to larger systems at over 1MW$_{elec}$ output. Overall system efficiencies are generally around 80%, with a variety of splits between electrical and thermal efficiency. Electrical efficiencies typically vary from 25-45%, while thermal efficiency typically ranges from 35-55%.

CHP systems can also be supplied using solid fuels such as biomass, but this is generally only feasible at a larger scale using steam turbine technology. Smaller gas-fired CHP systems use combustion engines to achieve high electrical efficiencies to maximise carbon savings and financial effectiveness.

CHP systems are generally more expensive than gas-fired alternatives and so they are generally sized to meet the baseload heat demand, with excess heat demands topped up using cheaper gas-fired boilers. This approach maximises the output from the CHP system

and therefore increases the financial viability of the system while ensuring significant carbon savings.

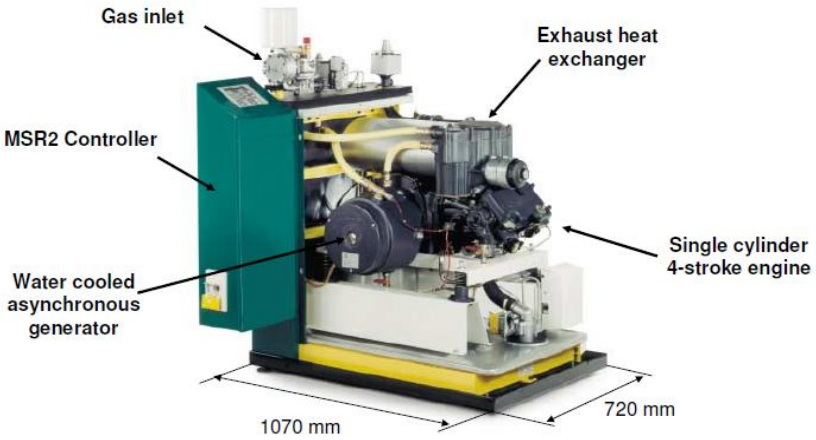
An example of this base load approach is shown below:



Dimensions

The physical dimensions of a CHP system are slightly larger than an equivalent sized gas-fired heat-only boiler, but much smaller than the equivalent space required to a biomass boiler with fuel storage. A full backup of conventional gas-fired heat-only plant is normally installed to cover periods of CHP maintenance and to cover extreme peak winter demands. Additional space may also be required for the necessary electrical infrastructure used to export electricity to the grid from the CHP unit.

The image below shows the key components of a gas CHP system.



Grid connection

For the smallest CHP systems (< 16 Amps per phase, or roughly 11.4 kW for 3-phase connection) the installer is only required to inform the Distribution Network Operator (DNO) that the connection will happen. For larger systems a grid connection report must be requested from the DNO, who may charge a fee of around £2,000 - 4,000 for this service. If any grid connection strengthening work is required, there will be an additional cost.

Rules of thumb and costs

Price ranges for different size systems are given below (as at June 2011).

- Typical capital costs: £650-£2,500/kW_{elec}
- Typical system efficiencies:
  - Electric efficiency: 25% - 45%
  - Thermal efficiency: 35% - 55%
- Typical system size: >5kW_{elec}
- Key financial sensitivities:
  - "Spark gap" the ratio in price between gas and electricity
  - Base load size and profile
  - Alternative options (off gas grid?)
  - Security of fuel supply
  - Note that gas CHP is not subject to any current financial incentive schemes (e.g. FiT, RHI, ROCs), however biomass fired CHP schemes are potentially subject to ROCs.

Planning considerations

There are generally very few additional considerations in planning terms for CHP, particularly if using gas as the main fuel. If biomass is being used, then fuel storage and supply issues become a consideration. For gas CHP, one of the main considerations is being located in a suitably dampened environment to prevent excessive vibrations causing a problem to nearby buildings/rooms. This can generally be resolved through the use of suitable engine mounts and consideration of layout and sound-proofing materials.

Further Information

Planning for Renewable Energy: A Companion Guide to PPS22 - http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

CHP Association –

http://www.chpa.co.uk/

This reference guide forms part of the CLASP technical support and training programme for North West local planning authorities, delivered by Envirolink, Quantum Strategy & Technology and AECOM (2011).