Woodfuel heating in the North of England: A Practical Guide






Providing advice on

- fuelling options
- boiler systems
- planning issues
- who to contact

Foreword

Although everyone loves a log fire, it is less widely appreciated that wood is an environmentally and economically attractive option to fuel modern heating systems in sizeable public buildings. Wood chip is a cheaper fuel than most fossil- based resources and it contributes some 90% less CO_2. Since heating consumes most of the energy used in buildings in the UK, introduction of a low carbon fuel for heating can significantly affect our region's emissions. In addition these systems can use forestry products which results in well managed woodlands, energy crops that offer diversification opportunities for local farmers or waste-wood which would otherwise be landfilled.

In recognition of the potential environmental benefits of wood-based heating and the opportunities it offers for sustainable development of the local economy, Government Office Yorkshire and Humberside initially approached the National Non-Food Crops Centre in January 2004 with a proposal to prepare practical advice on implementation of wood-based heating systems.

Since the initial launch of this publication in May 2004 positive feedback has been received along with requests for incorporation of domestic scale advice, hence its inclusion in this second version. We have also been approached by a number of other Regions for similar publications and following specific requests from the North East and North West we have altered the focus of this version - which now provides advice for the 'Northern Regions'.

With the help of many local consultants, businesses and individuals within local and regional government, as well as the sponsorship of Government Office's, RDAs and the Forestry Commission, we put together this booklet, which we hope will prove most valuable.

Jeremy Tomkinson
CEO National Non-Food Crops Centre

Who is this for?

This booklet has been produced to show the potential for generating heat from wood fuelled systems in the 21st century. If you are involved in the planning of new buildings, can influence the decision making process or are an engineer operating existing fossil fuelled heating systems this booklet offers a starting point. The information in this booklet offers a chance for you to consider heat from wood fuelled systems through the provision of up to date information on the options available for wood fuel supply, the technologies available, issues to consider and case studies of successful systems.

Following publication of the Biomass Task Force reports in October 2005, this booklet should be used by Government Offices, Regional Development Agencies, Regional Assemblies and Local Autgorities in response to a number of specific recommendations relating to regional delivery and implementation. The full Biomass Task Force report can be downloaded from the Defra website, www.defra.gov.uk

Contents

Benefits of wood-fuelled heating

Reduces

- CO_2 emissions by >90% compared with fossil-fuelled systems, supporting the move to a low carbon economy
- emission of pollutants eg sulphur (sulphur content of wood is negligible)
- biodegradable waste going to landfill by diverting clean scrap wood into fuel applications

Promotes biodiversity through

- cultivation of low input crops that provide alternative habitats
- sustainable woodland and countryside management

Provides economic advantages because

- wood fuel is usually cheaper than fossil fuels
- low cost option for reducing greenhouse gas emissions
- landfill charges avoided
- new jobs contribute to economically sustainable rural communities

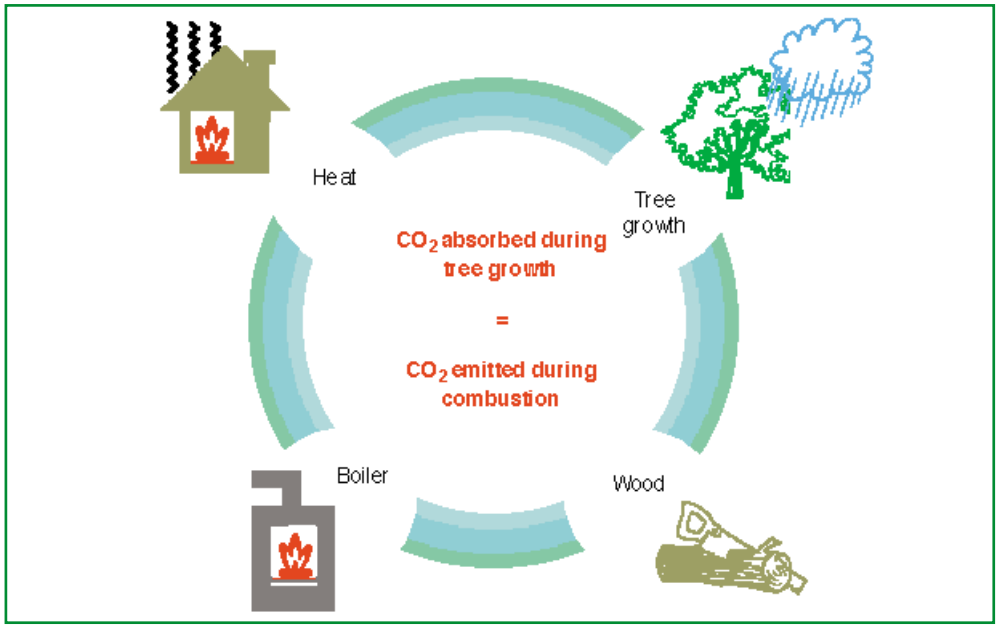
Chapter 1 – Introduction

Wood-fuelled boilers offer a technically simple and cost-effective means to heat buildings whilst realising large savings in carbon emissions.

The CO_2 that is released when wood fuel is burnt is equivalent to that taken from the atmosphere through photosynthesis during tree growth. Even allowing for CO_2 generated during planting, harvest, processing and transport of the wood, replacement of fossil fuel with wood fuel will typically reduce net CO_2 emissions by over 90%, assuming that the wood supply is managed sustainably.

Typical CO_2 emissions from different fuels	
Fuel Type	**Kg CO_2 per kWh***
Coal	0.3
Oil	0.25
LPG	0.214
Natural Gas	0.19
Biomass	0.025

** See Chapter 10 (10.4.1) for assumptions underlying calculations*



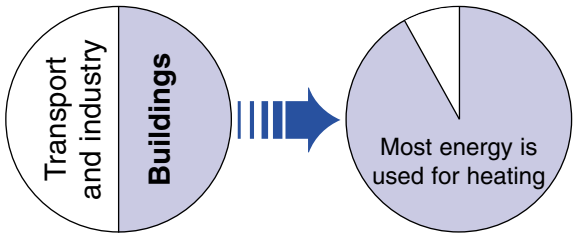
1.1 The Global Picture

The reliance on fossil fuels for energy has left our planet facing a serious environmental problem, known as climate change. An increased concentration of CO_2 and other greenhouse gases in the atmosphere has led to global warming. To address this issue, under the Kyoto Protocol, the UK is committed to reduce CO_2 emissions from 1990 rates by 12.5% during the five year period 2008-2012. UK Government has, in addition, set higher voluntary targets of a 20% reduction in year 2010, with the longer term aim of a 60% reduction by 2050.

