ZERO WASTE SCOTLAND

Energy Efficiency Business Support

Combined Heat and Power

CHP can be a cost-effective, energy efficient way of producing electricity and heat simultaneously

Combined Heat and Power, or CHP, is a system that makes use of the heat produced through electricity generation, rather than rejecting this to atmosphere. Conventional power plants generate electricity at around 35 to 55 per cent efficiency. In other words, 45 to 65 per cent of the fuel that's used to generate electricity is lost. A further 10 per cent lost during distribution through the grid. CHP, on the other hand can achieve system efficiencies of 80 per cent. The heat generated is comprised of low temperature hot water and, for systems above 600kWe, steam. System design will determine the proportion of electricity and heat produced.

The UK Government is incentivising high efficiency CHP systems to help offset some of the costs. Incentives include exemption from the Climate Change Levy (CCL) and tax relief through the Enhanced Capital Allowance (ECA) tax scheme. In order to qualify for these incentives CHP systems should meet the CHPQA (combined heat and power quality assurance) 'good quality' standard set by the government.

By generating and using electricity locally, CHP can help to reduce pressure on national distribution. However, CHP usually operates in conjunction with the mains electricity supply, so that when heating isn't required organisations can still get electricity from the grid without running the whole system. In addition, any excess electricity generated can be exported back into the grid. Current export prices are typically less than half the price of grid electricity. This means it tends to be more economically viable when more electricity can be used on site.

A compelling case for CHP can usually be made for energy intensive industries where there's a steady on-site demand for electricity and a supply of excess heat or steam. Paybacks on investment can be from two to five years. So too organisations with a constant and high heat and hot water demand, such as hospitals or colleges. It's a good option for district heating networks particularly when combined with high local demand for the electricity generated. However, the carbon benefits from CHP are fast-diminishing due to de-carbonisation of the grid. At the moment they still produce less carbon in comparison to grid supplied electricity and gas boiler supplied heat. But over the lifetime of the equipment, this is likely to reverse.

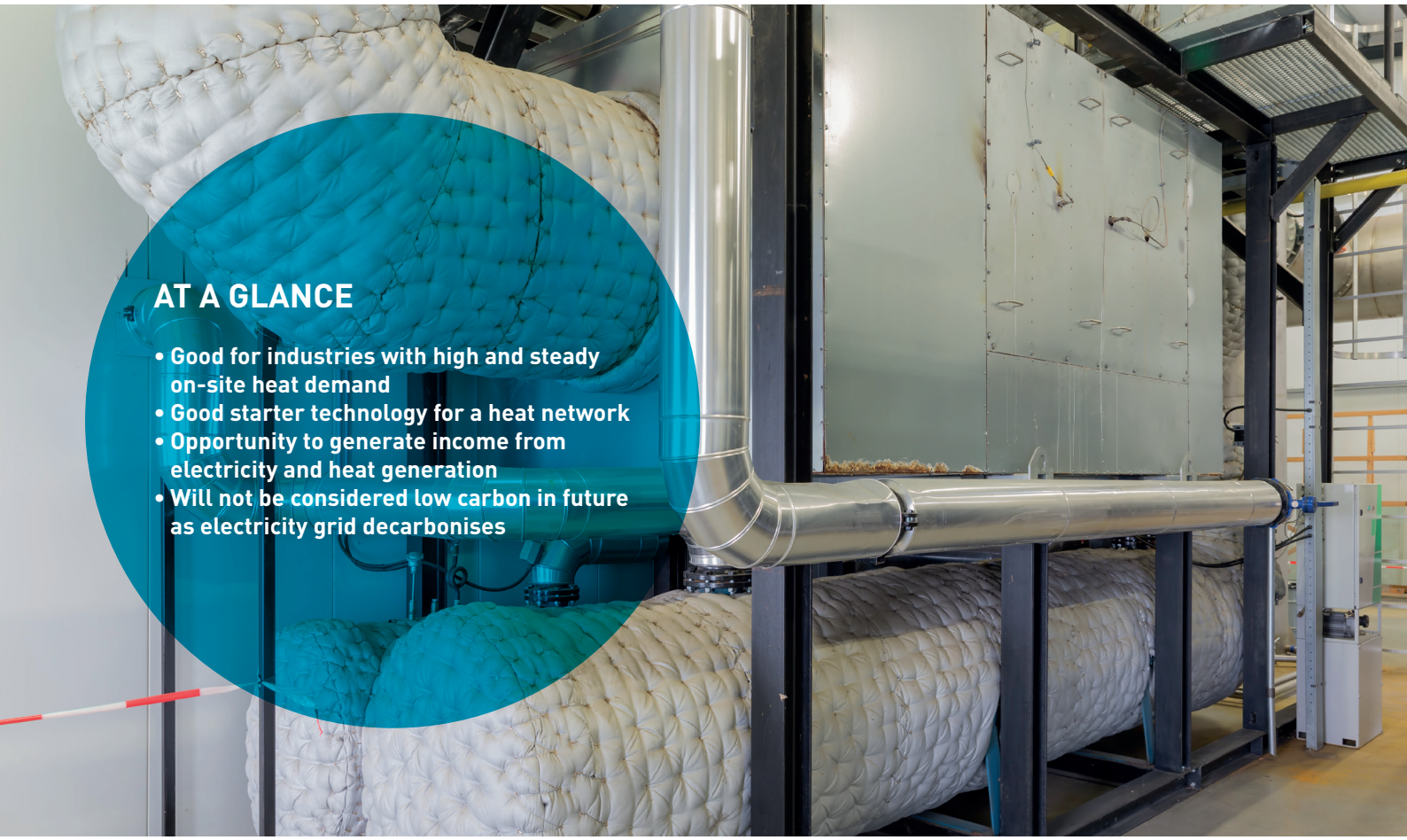
Most CHP systems run on mains gas. Renewable fuels such as biomass can also be used as the fuel source. Biomass CHP requires specialist technology however. It differs from gas CHP in electrical generation efficiencies, maintenance and space requirements.

How they work

CHP systems are composed of three main parts. There's the electricity generator, known as the 'prime mover', which is basically the engine. It can be a gas turbine, steam turbine or internal combustion engine. This is fed by fuel from an external source. In a gas turbine, the flue gases can be used to raise steam through a waste heat boiler. In a steam turbine, the exit steam is used directly. In an engine, steam can be raised by passing flue gases through a waste heat boiler, and low temperature hot water raised from the engine jacket cooling.. The heat recovery unit then captures the heat produced from the engine.

Large-scale CHP generates outputs of between 1MWe to 100MWe (MWe refers to the amount of electricity generated, MWth relates to heat generation). The most common applications to date are chemical plants, oil refineries, paper, publishing and printing businesses. Small-scale systems produce anything from 25kWe to 1MWe. These are used for smaller industrial and manufacturing sites, municipal buildings or district heating schemes.

CHP may not be suitable for all sites and may need a significant financial outlay. But it can be a cost-effective and energy efficient option for some industries and for heat networks. In fact, CHP is often a good "starter" technology for a heat network. The financial benefits of on-site electricity generation helps to pay back the network infrastructure costs in the early years of the project. As the heat network lifespan is much greater than the supply technology, CHP can be swapped out for lower carbon sources of heat in the future.



AT A GLANCE

- **Good for industries with high and steady on-site heat demand**
- **Good starter technology for a heat network**
- **Opportunity to generate income from electricity and heat generation**
- **Will not be considered low carbon in future as electricity grid decarbonises**