Combined heat & power

A modular approach to CHP provision

In achieving maximum performance from a CHP installation it can pay to use a highly responsive modular approach that also takes advantage of the latest technologies. **Beata Blachut** explains

VERY OFTEN when people think of CHP their first thoughts are of large scale plant designed to meet high but steady power and heat loads. However, if CHP is to realise its full potential in reducing the UK's carbon emissions it needs to be applied to a much wider range of project types – particularly relatively small projects - and this brings its own challenges. Not least of these is the inflexibility of traditional CHP designs, which has tended to impose constraints on the environmental benefits that can be achieved.

In an article in HVR earlier this year we explained how CHP systems that track loads and modulate in response to changing loads are able to deliver higher efficiencies than fixed output systems. However, where more than one CHP unit is used it is also important to consider how the loads are shared across the units, in parallel with the load tracking. It's also helpful to understand how high grade heat can be maintained at all times and the key factors in integrating CHP within heating circuits.

Modular CHP works on the same principles as the modular boilers that most HVR readers will be familiar with, using a number of smaller units to provide greater flexibility than a single, large CHP unit.

Large or small projects

And, as with modular boilers, modular CHP is suitable for both large and small projects. For instance, with modular CHP up to five units can be combined to provide a range from 15kWe/30kWth to 100kWe/200kWth.

The basic principle of load sharing across the units is that all units are operated in parallel until the load can be covered by 'one unit less'. This arrangement ensures the maximum efficiencies are achieved while minimising the number of units that are operating at any one time. As with modular boilers, lead and lag status can be alternated to even out the running hours for each machine.

It's also worth noting that the efficiency of some smaller CHP units has been improved significantly. Our latest models, for example, offer an overall efficiency of 96.8 per cent, based on net calorific value (NCV). In this respect it's worth noting that when comparing units the NCV should be the standard reference value. It is determined by taking the gross calorific value and deducting the latent heat of water vapour formed during combustion of hydrogen and from any moisture present in the fuel.

Another challenge for specifiers is that traditional CHP operates with a constant temperature differential (ΔT), resulting in variable flow temperature and inconsistent performance of the system.

Producing high grade heat

The solution to this is to incorporate a heat distributor that maintains a constant flow temperature, corresponding to the design flow temperature, irrespective of the return water temperature. The flow controller in the heat distributor can be set to deliver a heating flow temperature in the range 40-80 deg C.

As a result, the CHP always produces high grade heat that can be used on site without 'topping up' from boilers. In fact, as long as the heat loads are within the CHP's capacity, there will be no need to use the boilers.

Furthermore, any surplus heat is stored at around 80 deg C and this stored heat helps to optimise CHP operating times and further reduce the likelihood of back-up boilers being operated.

Load-tracking, modular CHP can be incorporated into a heating system either in series or in parallel with the boilers. In either case, to achieve the best possible performance from a CHP installation, careful attention must be given to integration of the CHP within heating circuits. To address this issue and optimise the system, attention needs to be paid to the whole system design, rather than simply the central plant room design. In particular, the system should be designed to meet the requirements of CIBSE Guide AM12, which identifies the following key objectives:

- The CHP unit should operate in preference to the boilers at all times.
- When boilers are in service, they should not prevent the CHP from operating at maximum output.
- Heat recovery from the CHP unit should be optimised.
- The CHP unit should always be able to generate heat even under part-load heating conditions.
- The building heating system should be designed so that return temperatures do not result in the CHP unit shutting down unnecessarily.

There is sometimes a perception that smaller projects are not suitable for CHP, even though they have load profiles that would benefit from CHP. Obvious examples include multi-residential housing, student accommodation, schools, nursing homes, hospitals, leisure centres and many more.

Modular CHP makes the benefits of CHP available to these smaller projects, as well as delivering a more flexible solution for larger projects. In fact, for all but the very largest projects

To achieve the best performance, careful attention must be given to the integration of the CHP within heating circuits

// The author is product manager at SAV Systems //