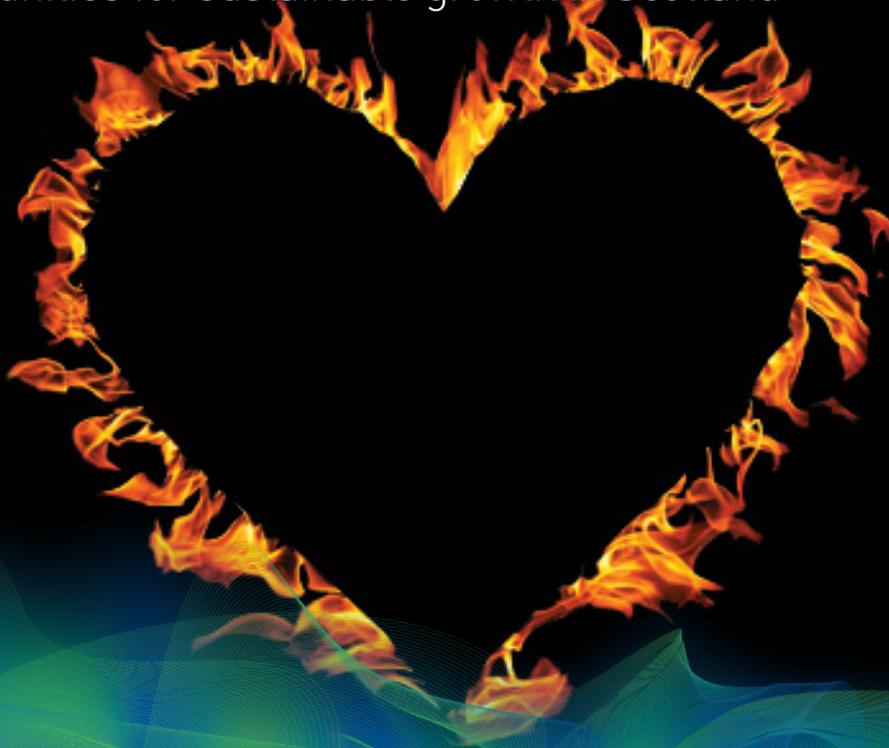


Heat Recovery

Sector opportunities for sustainable growth in Scotland



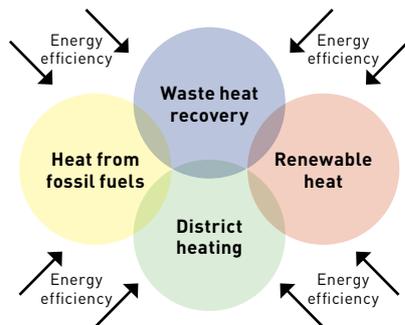
Heat recovery – sector opportunities for sustainable growth in Scotland

This report highlights the main economic opportunities for Scotland from 'heat recovery', defined as heat without additional **combustion** of fossil fuels or biomass. This includes:

- waste heat recovery; and
- renewable heat from geothermal and ambient heat sources

District heat networks are a prerequisite to the commercial development of many of the technologies associated with heat recovery.

This is one of a series of reports produced by Scottish Enterprise to highlight the economic opportunities for Scotland from a low carbon economy. A wider research group has input to these reports, comprising the Scottish Government, Highlands and Islands Enterprise, Skills Development Scotland, Scottish Funding Council, Resource Efficient Scotland and the Edinburgh Centre for Carbon Innovation.



Government policy

To meet climate change and energy efficiency targets there are European, UK and Scottish policy drivers to reduce the demand for heat, increase the efficiency of heat production and to increase the uptake of renewable heat, heat pumps and district heating.

Scotland's Ambition

By 2050 Scotland will have a largely decarbonised heat sector with significant progress made by 2030. This ambition will be realised through a number of means, including renewables and CCS, but is based on the fundamental first principles of keeping demand to a minimum, most efficient use of energy and recovering as much waste heat as possible, at least cost to consumers.

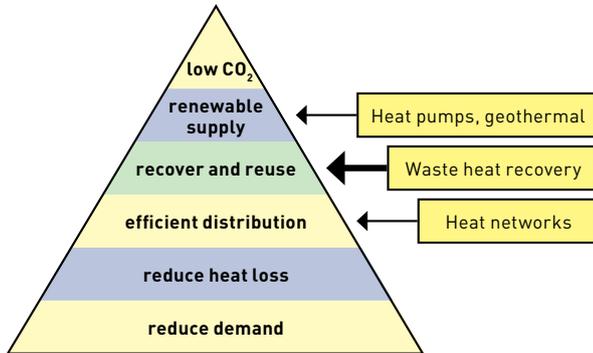
The Scottish Government has published:

- a Renewable Heat Action Plan which sets a target of 11% of heat demand from renewable sources by 2020;
- an Outline for a Draft Heat Vision outlining a heat hierarchy;
- a District Heating Action Plan; and
- a draft Heat Generation Policy Statement outlining scenarios to meet our heat targets.

Using waste heat will also support the target to reduce our total energy demand by 12% by 2020.

