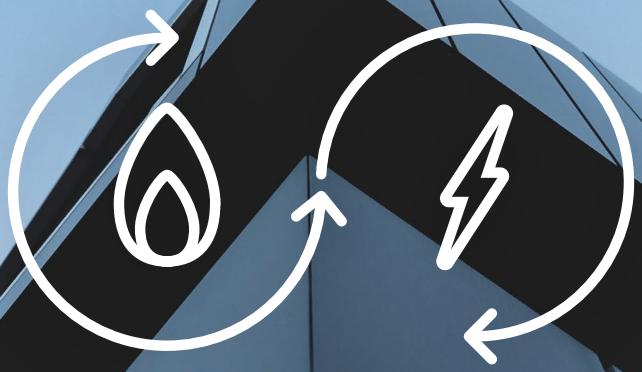
A guide to CHP unit sizing

Product series
November 2017



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A guide to CHP unit sizing

Get the full benefits from CHP by choosing the best unit size for your needs.

Investing in a Combined Heat and Power (CHP) plant is, in some ways, very similar to how you would lease office space – if you lease more than you need, you find yourself paying for space that you don't use. But if you lease too little, you will have to add on or find new space in the near future.

If you install a CHP system that's too small, it will not provide the full cost savings. If the CHP is too large it will struggle to meet its minimum load threshold to operate efficiently. Your CHP needs to operate as many hours as possible, because an idle plant produce no benefits.

Depending on the unit size, the typical cost of installing a CHP varies between £600-£1,500 per kWe[1]. This is why the installation of a CHP plant installation requires diligent consideration and planning to determine the optimal size and achieve the maximum return on your organisation's investment.

CHP systems will increase gas consumption whilst decreasing electricity usage, so check for the best tariffs with suppliers and adjust yours accordingly to ensure maximum benefit.

It is well worth taking the time to consider other efficiency measures – such as better insulation, staff training, utility buying – before installing CHP into an existing structure, as well as exploring possible changes to your energy requirements in the future.

By optimising a building's energy envelope first, you will gain data on the true hourly demand for heat and power to the building which can then be used to accurately size your CHP system.

[1] According to the Chartered Institution of Building Services Engineers (CIBSE)

Modelling demand

By establishing a detailed model of the heat and electrical demand, you can then establish the size of your CHP plant based on the following considerations:

1

Baseline

For optimal efficiency, CHP units should be designed to provide baseline electrical or thermal output, with any shortfall being supplemented by electricity from the grid or heat from boilers. In certain cases there is the option to size slightly above the thermal baseline in order to deliver higher electrical output and greater financial savings.

At times when the CHP output exceeds the thermal demand there is a need to reject heat. This is achieved through the operation of a dedicated dry air cooler or cooling tower. Getting rid of excess heat enables the CHP unit to maintain its full electrical output but would reduce its efficiency. Therefore, a careful balance should be achieved between CHP size and site demand.

2

Load following

CHP units have the ability to modulate, or change their output in order to meet fluctuating demand. These CHP units can be set up to track either the electrical or thermal demand profile. The decision to track thermal or electrical load depends on the heat to power ratio of the site and associated energy costs. When following the electricity demand, the implications of possible heat dumping into the atmosphere via heat trim or heat dump radiators have to be fully analysed.

3

Electricity export

Another way to deal with excess electricity is to export to the power grid, however this must be carefully evaluated as it can have significantly lower value than electricity consumed on site.

Another strategy is to employ multiple CHP units instead of one larger one. Using this strategy, an operator would set up a series of units to cascade to meet energy demand during times of peak demand. One unit would meet the baseline while smaller plants would provide excess needs.

