

Harnessing industrial waste heat

Roughly half of the energy used in UK industry is lost as waste heat. These losses are not inevitable. Instead, there is an opportunity to reimagine surplus heat not as an unavoidable loss but as a potential resource.



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The UK's unused surplus heat resource could be substantial. UK industry consumes approximately 15% of UK energy. If some of the surplus heat is captured and re-used, the UK could reduce industrial energy costs, bolster industrial competitiveness, lower costs for heat consumers, and reduce UK greenhouse gas emissions.

The Royal Society's report, *Unlocking Thermal Energy*, presents the idea of heat cascades, in which waste heat is captured from hot industrial sources and transported to other end uses such as home heating. Manufacturing industries like steel, cement, ceramics, glass and chemicals involve heating materials to high temperatures, often up to 2000°C, before cooling them again. This results in both a high heat demand and a great deal of surplus heat. Recovering, transporting, and re-using this otherwise wasted heat can provide a new supply of thermal energy for nearby users.

The further the heat travels, the cooler it gets. In a cascade system, recovered heat could first be returned to the process from which it originated, or used elsewhere on an industrial site where high temperature heat is required. Unused heat could then be transferred to other nearby users with lower temperature requirements, and finally for space and water heating in hospitals, homes or offices (see Figure).

Connecting producers and consumers

Heat networks are a fundamental aspect of a heat cascade system, transporting surplus heat from producers to consumers. Today, only 2% of UK buildings use district heating. This could rise to 20% by 2050 according to the

CCC. Heat networks are widely deployed elsewhere in Europe, and in some countries provide the majority of national building heat. In Sweden, recovered waste heat is already well integrated into heat networks. Further, as new local sources of waste heat emerge, including from data centres, heat networks will be critical to enabling the re-use of excess heat for businesses and communities.

A key component of a cascade system is balancing heat supply and demand. Not all surplus heat supply and heat demand occurs at the same time. Thermal storage systems overcome this challenge. Storage systems can take many forms, from technologies that can heat a single building for a day (e.g. heating bricks which then release heat throughout the day), to large-scale interseasonal stores which can heat multiple buildings for a season (such as storing surplus heat in subterranean aquifers in summer, when demand is low, and then releasing it to homes in winter when demand is high).

To unlock the benefits of heat re-use, the Royal Society's report makes four interlinked recommendations: integrate thermal efficiency and heat re-use into industrial and decarbonisation strategies; assess and map the national heat resource and demand; support research, demonstration and deployment; and establish the governance and financial arrangements needed for heat to be valued and traded.

An untapped resource for the transition

Doing so could support the UK's transition to net zero while lowering costs to heat users, supporting industrial competitiveness, and providing new local sources of heat for communities. UK industrial and energy infrastructure is already being redesigned as part of the energy transition. The transition presents an opportunity to reimagine the role of heat in the UK and harness this untapped energy resource.

Figure: visualisation of a cascade system recycling unused heat