Heat Hierarchy

As shown in the diagram below, reducing demand for heat and reducing heat loss should be the first priorities for energy management. However, this report focuses on the economic opportunities from waste heat recovery and the use of heat pumps. Heat pumps can be used to boost relatively low temperature heat sourced from excess waste heat from industry, the wider built environment or from naturally occurring sources.



Heat recovery potential

Heat accounts for 55% of Scotland's energy consumption (88 TWh in 2010). Heat recovery, district heating and heat pumps are essential tools to contribute to achieving Scotland's longer term climate change targets and therefore the assumption can be drawn that their wider deployment will lead to a significant growth in these markets:

- heat exchangers
- heat pumps
- storage

The Scottish Government is producing a detailed heat map of Scotland to provide geographic information on heat demand and supply that will help planners and developers to enable and improve the viability of heat infrastructure.

Heat pumps can be used to boost the temperature of low grade waste heat and heat from naturally occurring sources. The International Energy Agency estimates that heat pumps could reduce global carbon emissions by 8%.

Carbon efficiency of Heat Pumps

A heat pump with a Coefficient of Performance of 3 could reduce carbon emissions by up to 17% against gas and 44% against oil. If the electricity decarbonisation target for 2030 is achieved, the carbon reductions could be as high as 91% and 94% respectively.

The value of heat depends on its location, temperature, flow rate and whether the water or steam is contaminated. There is a substantial, but not clearly quantified, opportunity to utilise heat from canals, sewage treatment works and underground minewater.

Some of the major opportunities arise where there is simultaneous heat and cooling demands, for example, air conditioning and heating hot water (hospitals) or food production with heat and cooling requirements. Significant industrial and commercial users of heat include Scotland's 108 whisky distilleries and our manufacturing companies, particularly in the chemical and food and drink sectors.



*Technology Innovation Needs Assessment (TINA): Heat, Low Carbon Innovation Coordination Group, 2012

[†]Powry, The Potential and Costs of District Heating Networks, 2009

[▲]Renewable Heat in Scotland; 2020 Vision, IPA, 2009

Economic benefits

Installing and maintaining heat recovery will create local economic activity, provide opportunities throughout the supply chain and improve the efficiency of companies that recover the heat, providing them with more stable energy bills. Scotland will also benefit from reduced reliance on imported fossil fuels.

The economic activity arises from:

- specialist consultants, designers, architects and developers;
- system controls, sensors and heat modelling;
- equipment manufacturers, including pipework and drilling engineers (geothermal);
- construction and installation;
- maintenance and control engineers; and
- cost savings for property owners (sellers and the users of 'waste' heat).

The UK Technology* Innovation Needs Assessment, reports that innovation in heat pumps, networks and storage could reduce energy costs by £14-66bn and has the potential to add £2-12bn to GDP to 2050. The priority is to integrate heat networks and waste heat recovery with large scale storage. The report forecasts growth to 2020:

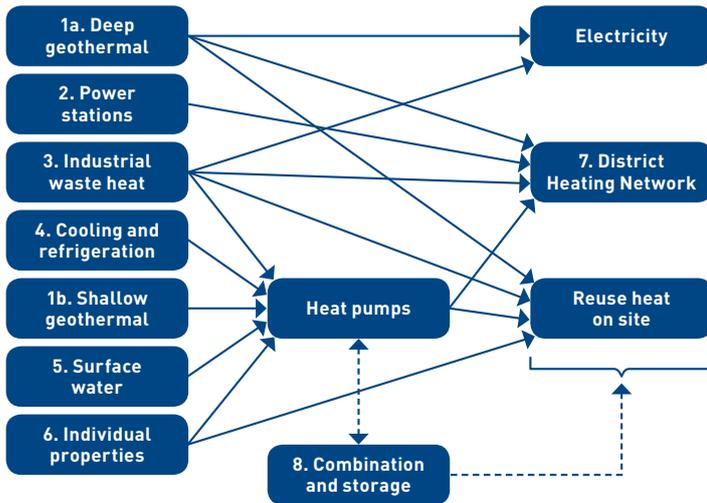
- heat pump market between 12-35 TWh;
- heat networks 9-27 TWh;
- daily heat storage near zero-4 GW; and
- inter-seasonal storage 0.2-2.8 GW.

Scottish Renewables estimate that the renewable heat industry could generate turnover of £2.7 billion by 2020.[▲]

The economic potential for district heating in the UK is estimated as 14%[†] of heat demand. If Scotland followed a similar deployment trend, district heating would reach 8.4 TWh, 810,000 dwellings and 2.3 million m² of commercial space.

Economic opportunity

The diagram below shows the relationship (not in any prioritised order) between 8 potential areas of economic opportunity for heat recovery identified by Scottish Enterprise.



1. Extract heat from deep geothermal and warm underground water, including minewater, to use on site or feed into a district heat network.
2. Co-location opportunities from use of waste heat from power stations, CHP plants and waste incineration plants.
3. Use technology to capture and use waste heat or to generate electricity.
4. Use waste heat from process cooling and refrigeration.
5. Extract heat from surface water – rivers, canals and sewage treatment plants.
6. Use technology to capture warm air from ventilation units, heat from wastewater drains or use ground and air sourced heat pumps on individual sites.
7. Using the heat maps, identify and support area based district heating and cooling networks.
8. Manufacture and use heat storage equipment and innovative techniques to provide flexibility between the electricity and heat markets and enable an increased penetration of renewable heat.