Using the load duration curve to size CHP

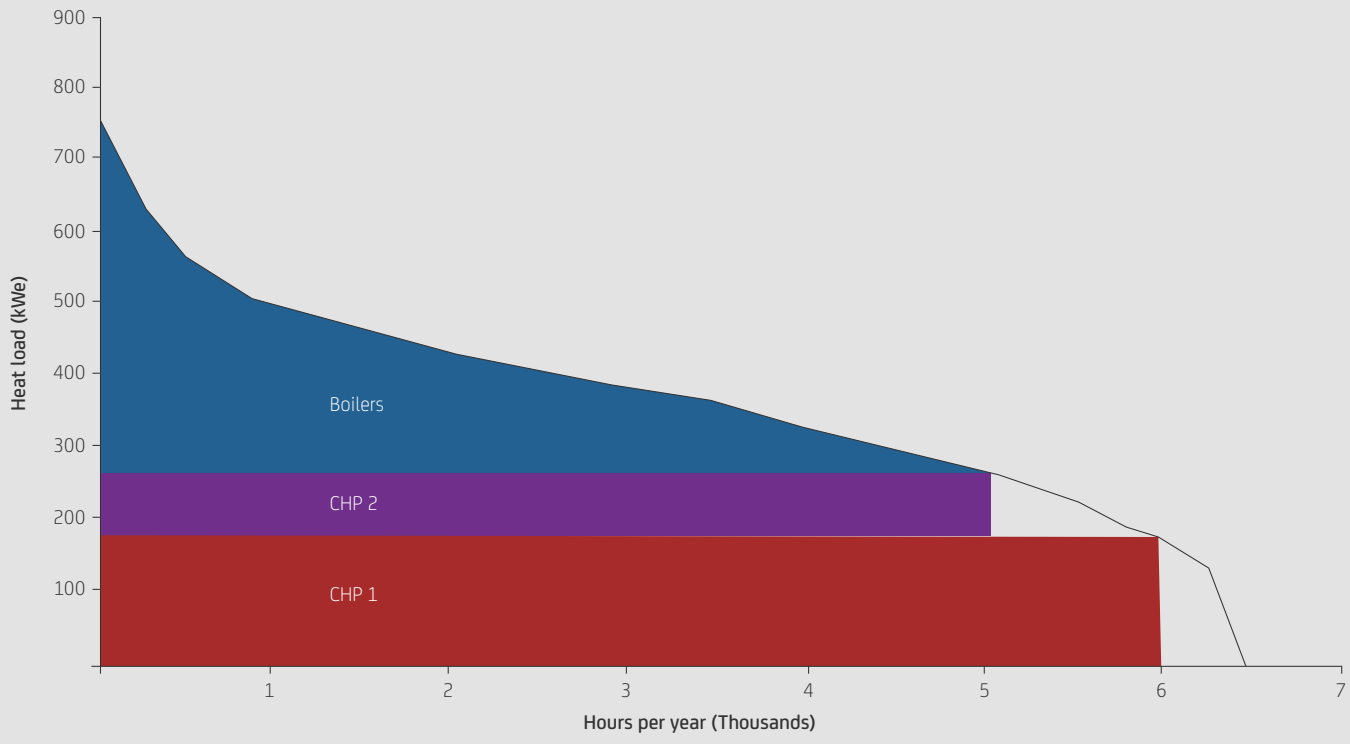
To correctly size a CHP, an organisation must understand how long a particular demand exists for.

A very effective way of assessing load is by producing a load duration curve.

This load duration curve shows heat load for one year and how two CHP units can be used in conjunction with each other. One 180kWe unit operates for 6,000 hours each year, and the other 90kWe one runs for 5,000.

Load duration curves can also be used very effectively to analyse a site's existing electrical demand.

Load duration curve for boilers and CHP



Calculating spark spread

CHP users also have to take into account the spark spread when producing heat and electricity.

A spark spread of around 3 or more is ideal for CHP applications. This means that the unit price of power is 3 times the unit price of CHP fuel (usually natural gas). **The University of Cambridge's Energy Policy Research Group** has estimated the potential impact of a change in spark spread on the up-take of CHP.

You invest in CHP to save money and reduce environmental impact. Choose the wrong size of unit, and those benefits go out the window.

The spark spread is the difference between the price at which you can buy gas in relation to the price you can buy power.

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