1.2 Wood-fuelled heating can reduce CO_2 emissions

Over 80% of the fuel delivered to public buildings will be used for heating. Since 99% of the fuel that is delivered is from non-renewable sources, heating of public buildings represents a significant opportunity for savings in greenhouse gases.

Buildings are responsible for around half of total energy use in the UK. The vast majority of this energy is used to heat buildings.



Wood fired heating could be widely used for public buildings with heating requirements of 30kW and above, as well as on a domestic scale. It is a cost effective means to reduce carbon emissions: for instance, replacement of oil-fired heating with wood-fuelled heating, could save over 0.1p for each kg CO_2 that is saved. (*See Chapter 10 (10.4.2) for assumptions underlying calculations.)*

1.3 Economics of wood-fuelled heating

Compared with other renewable energy sources, wood fuel is the cost-effective means to reduce CO_2 emissions, particularly if whole-life costs are taken into account.

- Wood is often cheaper than fossil fuel leading to lower whole life costs of wood-based heating systems
- The climate change levy has added between 0.15 - 0.46p / kWh to energy derived from fossil fuels
- Grants are available to help cover costs of conversion to renewable heating
- Fuel supplies are sufficient and growing
- Wood fuel creates local jobs for rural economies

1.4 The local picture

There are a total of 468 Local Authorities in the UK, 22 located within Yorkshire & the Humber, 25 in the North East and 47 in the North West. Typically these authorities are attempting to reduce their greenhouse gas emissions by 15% of 1990 levels by 2006.

Many authorities in the North of England use a higher proportion of coal than the national average, mainly for heating.

For instance, in Conisbrough and Denaby, 39% of fuel used for public administration is coal compared with a national average of 4%.

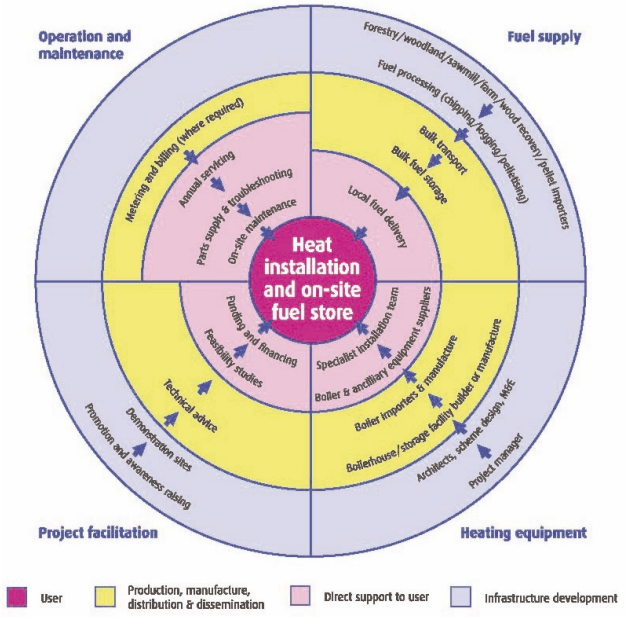
These coal-fired systems offer a significant opportunity for introduction of wood-fuelled heating and its associated economic and environmental benefits.

Chipping of arboricultural thinnings

1.5 Key considerations when selecting wood-fuel heating

- How big are the premises?
- How many hours of heating are needed?
- How easy is the access for delivering fuel?
- How much space do you have for storage?
- What fuel sources are available?
- Retrofit or new system?
- How much control do you want over the system?

Essential elements of the wood fuel heating supply chain (Source: SDC, 2005)



Chapter 2 – Fuelling options

A number of suitable and accessible fuel options are outlined below. Contacts for all these fuelling options are listed under Equipment Suppliers or Fuel Suppliers in the contacts list.

2.1 Wood Chip

Wood chips are produced from a wide range of sources such as forestry timber, forest co-products, arboricultural thinnings, short rotation coppice, reclaimed timber and sawmill residues. They can be significantly cheaper than fossil fuels and are most economical if sourced locally.

Wood chip derived from SRC

Wood chips are suited to automatically-fed larger systems of 30kWh or more.

Wood chips stored dry can be held for several years with little degradation of quality or loss of energy value.

Things to look out for when choosing wood chip fuel

- moisture content
- calorific value
- size of the chip

These will affect the efficiency of the boiler system. The boiler installer or manufacturer will provide a chip specification which best suits the boiler.

2.1.1 Forestry co-products

Forestry and woodland management activities produce a large amount of material suitable for fuel use. These include first thinnings, uneconomic thinnings, “lop and top” or timber that is assigned to be wood fuel. Although these are a resource used for nutrients and flotation when on the forest floor, the thinning of woodlands is an essential part of sustainable woodland management. The net effect of bringing under-managed woods back into management for wood-chip production, will result in healthier faster growing woodlands and increased bio-diversity.

Chipping of forestry co-products

2.1.2 Short Rotation Coppice Willow

Energy crops can be grown to meet the needs of the market and provide a secure long-term resource. The most commonly grown energy crop is willow, usually known as Short Rotation Coppice (SRC). Harvest occurs in the third growing season and every subsequent third year. An SRC plantation can often remain viable for up to 30 years. Material is chipped at harvest and can be stored and handled relatively easily. Energy crops and SRC provide wildlife habitats for birds and invertebrates, consequently improving on-farm biodiversity.

Harvesting of short rotation coppice willow

2.1.3 Arboricultural thinnings or arisings

Local Authorities and Tree Surgeons produce many thousands of tonnes of chip and other arisings from amenity and street trees each year. Much of this is currently landfilled – at a cost! With correct handling and grading this is a virtual "for free" fuel source that could be used to provide energy. The infrastructure for this source of fuel is under development.

2.1.4 Post consumer wood and timber processing by-products

Many categories of clean (untreated) used wood can be used as fuel. The term "waste wood" is best reserved for unsorted, contaminated or pressure-treated wood that cannot easily be diverted from the waste stream. Clean post-consumer wood may include unpainted scrap pallets and packaging timber, some categories of construction and demolition wood, and other sorted reclaimed timber. Sawmill and other timber processing by-products such as slabwood offcuts and sawdust can be converted into wood chip or wood pellets. This sector is particularly strong in the North West region.

Post-consumer wood

The "closed cycle"

Post-consumer wood collected by a Local Authority has the potential to satisfy that authority's own demand for wood fuel i.e. a 'closed cycle' is possible. The potential reduction in post-consumer wood going to landfill is vast. Community Energy Grants are available to employ consultants to identify and overcome any specific issues preventing implementation of a closed cycle scheme.

