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DIRECT-FIRED WATER HEATING IN THE 'LOW CARBON' MIX

The application of technologies such as solar thermal solutions, ground and air source heat pumps and combined heat and power (CHP) are somewhat different for domestic and commercial installations. Here Yan Evans, Technical Director of Andrews Water Heaters and Potterton Commercial explains this difference and how a mix of technologies is being adopted in the non-domestic sector.

Domestic versus Commercial

In the domestic sector it is very likely that the chosen renewable technology, particularly in the case of a ground source or air source heat pump, will replace the conventional fossil fuelled appliance. This will be due to capital cost implications and also perhaps space limitations. However, for commercial applications, in almost all cases, we are witnessing the use of a combination of conventional high efficiency boilers and water heaters working along side one another to deliver a low carbon plant room solution. The driver for the latter could be a combination of building regulations, UK and European legislation, corporate environmental policy and local authority planning consent. In our experience it is the latter that is currently the key catalyst for the adoption of low and zero carbon technologies in the commercial sector. End users, architects, design engineers and contractors are all striving to design and build properties with 10% to 15% of the energy being derived from some form of renewable solution.

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In some cases this could mean several tens of thousands of kWh being required from solutions such as solar hot water heating, heat pumps, biomass boilers, photovoltaics and CHP, or a combination of these.

Electricity Generation

In the case of the technologies that generate electricity, the issue of integrating them within the same property is not so much of an issue as it is with those generating heat. Photovoltaic panels and wind turbines would generally operate in parallel with the electricity grid infrastructure. As such, even when connected to the local single or 3-phase distribution board within the property, the generating appliance would effectively have access to an 'infinite busbar' through connection via the main incoming supply. There is no conflict between the technologies in gaining access to the electrical load although the 'spilling' or exporting of electricity to the grid needs careful consideration depending on the 'feeding tariff' available from the electricity supply company.

However, with products and solutions that generate heat there is a much greater chance of operational conflict. This is due to the fact that the heat load, whether space heating or hot water, is usually limited to the particular building being designed and constructed. The exception to this rule is in properties to be connected to a district heating scheme where the heat source is a remote centralised plant room.

Sources of Heat

As an example, let us consider the use of solar thermal solutions and CHP units on a given site. In order to maximise the economic and environmental benefits of the CHP installation it is necessary to select the heat output of the unit on the basis of the base thermal load in order to maximise the annual running hours. CHP units are heat lead devices and in the absence of sufficient thermal load will not operate.

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For many new build properties, depending on the building use and the nature of the occupancy, the base thermal load will be limited to hot water during the warmer summer months when there is little or no demand for space heating. In this case, the hot water load would be the only available thermal demand to sustain CHP unit operation.

Solar thermal collectors deliver the maximum energy during the summer periods when there are high levels of solar irradiation, prolonged daylight hours and higher ambient air temperatures.

Solar thermal solutions are often sized and designed for the daily hot water demand to maximise annual average Solar Fraction (SF) (the percentage of the hot water demand satisfied by the solar thermal solution). This sizing strategy would deliver a SF of typically 30% to 40% for a commercial property. There is an expectation that the SF during the winter months could be as low as say 15% to 20% whilst in the summer months rising to 100%, with the solar thermal solution satisfying the daily hot water demand. The need for the use of any primary heating appliances, such as boilers or direct-fired water heaters, would be negated during the summer time, leading to significant reductions in both fuel consumption and corresponding carbon emissions.

However, if the solar thermal solution is satisfying the daily hot water demand there is no hot water load to offer the CHP unit during the summer when there is also no heating load. In this scenario, the solar thermal system would hold off the CHP unit, reducing the annual operating hours and having implications on the economic and environmental benefits of the installation. As the CHP unit is displacing electricity with a higher carbon intensity compared with natural gas (0.43 kgCO₂/kWh for grid supplied electricity versus 0.193 kgCO₂/kWh for natural gas), the operation of the appliance offering the greater carbon dioxide benefit is being hindered.

The combination of solar thermal solutions and CHP units can work in the correct application with suitably selected equipment outputs. /MORE

Provided there is sufficient base thermal load to support both the operation of the CHP unit and the solar collector array during the summer months, then the marriage of these two technologies can deliver significant carbon dioxide reductions.

Another potentially ultra-low carbon solution is the use of ground source heat pumps along side CHP units. These technologies can work extremely well together. Both are heat sources and provided there is sufficient base thermal load to support the operating of both appliances there is no reason why they cannot work in harmony. In fact, the electricity generated by the CHP unit would be used to power the heat pump under normal operating conditions, which would have a significant impact on reducing the carbon footprint of the solution.

Controlling the Mix of Technologies

There is the potential to deliver a plant room design which offers significant reductions in carbon dioxide emissions and a hydraulic schematic that includes conventional fossil fuelled appliances working along side and in harmony with LZC technologies.

However, the control strategy for the operation and interface of a variety of heat sources that is the critical success factor for such installations, ensuring that carbon dioxide reductions are maximised with no compromise in the provision of space heating and hot water.

The more complex the mechanical and electrical services on project becomes, through the application of multiple heat sources, the greater the pressure is applied to the suppliers of conventional and LZC technologies to have a greater input into the system design. Andrews Water Heaters and Potterton Commercial are experiencing an increase in requests for a higher level of input into the application engineering, a trend we encourage and readily support.

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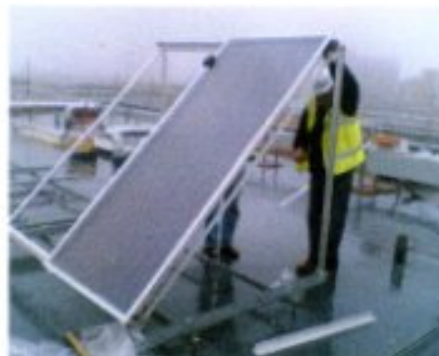
In order to ensure such projects are a success we believe that the equipment supplier has an important contribution to make and should be regarded as part of the project team. We are no longer just an equipment supplier, we a solutions provider and would encourage our early participation in the plant room design.

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(By-line for H&V News)



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