ZERO WASTE SCOTLAND

Energy Efficiency Business Support

Solar thermal

Solar thermal systems are a viable option for districts heat networks, even in Scotland's limited sun conditions

Solar thermal energy offers a promising heat supply option for district heat networks. Typically it needs to operate at a large enough scale to be commercially viable. It also needs to be combined with seasonal thermal energy storage (STES), and other heat supply technology, to balance supply and demand. STES uses ground or water like a giant thermal energy storage battery, storing heat during the summer months for use in the heating supply during autumn and winter.

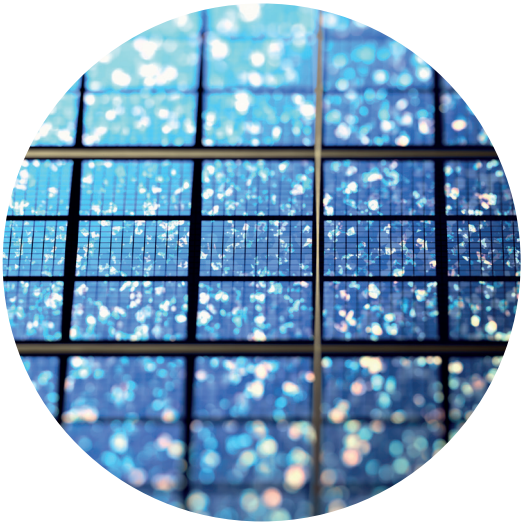
The advantage of solar is that heat from the sun provides a stable, renewable and carbon free resource. Systems also have low maintenance requirements and running costs. The lifetime of a system is around 25 years. Solar is a good option when used for new buildings because they tend to have lower heat supply temperature requirements. It can also be a good choice for locations not on the gas grid. The main requirements are sufficient land space and ground conditions to install a solar panel collector farm and STES.

It's not yet common in the UK but it's been proven at commercial scale in countries that have a similar climate to ours – Denmark, for example. A solar district heating system with thermal storage has been running in Marstal, Denmark since 2003. It produces 32MWh of heat for a district heat network that supplies 1600 homes. Solar energy accounts for 41% of the energy required for the network, with biomass making up the remainder. Energy is collected from the sun in solar panels covering a 18,000m2 area and stored in water in a 75,000m3 pit. Denmark has around 85 of these solar thermal supplied district heat networks covering over one million square meters of land.

How it works

Solar thermal district heating systems with STES typically need to be large scale to make them efficient. They consist of arrays of panels that absorb radiation from the sun. The best location is therefore open land where panels can be oriented south, and where the right geology exists for STES. While STES can be comprised of a water tank above ground, they tend to be mostly subterranean. This could be aquifers or water held in pits or tanks. Or it could be rock or saturated soil, with a series of vertical borehole heat exchangers running through it.

Of course, they should be sited in places that get a lot of annual sun. Solar insolation data will typically be collected first to test whether a site is suitable.



Solar insolation data measures how much solar radiation there is on a given surface over the year. Weather conditions, altitude, latitude, and shade all affect the rating.

As well as taking into account land availability and geology, the design of solar thermal systems will depend on the district heating supply temperature requirements. Successful systems tend to align more with district heating networks that have low distribution temperature requirements. The system is more efficient if heat can be stored above the supply temperature and heat pumps used to discharge the STES at low temperatures.

Other heat supply technology is typically used in combination with solar thermal to balance out high heat supply and low demand in summer, and low supply and high demand in winter. The solar fraction is a measure of the amount of heat supplied by solar thermal as a percentage of the total heat demand for the DH network. With STES, a solar fraction of around 30-50% can be achieved.

Solar thermal is eligible for Renewable Heat Incentive (RHI) payments.

AT A GLANCE

- **Commercially viable at large scale only**
- **Needs large amount of open land for solar panel collector arrays**
- **Needs to operate in conjunction with STES and other heat technology**
- **Proven technology for DH networks in Denmark and other countries**