Utilising reclaimed timber and post-consumer wood as a fuel source reduces the pressures on landfill sites and contributes to targets for reduction of biodegradable waste going to landfill.

2.2 Pellets and Logs

In addition to wood chip, three other wood fuels are commonly used for heating, wood pellets, logs and briquettes. Wood pellets are mainly produced from untreated wood waste such as sawdust, pulverised pallets or reclaimed timber.

Wood pellets range in size from 5 - 40mm in length with a diameter of between 5 - 12mm.

Wood pellets

In comparison to other wood based fuels, pellets are more expensive to buy and are currently less readily available. They are however easy to store and handle whilst having a higher calorific value than wood chip.

Pellets can be used in specially designed domestic stoves and boilers; in certain designs of traditional solid fuel boilers, pellets can be burned in place of coal after a small amount of modification. Pellet fuel supply is currently under development in the UK with five production facilities currently running and a further seven planned for the near future. Imported pellets are also available from certain suppliers.

Logs

Logs are the most well known and historically used wood fuel. Logs are used most efficiently in closed boiler systems, which tend to be smaller scale domestic type systems.

Wood briquettes are the third and least common alternative which can be used in place of logs in traditional manual-feed stoves and modern log boilers. Again, they are produced from clean waste wood, such as joinery offcuts and sawdust.

2.3 Security of fuel supply

There is an abundant supply of wood based material available in the North of England which could be used as fuel.

2.3.1 Forestry and SRC

A Forest Research study was carried out to establish the current resource of wood fuel from traditional forest products, aboricultural thinnings, sawmill residues and energy crops. This study estimates a total resource of almost 1 million ODT per annum across the Northern regions; comprising 331,000 ODT in Yorkshire and the Humber, 300,000 ODT in the North West and over 400,000 in the North East.

Taking into consideration the resource already accounted for, the available wood fuel resource is estimated to be in the region of 600,000 ODT per annum. In practical terms this could generate over 2.5 billion kWh of heat annually, enough to heat some 25 million m^2 of building space, thus avoiding almost 700,000 tonnes of CO_2 emissions annually.

Importantly, the volume of forestry and woodland products is predicted to rise steadily (23% up 2015) and this is combined with an increasing supply of SRC.

2.3.2 Post consumer wood

Further to the supply identified above, the post consumer wood resource is substantial: 1 - 1.5 million tonnes per year in England in the municipal waste stream alone. For instance, the tonnage of post consumer wood collected by the municipal sector in Sheffield is in the order of 20,000 tonnes. This could generate 100 million kWh, heat a million square metres of public space and displace 27,000 tonnes of CO_2 emissions*. In addition arisings of post consumer wood in the North east have been estimated at 750,000 tonnes per year.

** See Chapter 10 (10.4.3) for assumptions underlying calculations*

2.3.3 Supply chain and processing issues

There are a number of wood chip supply companies in existence or currently being formed to meet the increasing demand for wood fuel from all these sources. As a relatively new industry to the UK, wood chip supply is still developing, however there are a number of companies that are currently trading in wood chip and biomass fuels in the region (see 9.3 fuel suppliers).
The simplest means to address supply issues is to employ an Energy Supply Company (ESCo) who can deal with the whole heating system including fuelling issues. To retain more control over the heating system, an alternative is to buy the fuel as heat (kWh) rather than by the tonne.

Biomass energy production has been common in Europe for over 30 years so some of the wood fuel supply models that operate successfully there are being introduced here. As more biomass boilers are commissioned, so the demand for wood chip will increase, long term contracts of supply (i.e. 3 to 5 years or more) will create long term security for the businesses supplying wood chip and thus produce stability in the market.

Hook-lift delivery at Worcestershire County Hall

2.4 Key considerations

- What wood fuels are available?
- Can you sort your waste wood if you are a Local Authority?
- What happens to arboricultural thinnings?
- Do you have any local SRC growers?
- Are there any local forestry management growers?
- Are you able to take a variety of fuel sources/sizes or does fuel need to meet certain specifications?

Chapter 3 – Technology overview

3.1 Types of combustion technology

Installations fall into one of two categories, either new build or retrofit. The technology currently available is optimised for new builds; however it is possible to retrofit into existing heating systems.

Four combustion systems are available, one grate-based, the Inclined Grate, and three others - the ram-feed stoker, the underfeed stoker and the pre-combustor. The main factor affecting the choice of combustion system is fuel moisture content. If combustion is carried out properly, following the three Ts rule (see section 10), the burning operation should be smoke free.

Properties of available combustion systems				
	Inclined grate	Ram-feed stoker	Underfeed stoker	Pre-combuster
Output (kW)	>100kW		3MW	
Capital cost	high	medium	low	
Efficiency	82-86%		90%	
Fuel moisture	Up to 70%	<25%	<25%	<25%
Chip size range	wide	narrow	narrow	narrow
Ash removal	automatic	manual	automatic	manual
Load response	slow	rapid	rapid	rapid
Retrofit possible	no	yes	yes	yes

For further information on the technology, please refer to 'Useful Contacts' in Section 9.

3.2 Fuel Handling

There are three discreet elements within fuel handling: reception, storage and boiler feed. All three need to be considered with care, since they impact significantly on the cost of the installation.

3.2.1 Fuel Reception

- Access must be appropriate for heavy vehicles
- Tipping or transfer of fuel must be quick and simple

3.2.2 Fuel Storage

Underground bunkers

- Best for large scale installations
- Easy to deliver fuel (simple tipping)
- Expensive for small scale systems

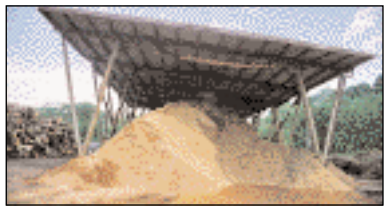
Hoppers

- High tip trailer delivery required
- Suitable for situations where space is limited
- Restricts delivery options

Hook lift bins

- Suitable for situations where space is limited
- Fuel delivery may be complex
- Restricts delivery options

Open store in covered shed



- Easy to deliver fuel
- May be cheapest option
- Transfer of chip to boiler may have to be manual

How much storage space will I need?

The volume of fuel that has to be stored will be defined by

- the size of the system
- the frequency of fuel delivery
- the moisture content of the woodchip

It is important to appreciate that storage facilities need to be near to the boiler, unlike oil and gas systems, to permit feeding of the boiler. Ongoing supply of fuel will be easier if the storage system is capable of receiving full loads of wood chip rather than part loads.

