



Kielder's Wood-Fired District Heating Scheme: Technical Information

The Kielder district heating scheme is one of the first of its kind in Britain – a shared heat network fuelled by wood. However, district heating networks are commonplace in Scandinavian countries such as Sweden and Finland, where forestry residues are often used as a fuel.

Architects and Project Manager:

Geoff Buckley, **Kevin Doonan Associates**
13 Hallstile Bank, Hexham, Northumberland NE46 3PG.
Tel: 01434 601020 | Fax: 01434 600688

Quantity Surveyors:

Bill Fraser, **Robert Burn Partnership**
6 Jubilee Buildings Hexham, Northumberland NE46 1NW
Tel: 01434 605265

Mechanical and Engineering Surveyors:

Mike Rhead, **Armstrong Rhead Partnership**
Stonehills, Shields Road, Gateshead, Tyne and Wear NE10 0HW
Tel: 0191 495 2405 | Email: arp@armstrongrhead.co.uk

Main Project Contractor:

John Shepherd/ Tom Quinn, **T. Graham and Sons**
Auldby Farm Business Centre, Dacre, Penrith CA11 0HN
Tel: 01768 480460

Sub-contract (mechanical and electrical services):

Emcor Drake and Scull Ltd
Tower House, St. Catherines Court, Sunderland Enterprise Park, Sunderland SR5 3XJ
Tel: 0191 516 8998 | Fax: 0191 516 9977

Sub-contract (external site works):

Ken Hope Ltd
Westmoor, Rockcliffe, Carlisle CA6 4BH
Tel: 01228 673423 | Fax: 01228 674186

Sub-contract (supply and installation of boiler):

Gavin Gulliver-Goodall, **3G Energi**
Tel: 01835 824201 | Mobile: 07773 781498 | Email: gavin@3genergi.co.uk

In the Kielder scheme, locally-grown wood is chipped and stored by Forest Enterprise at a specially designed fuel store in Kielder village, which will be filled up about 3-4 times a year. The wood chip fuel is then delivered to the boiler house and is fed to a 300 kilowatt Austrian KÖB boiler. The hot water is piped to surrounding buildings, where heat exchangers transfer the energy into domestic central heating and hot water systems. A heat meter measures the amount of energy used by each customer, and the local community company sends them monthly heating bills. Kielder Community Enterprise Ltd. has been established as a community-owned energy service company or “ESCO”, providing a permanent source of local employment.

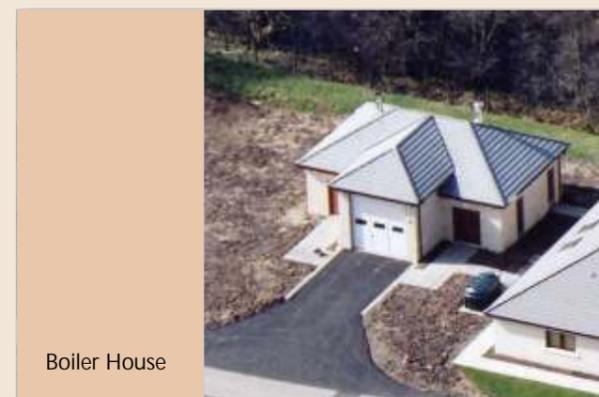
The Kielder district heating scheme supplies heat and hot water to:

- 1 Kielder Castle Visitor Centre
- 2 Six new 3-bedroom homes
- 3 Rivermead Workshops
- 4 Kielder Community First School
- 5 Kielder Youth Hostel

(see numbered diagram overleaf)