Supply chain

Scotland has a small number of companies with an international competitive edge in heat recovery. However, projects compete in a global market place, dominated by Scandinavian and German companies. If heat recovery projects accelerate in Scotland then there may be opportunities for inward investment.

The following companies have a Scottish base and can provide heat recovery solutions:

- Star Refrigeration (Glasgow) – industrial refrigeration, HVAC, heat pumps.
- Heliex Power (East Kilbride) – steam rotary screw expanders to produce electricity.
- Turner EPS (Glasgow) – distribute screw expanders to produce electricity.
- Scotia Energy (HQ Glenrothes) – supply heat recovery equipment.
- Sunamp (Tranent) – produce phase change heat batteries.
- Doosan Power Systems (Renfrew) – produce boilers and generators.
- Cochran (Dumfries) – manufacture steam boilers and economisers.
- Mitsubishi (Livingston) – manufacture air sourced heat pumps.
- Torishima (Coatbridge) – manufacture pumps.
- Integrated Environmental Solutions (Glasgow) – simulation and heat modelling.

Sustainability drivers and enablers

The increasing and fluctuating market price of energy and additional carbon taxes are the key drivers for efficient heat solutions. Energy security, fuel poverty, environmental commitments and corporate social commitments are also relevant.

Organisations regulated by IPPC are obliged to consider waste heat recovery as part of the permit system. Under the Thermal Treatment of Waste Guidelines, all incinerators and energy from waste plants must produce heat plans.

The EU Energy Efficiency Directive (2012) will require large enterprises to complete an energy audit by 2015 and it will promote efficiency in heating and cooling.

The draft Scottish Planning Policy (2014) requires the planning system to support the expansion of renewable energy and heat networks using the heat maps to assess the potential for co-locating developments. The National Planning Framework includes a focus on low carbon heat including district heating.

Scottish building regulations from 2015 will further reduce emissions by 21% for new homes and 43% for non-domestic properties from heating/cooling, lighting and ventilation. Longer-term zero carbon standards, and allowable offsets, will further shape the market.

Challenges

The fundamental market failure is short-termism. Most heat recovery options are capital intensive. Many companies demand very short payback periods before they will invest and may be reluctant to sign up to long-term heat supply contracts.

For most companies heat recovery is not their core business, so they may not recognise opportunities, or have the will to pursue them. There is a commercial risk that the investment may negatively impact on their core operations or that the project will fail to deliver anticipated returns.

The returns are highly dependent on the cost of electricity. The challenge is to persuade a commercial customer to take on a project that may yield a modest and long-term return that may be disruptive to install.

District heating requires a strategic approach, with anchor loads, certainty over future supply and a willingness from partners to sign up to long-term contracts.

Delivering the opportunities – resource and support available

As a consequence of these challenges, there is a case for the public sector to intervene to facilitate and stimulate companies to take advantage of the opportunities.

There are a number of **financial incentives** in place:

- Renewable Heat Incentive (but excludes waste heat from fossil fuels);
- Green Deal and Energy Company Obligation;
- Enhanced capital allowances for companies installing energy efficient products;
- The District Heating loan scheme, the Warm Homes Fund, the Renewable Energy Investment Fund and the Green Investment Bank can fund district-heating schemes.

Resource Efficient Scotland offer support, including Small Business Loans, to Scottish organisations to improve energy, water and resource efficiency.

The **Energy Saving Trust** provides advice and support to householders and to the supply chain on energy efficiency and home renewable measures, the Green Deal, Energy Company Obligation, Renewable Heat Incentive and Scottish Government programmes.

Scottish Enterprise and **Highlands and Islands Enterprise** commission research and promote market opportunities with companies, support inward investment and export opportunities, provide innovation support, advice on access to finance and can help to develop the supply chain and develop collaborative opportunities.

Skills Development Scotland's Our Skillsforce website offers a wide range of skills related support for employers. The Low Carbon Skills Fund offers SMEs a grant towards employee training costs for energy efficiency and built environment. Modern Apprentices on construction and plumbing courses now receive additional training on solar thermal water heating, biomass heating and heat pumps.

The **Heat Network Partnership**, led by the Scottish Government, aims to facilitate the development of district heating by coordinating activity amongst the public sector agencies.

The **Low Carbon Innovation Co-ordination Group** has published a Technology Innovation Needs Assessment on heat pumps, heat networks and heat storage. The Technology Strategy Board offers occasional innovation calls on heat related technologies.

If you would like to find out more about growth opportunities in sustainable heat recovery, please contact your Scottish Enterprise Account Manager or Business Gateway Adviser

Please email: enquiries@scotent.co.uk
or call our helpline on: **0845 607 8787**

If you would like to receive the full report, please contact neil.kitching@scotent.co.uk



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