3.2.3 Boiler feed system

Transfer of the wood chip from the storage facility to the boiler is critical to the efficient running of the heating system. For smaller installations, chip stored in the open can be transferred to a hopper that feeds the boiler using a materials handler such as a mechanical loading shovel.

Larger systems require an automatic feed from the storage facility to the boiler. These commonly use an auger or walking floor, as illustrated below. If your combustion system will accept a wide range of chip sizes you might consider purchase of an agitator to prevent bridging and ensure a constant feed of fuel to the boiler.

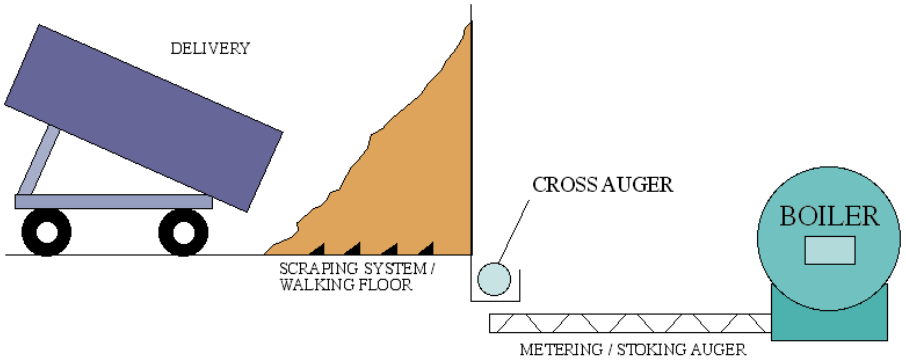


Table illustrating typical volumes needed to feed different sizes of boiler

	Boiler Output	18 kW	80 kW	350 kW
	Fuel Input	6.25kg/hr (25kw)	25kg/hr (100kW)	200kg/hr (400kW)
Fuel storage capacity	$1m^3$	24 hrs	6 hrs	
	$4m^3$	4 days	24 hrs	6 hrs
	$16m^3$		4 days	24 hrs
	$48m^3$			3 days

NB: Figures provided assume systems are working at maximum output and are derived from the Welsh wood fuel study. Coal-fired systems need to be able store fuel for at least 10 days in case of problems with delivery during winter.

Wood ash can be a useful product

Wood burning produces typically less than 1% ash. As it is not classified a special hazardous waste, it can be used as a valuable by-product either as a nitrate fertiliser or as a raw material in brick and cement industries. As a last resort ash can be disposed of to the Local Authority for landfill or via a waste disposal company.

Wood chip handling prior to distribution

3.3 Key considerations

- Which combustion system – scale of the system, quality of fuel
- Location and scale of storage facility – access for vehicles, proximity to boiler, frequency of fuel delivery
- Boiler feed design – scale of system, nature of storage facility

Chapter 4 – Costs

4.1 Capital costs

The capital costs of wood-fuelled systems are higher than for oil or gas, but the outlay is rapidly recovered through lower fuel costs. The pay back time for the extra capital can be as little as three to five years.

Wood-chip fired heating systems of less than 500kW cost between £180-250 per output kW, but for systems over 500kW, capital costs fall to £150-230 per kW. This covers the core components; the boiler and handling system, flow and return systems and piping. The capital costs of installation of a wood-chip fired heating system are variable and additional costs, such as a fuel reception facility, may add to them. These figures should therefore be seen as a guide only.

It is also worth noting that the market for wood-fuelled systems has been quite small in the UK. As wood-chip systems become more widely used, competition and economies of scale will bring prices down.

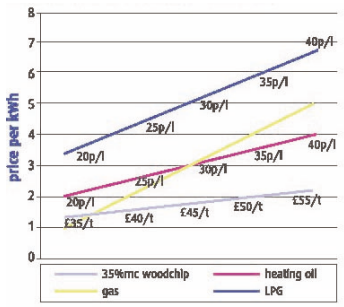
Also, in recognition of the potential of wood fuel to reduce carbon emissions, there a number of schemes that will give grant support to help cover capital outlay on renewable energy sources (see “sources of funding” section).

4.2 Fuel costs

The price of woodchip varies from 1.0 – 1.8 p per kWh. Typically it costs from £25 - £45 per tonne depending on the moisture content, the source of the wood and the distance it has to travel.

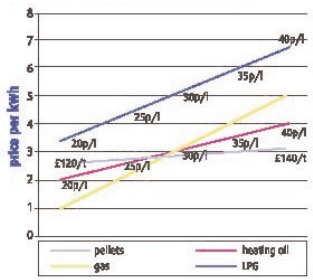
Comparative heating costs for (a) wood chip and (b) wood pellets, against natural gas, heating oil and LPG

(a)



Source: SRC, 2005

(b)



4.3 Ongoing, maintenance and service costs

Guide to servicing time assuming operation nine months pa			
Flue sweeping	Monthly	0.5 hours	4.5 hours
Greasing	Weekly	5 minutes	3.25 hours
De-Ashing	Monthly	0.5 hours	4.5 hours
TOTAL			12.25 hours *pa*

Contrary to what one would assume, modern smaller installations are generally fully automated and require minimal attention, whereas larger installations require more regular monitoring and assistance.

A small modern, fully automated boiler system would simply require an annual service, for a fee in the region of £400-500. Additional breakdown costs may also be incurred.

Larger boiler installations, generally above 500kW, require 10-20 minutes attention daily and will again require an annual service which would cost between £500-600. Breakdown and general repair costs are usually estimated annually at 3% of the system’s capital costs.

	mains gas	coal	oil	LPG	**Wood fuel**
CO_2 (kg CO_2 per kWh)	0.19	0.29	0.28	0.194	**0.025**
Fuel cost (p/kWh)	1.0 - 1.8	1.5-2.4	1.8-3.0	2.8 – 4.0	**1-1.8**
Capital costs (per kW)	£40	£200-300	£60-115	£60-115	**£110-265**
Whole life costs (p/kWh)*	1.2	1.9	2.1	3.2	**1.9**

