Data centres and heat reuse: Light at the end of the tunnel?

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Data centres may not look very interesting from the outside but they provide the core digital infrastructure that underpins our modern economy. Data centres process, store, transmit and manage digital data in secure, controlled environments. They consolidate the computing functions associated with corporate and government IT, retail, social and business media, industrial and academic research. The Cloud is not in the sky: it is in a data centre.

The by-product of computer processing is heat and where large numbers of servers are located together the heat output is considerable. In theory then, data centres should be good candidates for heat reuse. However, there are few examples of successful heat reuse in the sector and none that we are aware of in the UK. The reasons include the low grade of the heat, the lack of infrastructure and absence of customers.

Government is keen to help businesses tackle these and other barriers to heat reuse and issued a call for evidence at the end of 2017 on support proposals. We responded in brief explaining the sector's position and confirming our willingness to engage in any relevant policy dialogue. Government responded by including data centres in the sectors eligible for support – which was great news. In a subsequent announcement on 15th October, Government committed £320m to the development of heat network infrastructure: infrastructure that is a prerequisite for the rollout of successful heat reuse projects in the UK. So they clearly mean business.

Infrastructure aside, our biggest problem is the grade of our waste heat: hot air is much less useful than steam. The grade of heat is also to some extent a function of how operators implement cooling which is delivered in various ways – chilled water, chilled air or fresh air ventilation for example. Other more novel cooling approaches are being rolled out or are in development such as immersive cooling or the use of underground aquifers for heat transfer.

Cooling typically accounts for nearly a third of energy costs, so is the focus of much R&D and commercial attention. At the same time, the industry is attacking the problem from the other end: computer servers are being developed to operate at higher temperature and at wider humidity ranges, thus reducing (but not eliminating) the need for cooling. While all cooling processes provide a route for heat rejection, historically the focus has been on dissipating the heat, not concentrating it. However, some modern cooling technologies do concentrate heat and therefore present us with much more scope.

First, though we should take a look at places where heat reuse is more common, for instance in Scandinavia and the Netherlands, and examine some data centre case studies to establish how it works, the issues that they have encountered and how they have been dealt with. There is also a world of difference between retrofitting an existing site and accommodating heat reuse potential in designs for a new facility, so we have to be realistic: the UK may have the largest commercial data centre estate in Europe but only a fraction of it may be suitable to retrofit and we may find we have to concentrate our efforts on new developments.

Nevertheless, there is clearly appetite in the sector to make better use of our waste heat: the industry has developed a performance metric based on the proportion of waste heat that is reused: ERF or Energy Reuse Factor[1]. This metric is likely to be included in the Green Public Procurement criteria currently being developed by the European Commission – so heat reuse could be a differentiator in tendering for public sector data centre contracts in future.

The good news is that, through techUK, data centre operators will soon be engaging with BEIS and their technical consultants to explore this landscape further. We will be holding workshops to explore sector specific barriers that are preventing waste heat from our facilities being reused, whether these are technical, contractual, regulatory or cultural. With the right infrastructure in place, the right incentives and the right technology, we hope that data centres will make a viable contribution to energy efficiency through heat reuse.

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[1] See: Data Centre Performance Metrics for Tiny Tots)