



Energy Efficiency Business Support



Industrial waste heat

Heat generated from industrial processes can be re-used instead of letting it go to waste

Heat use in industry contributes a significant percentage of Scotland's carbon emissions. In 2010, around 15 per cent of all carbon emissions in Scotland were generated by energy intensive industries (EIIs), such as the chemical, oil refining, and food and drink industries.

In some cases, excess heat energy can be re-used on site for other processes. However, much of the heat is low grade and would be better harnessed for use off-site. There's a lot of potential to integrate this lower temperature heat in district heat networks or nearby industries. Demand would have to be high enough, and these secondary users close enough, to be worth it. Installing and managing heat distribution infrastructure is complicated and requires layers of contractual agreements. Taking a strategic approach to energy planning across a wide area can highlight the most promising opportunities for investing time and money.

On the continent, large industrial sites are frequently key heat suppliers to district heating networks. In some scenarios, surplus heat sales may provide an additional revenue source. Zero Waste Scotland's 'Industrial Decarbonisation and Energy Efficiency Roadmaps: Scottish Assessment' states that in a best-case scenario, CO₂ emissions from EIIs could be reduced by up to 76 per cent of 2012 levels by 2050. This best-case scenario assumes decarbonisation of the electricity grid and developments in carbon capture and storage (CCS) commercial deployment. It's little surprise that the Scottish Government has made industries such as these a key target area for CO₂ reductions.

One example of a successful heat network using industrial waste heat is the North British Distillery and Tynecastle High School in Edinburgh. During construction of the new school, which sits a mere 250 metres from the North British Distillery, an opportunity was spotted to re-use some of the waste heat generated in the whisky distilling process. A couple of 1.5MW heat exchangers at the distillery are used to capture the heat and transfer it to water, which is then piped at 85°C into the school's heating system. It cost £45k and reduces the school's CO₂ emissions by 500 tonnes a year.

How it works

There's an endless array of proven technology to capture and re-use heat from a range of sources. This includes different types of heat exchangers to capture the heat, heat pumps to raise the temperature where necessary, and heat storage.

Sources of waste heat include:

- flue gases from engines, boilers, ovens, furnaces and process equipment
- hot effluent streams from cleaning, treatment or manufacturing processes
- process water, air or products at temperature
- electrically-led combined heat and power (CHP)
- heat released from equipment, including cooling and refrigeration processes

The captured heat can then be used for:

- pre-heating combustion air for boilers and furnaces
- space heating
- pre-heating of boiler-feed water, process water or process air
- drying and other industrial heating or pre-heating processes
- off-site heat supply

Within any industrial plant there's likely to be more than one source of waste heat and several potential ways of reusing that heat. To get started, an assessment is needed to map energy flows through a plant.

This can be done by producing a Sankey diagram which shows the energy balance for a process and quantifies the waste heat sources. The Sankey diagram – together with information on site layout, surplus heat availability, and the proximity and demands of potential heat sinks – provides the basis for identifying heat recovery opportunities.

Any new heat-capture technology, while reducing costs over the long term, is likely to require a large initial capital investment. Careful consideration is needed to assess the best outcome. ●

AT A GLANCE

- 15 per cent of carbon emissions generated by energy intensive industries in Scotland
- Good potential for re-use of heat within factories and in heat networks
- Lots of proven technology available to harness waste heat
- Complex and capital intensive but with good savings potential over long term