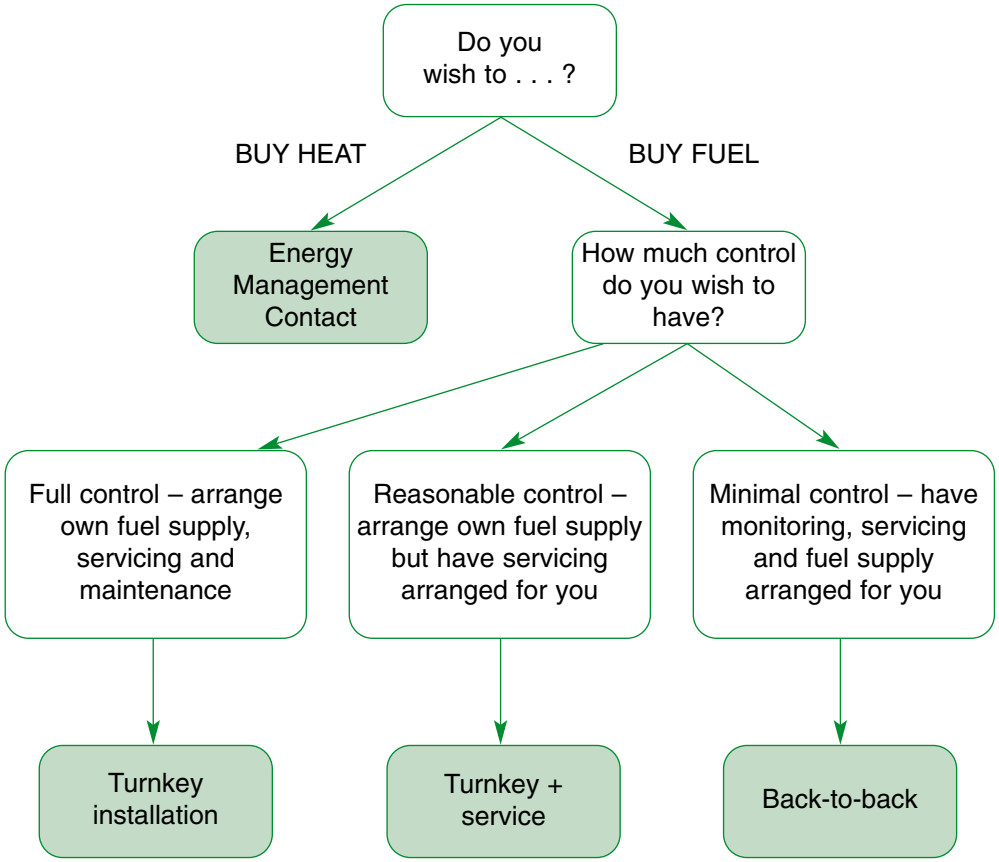
* See Chapter 10 (10.4.2) for assumptions underlying calculations

4.4 Critical factors affecting cost

- Scale of system: the bigger the cheaper
- Engineering fuel storage and reception area
- Access to grants

Chapter 5 – Contract options

There are a number of contract options available through fuel and equipment suppliers, as well as Energy Supply Companies (ESCo's). Precise cost data for the various contract options is often confidential and varies on a case-by-case basis.



5.1 Turnkey Installation

5.1.1Services:

Contractors simply install the fully functional heating system, all subsequent maintenance and management tasks are down to the user, fuel and servicing must be sourced independently.

5.1.2 Charges:

The only costs incurred are for the installation and construction, all fuel, maintenance, service and repair costs will be paid in addition to the contract charges.

5.2 Turnkey and Service

5.2.1 Services:

Contractors will install the heating system and carry out annual (or regular) services. Extended warranties are often offered with this contract. It is down to the user to source fuel and arrange repairs as necessary.

5.2.2 Charges:

Installation costs and an annual service charge will be incurred; in addition to this the user will have to pay for fuel and maintenance as necessary. Note that it may be possible to buy the fuel as heat (kWh) rather than by the tonne.

5.3 Back-to-Back: turnkey, operations, maintenance and fuel supply

5.3.1 Services:

The contractor installs the heating system and looks after the operations, maintenance and fuel supply. The user is involved in the day-to-day running of the system, although full support and guidance is offered by the contractor.

5.3.2 Charges:

In addition to initial installation costs the user will pay a standing charge to cover general management and maintenance and will also pay *pro rata* for the heat output, per kWh.

5.4 Energy Management Contract

5.4.1 Services:

An Energy Supply Company (ESCo) installs the system and manages the entire process, including operation, maintenance, fuel supply and day-to-day running. The ESCo remains the owner of the boiler, provides the heat and manages the system.

ESCo's can also supply the end product (i.e. heat), as opposed to the raw material for on-site energy generation. In this case, the user has no involvement in heat generation; they simply purchase metered renewable heat under an energy supply agreement.

The main control the owner of the building has over the fuel supply is through the heating contract by including clauses that oblige the ESCo to source a large percentage of the fuel locally.

5.4.2 Charges:

An initial connection fee and ongoing payments for heat output as provided. This concept eliminates the need for high capital outlay as purchase of a new heating system is not necessary.

5.5 Split contract

5.5.1 Services:

A split contract is offered between the boiler supplier and the fuel supplier. The boiler supplier installs and looks after the day-to-day running of the boiler and the fuel supplier provides the fuel and arranges deliveries etc. The main issue with this is that if the boiler feeding system jammed the user would have to liaise with the fuel supply company directly, and likewise any issues with the boiler would have to be resolved directly with the boiler supply company. Under an Energy Management Contract all such issues would have been resolved without the user becoming involved.

5.5.2 Charges:

The boiler supplier will charge an initial installation fee and there will be ongoing service and maintenance costs. The fuel supplier will charge for sourcing and delivering, in addition to the actual wood fuel.

5.6 Key considerations

- How much control do you want?
- Do you want to purchase heat or fuel?

Chapter 6 – Planning and regulatory issues

Many wood chip heating installations do not involve gaining planning consent, particularly where they are small and can be incorporated into existing buildings. The principal issues to be considered are:

- Visual impact, particularly the chimney
- Noise from engines, boilers, handling equipment and traffic
- Local ecology

A Planning Policy Statement specifically relating to Renewable Energy (PPS 22 and companion guide) is available to guide planners and developers. It is advisable to consult your local planning authority at an early stage to ensure that the installation complies with planning policy. As for all developments, buildings or areas that are designated in planning terms, eg Areas of Outstanding Natural Beauty, can raise specific issues.

6.1 Fuel Storage and Delivery

6.1.1 Traffic

Fuel deliveries are unlikely to vastly increase traffic to the site. Frequency of deliveries will be variable, depending on system size, storage capacity and load demand. However, as a guide a 100kW boiler working at full load in winter will require either an agricultural trailer load per week or 1 hook bin delivery per month. Good access for heavy vehicles will be essential to minimise disruption to local road networks and surrounding communities.

