

Section 4: District Heating

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4 District Heating

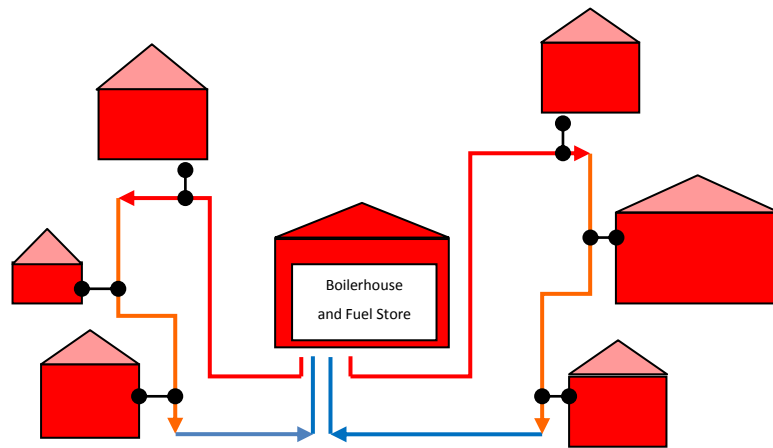
This section deals with heating groups of buildings from a single renewable heat source.

4.1 Overview

District Heating systems have a single heat source supplying heat to a number of properties within a certain area. This form of heating is common in mainland Europe and is now being employed by a number of communities in Scotland. It works best where there is a cluster of houses or buildings in close proximity that can be supplied with heat through a communal system.

A district heating system works by heating water that is then pumped around an underground district heating ring-main pipe. The pipe carries this heated water past each building (see diagram below). Each building is fitted with a heat exchanger which allows that individual building to take the heat it requires from the ring-main. For systems serving housing developments, the heat is then used for both the living space (radiators and under floor heating pipes) and domestic hot water (hot water storage tanks).

Each property drawing heat from the ring-main is metered for heat consumption and will pay for this heat accordingly. An energy supply company (ESCo) is sometimes formed to deal with billing and collection of payments for heat supply and to maintain and manage the boiler system and heat network. ESCOs can be community owned and run or can be a service provided by an outside company, sometimes the boiler supplier.



A district heating scheme with two loops serving six properties

For new-build developments an evaluation of the housing or building heat demand and the clustering of buildings at an early stage would be advantageous so that a district heating scheme can be installed during site construction. For existing properties there would need to be retrofitting of the heat exchanger and ring-main network and so project economics will need to be evaluated closely. To date the insulated pipe network for district heating has proved to be quite costly.

For further information see

http://www.biomassenergycentre.org.uk/portal/page?_pageid=77,97356&_dad=portal&_sc_hema=PORTAL

4.2 Determining the Energy Source

For a community group seeking to review the feasibility of a district heating scheme in their locality, energy sources and systems will need to be evaluated thoroughly. Current options using renewable resources could be based on a boiler or a combined heat and power (CHP) system fuelled by biomass and would entail using local biomass resources. This could be woodchip or pellet based and communities should aim to work with local suppliers to assess feasibility of supply to a district heating scale project.

The quality of woodchip or pellet supplied is crucial to the efficient operation of a biomass boiler and communities should seek to discuss with local users of woodchip or pellets to gain awareness of the quality of material supplied. It should be noted that some purchasers and suppliers of woodchip are now moving to long term contracts which detail quality of chip to be supplied. One way of ensuring that a supply of good quality fuel is maintained is by monitoring of heat produced by the fuel and basing payments to the supplier on the amount of energy it produces rather than paying for woodchips by either weight or volume.

4.3 Project Management and contractual issues

A project involving district heating is of its nature a large and complex project. The project will involve

- Securing planning permission
- Tendering for supply of system and contractual negotiations
- Securing grid generation connection if CHP to be used and electricity export required
- Installation of a network of pipes and heat exchangers and a payment system
- Installation of a boiler or CHP system and fuel reception / storage and fuel augers
- Possible retrofitting of new heating infrastructure in existing properties
- Securing fuel supply
- Raising finance for the project costs
- Possible establishment of an ESCo
- Items to be co-ordinated by an ESCo or community
 - Long term management and maintenance of system and all network connections
 - Heat monitoring and billing
 - Fuel supply monitoring

See case study 13, Glenshellach district heating system, Oban, in Annex 2 for an example of a district heating system for 89 domestic properties using a woodchip boiler.

4.3.1 Checklist of Key points for district heating

This section provides a selection of top tips for considering a district heating scheme. It should be noted this is not an exhaustive list and all projects present individual circumstances to consider.

1. Ensure you have a community group willing and able to take on the scale of project demanded by district heating.
2. Ensure you have a cluster of houses or other buildings that require a heat supply.
3. If these are existing buildings, clarify you be able to install a ring main network.
4. Investigate a biomass supply or other supply of fuel suitable for use in a large boiler.
5. Be sure you can you raise the finances necessary to complete such a project.
6. Decide if you have the skills and resources to establish and run an ESCo or if you would prefer to see this outsourced.