Köb Pyrot Boiler

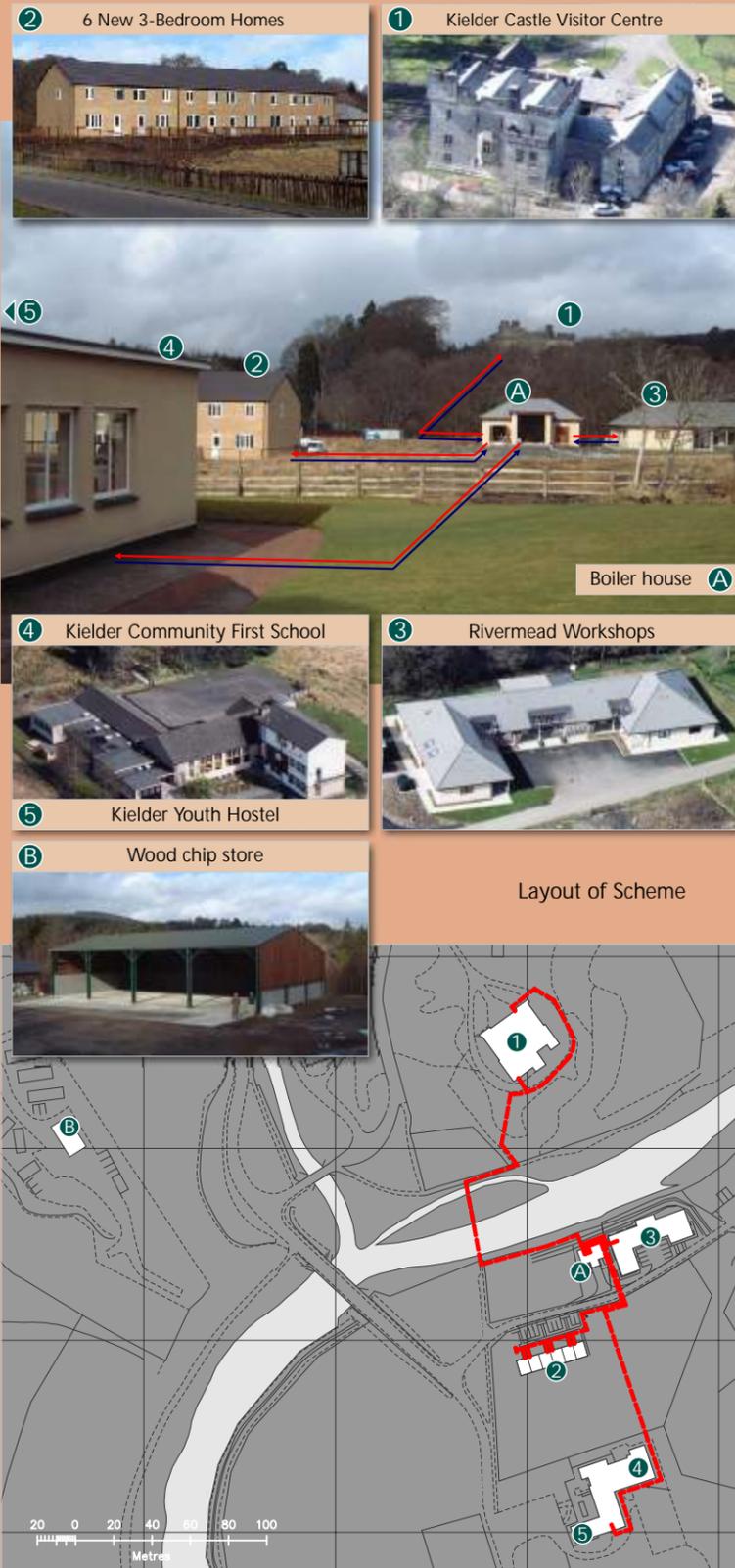


Boiler House

Financial Support

The Kielder District Heating project has been supported by a variety of sources including the European Regional Development Fund, the Northumberland Strategic Partnership through One NorthEast, Northumberland National Park Authority, Powergen, Forestry Commission, Northumberland County Council and Tynedale Council.





System Configuration

The district heating network has a spurred arrangement i.e. the flow to and return from each building emanates from the boiler house. Over 950m of district heating pipe of various sizes was used in this system the size chosen being dictated by the flow rate required. The super-insulated plastic heat pipe is made in Europe by Flexalen, and has been used in District Heating schemes in many European countries. Electrofusion ensures that pipes are bonded at a molecular level and are totally leakproof. Heat losses on this type of heat main are modest, typically 10-15% for the Kielder system as a whole (based upon an average 40W heat loss per metre of pipe run).