6.1.2 Storage

- Subterranean bunker – not visible from the ground and therefore not likely to incur any planning issues
- Above ground storage - visual impact may be an issue, therefore requires screening, and must be secure against unauthorised entry

6.2 Flues/Chimneys

Modern wood-fuelled heating systems emit very little smoke. However, like all combustion systems, the chimney of any wood burning installation must be:

- Of sufficient height and diameter to remove combustion products from the flue outlet of the boiler;
- Of sufficient height to discharge the products of combustion so as not to cause nuisance to people either within or outside the property;
- Visually acceptable to the planning authorities

Existing chimneys can be used for retrofit systems, therefore there are unlikely to be any planning issues arising in this situation. Existing chimneys can be fitted with a lined flue to ensure their suitability for wood fuelled appliances; vent material must ensure sufficient air movement for efficient operation of the stove.

Within a smokeless zone (see ‘pollution/emissions’ below) a tall chimney policy will be in place to encourage dispersion of emissions into the atmosphere. Where installation of chimneys of any significant height is restricted, modern clean-up technology is available to reduce gaseous emissions and eliminate the requirement for dispersion.

Wood-fuel flues can be small

In the picture adjacent the small chimney in the distance services the wood-fuelled appliance and the large chimneys in the foreground belong to the fossil-fuelled system that it replaced.

Worcestershire County Hall

6.3 Emissions

Regulatory authorities involved in controlling heating installations

- < 0.4MW – not subject to control unless in a smoke-free zone
- 0.4MW and 3MW – Local Authority responsible for authorisations
- >3MW – Environment Agency responsible for authoritisation

Authorisations for larger scale installations can take up to four months to process; technical details and a breakdown of predicted environmental impacts will be required.

In response to urban air pollution issues, the Clean Air Act (1956) created smokeless zones in and around the UK's major cities. It is an offence to emit smoke from a chimney, caused by the burning of an unauthorised fuel or use of an unauthorised appliance. This means that coal, oil or damp wood can not be used as a fuel unless burnt in a system which is smoke-free.

Modern wood-fired boilers are smoke free when fuelled with dry wood. It is therefore essential that wood-burning appliances are fuelled by relatively dry material (25-30% MC). Emissions are often restricted to some minutes per day – at both ignition and cool down.

6.4 Building Regulations

Part J of the Building Regulations 'Combustion appliances and fuel storage systems' provides full details of the regulations covering wood-fuelled heating systems.

General provisions which apply to combustion installations include safe accommodation, sufficient air supply, good ventilation, provision of appropriate flues and chimneys, re-use of existing flues, safe access to appliances for maintenance and repair.

Revised Building Regulations will come into force on 6th April 2006. For the latest information visit http://www.odpm.gov.uk/planning

6.5 Key considerations

- Will the installation cause a visual impact?
- Will traffic to the site increase, how frequent will deliveries be required?
- Is access to the site adequate?
- How and where will fuel be stored?
- Is chimney height likely to be an issue?
- Will the installation be located within a designated area, e.g. smoke-free zone.

Chapter 7 – Case Studies

Yorkshire & Humber Case Study 1
RSPB Old Moor Wetland Centre, South Yorkshire

In February 2004, RSPB Old Moor installed a 100kW state of the art KWB wood fuelled heating system to provide heat to a range of converted farm buildings on site. The Centre includes education facilities, offices, meeting room facilities, a visitor centre and café, and warden accommodation.

Key facts	
Size of boiler	100kW
Fuel (moisture)	Sawmill offcut (25-30%)
Fuel delivery	5m^3 2 x per week
Technology	Underfeed stoker
Capital cost	£69,000
Grant aid	£34,500
Fuel cost	£4,300 pa

* See Chapter 10 (10.4.2) for assumptions underyling calculations

YH 1.1 Fuel supply – wood chip

A contract with a local sawmill provided an initial fuel supply; offcuts are dried to a moisture content of 25-33% in bundles in the open air, chipped and supplied as required. The RSPB site is located within a 'Smoke-free zone' so the moisture content of the fuel is critical. Under Clean Air Act Regulations sites located within 'smoke-free' zones are restricted to only 15 minutes of emissions per day; however smoke will only be an issue if wet fuel is used.

Fuel deliveries occur twice per week during winter, and are expected to fall to once every two weeks during the summer. Each delivery consists of around 1 tonne of material, requiring storage capacity of 5m^3. Under the current agreement it is up to the fuel supplier to ensure the hopper is always full.

Solutions to problems

Fuel Reception The preferred solution of an underground hopper was too costly. A metal stand-alone hopper was engineered, which reduced capital outlay but can only accept fuel from a high tip trailer.

Fuel Supply There were initial problems with fuel moisture content, some fuel was being delivered wetter than others and burning more/less efficiently. This was overcome through purchase of fuel as heat (by the kWh) rather than the tonne.

YH 1.2 Technology

The heating installation is housed in an entirely new boiler room, but was linked to the existing boiler system to provide back-up when the new system can not satisfy demand of the entire range.

The system is very user friendly, an intelligent control system minimises pressures on staff to maintain and monitor the installation and ensures the system continually runs at optimum output. The controller also incorporates weather compensating heating and DHW control module, which may be networked to modular or zone units as required. Automatic ash extraction ensures minimal manual input is required, the ash container simply requires emptying on a monthly basis. Other than checking functionality on a regular basis staff have no further input into the operation.

The KWB boiler system

YH 1.3 Costs and contract options

Anticipated capital cost of the installation is £68,806, this includes the boiler and housing, labour, pipework, design, the hopper and base, and the flue. It is estimated approximately 34% of the overall cost was accounted for by the boiler and a further 10% by the hopper and base. 50% grant aid was received from South Yorkshire Forest Partnership, under the Objective 1 Forest Resources Grant Scheme, to assist with the installation costs

The system was installed under a turnkey and service contract. The site holds a three year service agreement, the cost of which is included within the anticipated capital cost of the installation. Fuel is purchased on a kWh agreement, monitored by a heat metering system, at 1.3p/kWh; this compares favourably with 4.4p/kWh for LPG and 6p/kWh for peak rate electricity. It is estimated that annual fuel bills will be in the region of £4,300.

The boiler house and storage hopper at RSPB Oldmoor

Yorkshire & Humber Case Study 2
Paddock House Farm, Sicklinghall, Wetherby

In 2001 Paddock House Farm installed a 150kW wood fuelled heating system to heat a new range of office buildings and several on-site houses. The decision to install a wood fuelled system was made during the early planning stages when a 'sustainable' office development was proposed, wood fuel appeared more favourable and cost-effective over other renewable sources (e.g. solar, wind, etc.).