For a manufacturer's guide to district heating pipe work installation, see http://www.rehau.co.uk/files/Technical_information_RAUTHERMEX_817600_.pdf

4.4 Future directions

4.4.1 Combined Heat and Power Plant (CHP)

A CHP plant is any plant that generates electricity and usable heat simultaneously in the same process. This process is a very efficient use of fuel as it maximises the amount of energy recovered from combustion – typically CHP plants can achieve efficiencies of over 70%, whereas conventional electrical generation plants can only achieve efficiencies between 35% and 45% due to heat loss. The power generated can either be used on site or exported to the grid.

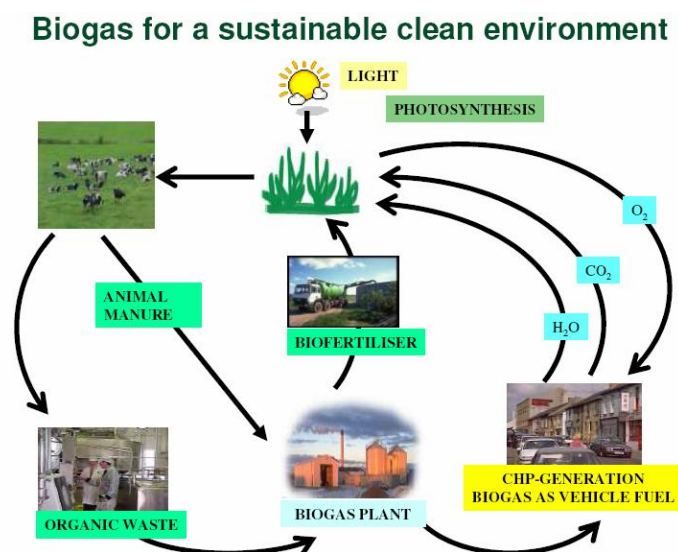
The source of fuel can be renewable or fossil fuel; renewable fuels can include biogas, biomass, and bio energy crops. All of these are eligible for ROCs and indeed may even be eligible for ROCs if used in conjunction with fossil fuels in a CHP system. Energy from waste using CHP is also eligible for ROCs – please see further detail on ROCs in Annex 1.

4.4.2 Anaerobic Digestion (AD)

This is a process whereby biogas (which is predominantly methane) is generated by anaerobic decomposition of organic waste. Organic waste is decomposed in the absence of oxygen by bacteria to produce methane which is then captured and stored. The methane gas can be used to generate heat and/or power which could be used for district heating, or through a CHP plant to provide heat and power to a site or a community. Research is also being carried out on upgrading biogas to make it suitable for injection into existing or new gas networks for use in domestic gas boilers.

The waste product from the anaerobic digestion process is nutrient rich and can be used as a fertiliser in agriculture. The resultant fertiliser is easier to spread than raw slurry and can reduce the need for artificial fertilisers.

The diagram below gives an insight into the general principles behind the whole process.



AD is a biological process and can work with a variety of feed stocks:

- food waste segregated at source i.e. in households and collected as organic waste
- animal wastes - slurry and dairy products
- industrial organic waste
- brewery and distillery waste
- food processing waste
- seaweed

As the feed stocks can vary, an AD plant will need to be designed to treat all the possible wastes, and ensure that it meets all the relevant regulations. As AD can cross the waste, wastewater, agricultural, food and energy sectors there can be quite a lot of regulation to keep up to date with for AD plant operators.

AD is set to qualify for two ROCs per MWh under the Renewable Obligation Scotland schemes from April 2009.

Some community groups are currently investigating the use of organic waste in anaerobic digesters for community heat or power.

See case study 14, the Creed waste management facility, Isle of Lewis, in Annex 2 for an example of an anaerobic digester plant project.

More information at:

<http://www.orkneycommunities.co.uk/WESTRAY/Documents/Renewables.pdf>

<http://www.orkneycommunities.co.uk/WESTRAY/index.asp?pageid=1032>

http://www.foe.co.uk/resource/briefings/anaerobic_digestion.pdf

<http://www.highlandenvironment.org.uk/sitebuildercontent/sitebuilderfiles/wdtbiofuelsenergyfromwaste.pdf>

<http://www.nnfcc.co.uk/metadot/index.pl?id=2192;isa=Category;op=show>

4.4.3 District Wind to heat

This is a system currently being investigated by some community organisations whereby large scale wind generation of electricity can be used to heat water for district heating. This would act to enhance the value of the generation from wind turbines in that it would provide a storage mechanism for the energy generated. The water would then be used as a heat source for properties connected to a ring-main and heat exchange network.