Wood Chip Boiler

Heat and hot water are produced using an Austrian K b Pyrot boiler which has an output of 300 kW. Annual wood chip consumption is anticipated to fall in the range 250-450 tonnes. Locally-grown wood chip fuel from Kielder Forest is supplied from the Forest Enterprise depot in the village. The main fuel store can hold up to 450 cubic metres (between 80 and 120 tonnes) of wood chip. Conversion factors between volume, weight and energy content of wood chip vary with moisture content and packing density. Wood chips supplied to the Kielder system have moisture content in the range 25-35%. The volume of one tonne of wood chip at this moisture content may range from 3-4 to as much as 6 cubic metres, depending on chipping method and the resulting particle size distribution. The Kielder wood chips are supplied as approx. one-inch (25 mm) chunks of sitka spruce.

Wood chip is delivered by tractor and trailer. The Fliegl wood chip delivery trailer holds about 16 cubic metres (2-3 tonnes) of fuel, and has a "push off" action to empty the chips into the boiler house fuel store. Inside the boiler house, a "walking floor" moves the wood chips from the storage area to the screw augers, which then convey the wood chips into the boiler where they are burned.



Super-insulated Heat Pipe

The K b boiler uses a maximum of 80kg of wood chips per hour. It has a special rotating firebox, designed to burn all kinds of dry or damp wood fuels (chips, sawdust shavings, pellets, briquettes, forestry wood shavings). The boiler has an efficiency of 87% (measured as heat output to wood fuel energy input). The boiler house also incorporates a back-up system (an oil-fired burner) that can be used if the primary system requires maintenance.

Hot Water

The hot water from the boiler is piped to surrounding buildings, where heat exchangers transfer the energy into the central heating and hot water systems within each building. The hot water leaves the boiler at 85 C and returns from the "primary circuit" a little cooler, at



Cutaway of K b Boiler

about 70 C. The secondary domestic hot water systems typically have an output temperature of 80 C and a return temperature of 70 C.

The heat exchangers used in each building are manufactured from stainless steel by Alfa Laval. They consist of a series of thin corrugated plates which are brazed together with copper. The plates are then supported in a rigid frame so that a series of parallel flow channels are created between the plates. There are two separate fluids circulating through each heat exchanger (i.e. those from the boiler house and those circulating around each building) with one fluid travelling through the odd numbered channels and one flowing through the even numbered channels. In this way heat is rapidly transferred between the two fluids.

Heat Supply & Emissions

A heat meter measures the amount of energy used by each customer, and the local community based company sends them monthly heating bills. Kielder Community Enterprise Ltd. has been established as a community-owned energy service company or "ESCO".

The boiler produces very little noise, smoke or ash. Visitors sometimes cannot even tell when it is running! Emissions from the chimney are mainly composed of water vapour: total emissions are expected to be less than a single household coal fire (emissions quality will also differ, as burning wood fuel will not release sulphur dioxide). The few wheelbarrow loads of ash produced each year will be used as a fertiliser to mix with compost for the village gardens and allotments.

Because wood fuels are carbon neutral (i.e. the carbon dioxide produced on combustion is equivalent to that absorbed during the life of the plant) the avoided carbon emissions from this scheme have been estimated at about 57 tonnes CO₂ per year. This figure is based on a comparison with the alternative fuel which would be heating oil.

Typical features of a Wood-Fired District Heating System

- District heating systems can supply groups of houses and other properties with their heating and hot water requirements via an underground pipe network
- Wood fired schemes can be environmentally friendly and sustainable, with reduced emissions of air pollutants and a long-term fuel supply that does not deplete natural resources
- District heating schemes that link to forestry and wood chipping operations can also provide a source of local employment.
- Instead of buying their own oil or solid fuel, homes are fitted with a heat meter (similar to a gas or water meter).
- One advantage of buying heat in this way is that customers do not need to store fuels on site.

What kinds of location are suitable for Wood Fired District Heating?

- Areas which currently rely on fossil fuels for heating dwellings and municipal buildings, because a mixture of types of building helps to create an even heat load throughout the day.
- Areas which have access to a plentiful supply of wood, e.g. sites near local forests and managed woodlands.
- Wood fired district heating schemes are ideal in areas which are not (or are not likely to be) serviced by mains gas. Wood fuel may be competitive with coal or heating oil, but gas is presently the cheapest fuel where available.