The installation heats a total area of 1,250m², comprising 700m² of office space and 550m² of on-site housing. Surplus heat which is generated is also utilised to power a wood chip dryer on-site.

Key facts	
Size of building	1,250m²
Size of boiler	150kW
Output *pa*	300,000kWh
CO_2 saved *pa**	81 tonnes
Fuel (moisture)	SRC (25-50%)
Fuel delivery	n/a
Capital cost	£8,000
Grant aid	0
Fuel cost	£4,500

* See Chapter 10 (10.4.2) for assumptions underyling calculations

YH 2.1 Fuel supply – wood chip

SRC willow is grown and chipped on site for the installation as part of a growing enterprise. Chip is stored in a converted grain store, with a storage capacity of 500 dry tonnes, and fed into the bin once or twice per week with a mechanical loader. Optimum moisture content of the fuel is 25%; however fuel of up to 50% moisture content is accepted. The system is also quite versatile in that it is able to accept variable chip sizes up to 50mm.

Problems and solutions

The installation generated few problems and was welcomed by planners as the fuel was grown on-farm and delivered sustainable heating.

As the boiler was one of the first of its kind to be installed, some design problems were encountered. All were overcome through adaptation of technology.

Insulated black iron piping was used in place of the specified district heating piping, which is thought to have led to a leak in the early stages of the installation.

YH 2.2 Technology

A Talbott's B3, inclined grate boiler was installed. The system requires manual de-ashing once per week and cleaning of the heat-exchanger once every two months. The installation is expected to have a lifetime of 20-30 years, all parts are fully replaceable and repairs are carried out by on-site staff as required.

Operation	Frequency	Time (hrs)
Bin feed	1-2/week	0.2
De-ashing	1/week	0.5
Cleaning heat exchanger	6/year	2.0
Maintenance	1/month	0.5

* See Chapter 10 (10.4.2) for assumptions underyling calculations

YH 2.3 Costs and Contract options

The cost of the boiler was around £20,000, the cost of pipework, heat meters etc totalled an additional £8,000. Unfortunately due to the timing of the installation no grant aid was available; however the system is eligible for enhanced capital allowance as it works at over 80% efficiency. Payback on the capital cost is expected within five years, ongoing costs are minimal as all repairs and maintenance is carried out by existing staff.

No contract is held as fuel is sourced and maintenance carried out in-house. The offices and houses which are included are monitored by heat meters; heat is sold to occupants at a rate equivalent to oil of 3.5p/kWh. This cost includes:

- Capital cost (depreciated over 5 years)
- Fuel
- Maintenance
- Margin

And also takes into consideration the cost of the electricity used to run the boiler and monitor heat output.

The Talbott's B3 boiler and feed hopper

Yorkshire & Humber Case Study 3
Sheffield Road Flats, Barnsley

Sheffield Road flats in Barnsley consist of 3 seven storey blocks containing 166 individual residencies in total. The flats were originally built in the 1960's and heated via a 2,346kW coal fired system.

Key facts	
Size of building	166 flats
Size of boiler	470kW
Output *pa*	1.2 GWH (est.)
CO_2 saved *pa*	1,300 tonnes
Fuel	Arboreal arisings and forestry products
Fuel delivery	7 tonnes/week (max)
Technology	Inclined grate
Capital cost	£1.7m
Grant aid	Full cost
Fuel cost	£29,000 per annum

In 2004 it was agreed the system be upgraded for safety and efficiency reasons, and upon consideration replacement was not a viable option due to the age and condition of the existing system. If replacement was undertaken a major system failure was predicted within the following heating season.

YH 3.1 Fuel supply – wood chip

Wood chip comes from a mixture of local arboreal arisings and forestry products. The wood fuel supply contract has a clause which requires the ESCo contractor to utilise as much as possible material sourced from the Council's tree teams and local tree surgeons, etc, thus Barnsley will be operating a 'closed loop' supply chain.
Chip is supplied through Silvapower Ltd, a local wood fuel supply company supported by Yorkshire Forward and South Yorkshire Forest Partnership, using a custom built high-lift trailer. Approximately 7 tonnes of chip (in the region of 20m^3) are delivered at a time, taking just a few minutes. This process is virtually noiseless in comparison to the old pneumatic coal deliveries.

Problems and Solutions

A larger fuel store was required due to the lower bulk density of wood compared to coal. A new bunker was therefore constructed on the front of the building with top loading access to ease delivery.

Maintaining heat availability to the tenants throughout the installation was a challenge. By linking the three blocks together in the early stages the coal boiler plant was able to serve the entire project until the second was converted to gas. Once the gas plant was running the heat was supplied from here until the wood plant was installed. Upon completion the gas plant now acts as a standby facility.

YH 3.2 Technology

The two wood fuelled boilers operate with a capacity of 470kW and is supported by a standby gas boiler with a capacity of 800kW, this additional system is only to be used in case of problems or when the wood fuelled system can not meet heat demands, particularly in extreme winter weather conditions.

The Froling boiler

The boilers are manufactured by Froling of Germany. The system is extremely robust, fully automatic and self de-ashing. Emptying of the ash bins is carried out once per week and takes very little time, producing very little waste. The small amount of ash produced acts as a phosphate fertiliser which is spread on the lawns and gardens surrounding the flats, hence no landfill waste is generated.

Not only will the new system reduce the cost of heat provision it is also saving the discharge of almost 1,300 tonnes of CO_2 to the atmosphere per annum.

YH 3.3 Costs and contract options

The cost of the installation, including replacement of both plants, distribution mains between and within the blocks and new heating systems within the flats totalled £1.7 million. The entire cost of the installation was met by grant funding, through Community Energy Programme, Bio-Energy Capital Grant, Yorkshire Forward's Pathfinder 1 and South Yorkshire Forest Partnership's Forest Resource Grant and EEC funding, and hence the Council incurred no direct cost.

The annual running and maintenance cost of the original coal fired system was £50,000, including daily attendance. The projected annual running costs of the new wood fuelled installation is almost half this amount, at only £29,000, this cost may be reduced further by the fact that tenants are now on pre-payment plans which should force a significant drop in heat demand.

An Energy Supply Contract (ESCO) is currently being secured to ensure the Council does not have to procure fuel or be directly responsible for attendance and maintenance. Heat will be sold to the Council as opposed to fuel to eliminate the variation in fuel heat energy due to moisture content.

Yorkshire & Humber Case Study 4
Acis Housing Association, North Lincolnshire

The Acis Group have recently retrofitted wood pellet central heating systems in two small tenant houses as a cost effective alternative to installing oil-fired boilers. The systems have replaced ineffective and expensive night storage heaters and were selected on the carbon savings they offer in addition to cost savings.

The first property is a converted chapel with a solid wall structure which has previously encountered vast heat loss, the second being a 3 bedroom semi-detached house which was previously served by an alternative solid fuel heating system.

YH 4.1 Fuel supply – wood pellet

The systems are fuelled by 6mm wood pellets which are currently imported due to lack of pellet infrastructure in the UK. The housing Association holds stocks of pellets in 15kg bags which are then delivered to the two users on a monthly basis. 5 tonnes of fuel can be stored by the Council at any one time, equating to almost one-years supply for the two properties.

YH 4.2 Technology

Each installation consists of a 12kW Rika Evo Aqua pellet stove, each of which generates around 17MWh of heat per annum. Very small amounts of ash are produced, emptying is required only once per week and the amounts are small enough to dispose of in the garden.

The automated wood pellet stove

Once the pellet container has been filled the system can operate continually for up to 72 hours. The fuel is fed automatically depending on heat demand, monitored constantly by an electronic system connected to a thermostat.

YH 4.3 Costs and contract options

Each basic stove cost in the region of £5,000, the cost is however increased to £8-10,000 when installation and associated costs are accounted for.

Running costs for pellet heating systems are estimated at 10 - 15% less than those of an equivalent oil-fired system, which equates to around 4p/kWh at present, with a cost decay expected over time.

In addition to the cost savings, each installation is estimated to save around 5 tonnes of CO_2 per annum.

Key facts	
Size of building	2 small bungalows
Size of boiler	12kW each
Output *pa*	17MWh each
CO_2 saved *pa*	5 tonnes each
Fuel	Wood pellet
Fuel delivery	Monthly
Technology	Heating stoves
Capital cost	£8 - 10k
Fuel cost	4p/kWh
Running cost	10 -15% less than oil

Problems and Solutions

Associated works - due to the nature of the installation a lot of work was required to the site in addition to stove installation, for example a chimney, wet heating system and other minor works. This inevitable increased the cost of the installation significantly. As installations become more common a cost-decay will be experienced.

Fuel supply - as the UK pellet supply industry is immature suitable fuel currently has to be imported. This will hopefully be overcome in the short-term by supply from Balcas, Northern Ireland, and in the longer term by development of UK mainland suppliers and local distributors.

Yorkshire & Humber Case Study 5
Kirk Balk Secondary School (Wood Pellet Trial)

A trial was developed by South Yorkshire Forest Partnership and funded by Yorkshire Forward. It was undertaken at a number of sites across South Yorkshire. The purpose of the trial was to assess the suitability of traditional underfeed coal boilers in accepting wood pellet as a viable fuel alternative.

YH 5.1 Fuel supply – wood pellet

The fuel initially supplied to the trial was imported (Balkan) 6mm diameter soft-wood pellet, however towards the latter stages this was upgraded to 8mm with no noticeable effects on operations.

Converted boilers at Kirk Balk School

From the trial commencing in April to the end of August 2004 only 12 tonnes of pellets were used to provide the base load requirements, this equates in energy terms to only 7 tonnes of coal. The delivered heat capacity of wood pellet was seen to far exceed that of the former coal equivalent. The Council is experiencing one tonne of pellet providing as much useful heat as one tonne of coal.

Had the plant operated as per the original theory, eg. that more pellet would be required to be burnt due to its lower Calorific Calue (CV) by a factor of approximately 2:1. Earlier assumptions indicated that it should have been necessary to burn some 437 tonnes of pellet, to equate in energy terms to 308 tonnes of coal. This proved to be far from the case.

Advantages

- There are no clinkers formed so no unburned fuel is removed in the cleaning process
- Combustion efficiency is around 90% compared to a normal stoker which works at around 60%
- Almost no ash remains, the little that is collected can be used as a ground fertiliser, thus no waste to landfill
- Reduced wear and tear as wood is less aggressive than coal

YH 5.2 Technology

This site was chosen to test the burning potential of wood pellet fuel on 'underfeed stokers'. The stokers are fully modulating, computer controlled, operated to maintain a constant negative pressure within the combustion chamber

Three boilers, each rated at 586kW are installed at the school, although only in the severest weather is it necessary to operate all three. Prior to conversion to wood fuel during the trial typical coal consumption was around 272 tonnes per year. No physical/structural modification was required to the boilers, "green Coal" tests were undertaken to establish fuel flow and air flow rates, these were the only modifications required - again, against previously held assumptions.

YH 5.3 Costs and contract options

Currently wood pellet is the most expensive form of wood fuel, equating to £106 per tonne in comparison to only £67.70 per tonne for coal. However, in order to make a true cost comparison the following should also be considered;

- Reduced daily attendance during working days
- No weekend / holiday attendance necessary
- No skips required for ash removal
- No waste disposal costs to landfill
- Reduced maintenance costs over time

Key facts	
Size of building	10,700m²
Size of boiler	3 x 586kW
Output *pa*	1,720 MWh
CO_2 saved *pa*	473 tonnes
Fuel	Wood pellet
Fuel delivery	Pneumatic
Technology	Underfeed stoker
Capital cost	Nil
Grant aid	Fuel cost subsidy
Fule cost	£106 per tonne
Running cost	£32,664 per annum

Full cost analysis presents a cost increase of £3,142 per annum on the wood pellet system; however this does not take into account the saving in attendance time, weekend and holiday overtime. In addition, the price of coal has increased from the figure above and there are plans to develop a wood pelletisation plant in South Yorkshire, which it is hoped will bring parity in cost between pellet and coal.

Due to the success of the trial the intention is now to continue the experience to disseminate the technology to other remaining coal burning sites that still have useful life left in the boiler / stoker plant.

Yorkshire & Humber Case Study 6
Wood Supply Infrastructure
Silvapower Ltd, South Yorkshire

Following the successful development of a woodfuel boiler cluster in South Yorkshire by Yorkshire Forward (YF) and South Yorkshire Forest Partnership (SYFP). It was identified that a dedicated woodfuel supply would be required to meet the specific needs of the new emerging industry. Due to the embryonic nature of this industry, traditional business models did not fit with the level of growth and demand of the woodfuel market. As it was essential for customers and clients wishing to install biomass boilers, to have security of supply for woodfuel, the establishment of a suitably equipped supply company was identified as paramount. During 2004/05, YF and SYFP supported the development of such a business which became Silvapower Ltd.

YH 6.1. Sourcing Feedstock

Silvapower Ltd sourced material suitable for chipping from a number of local sources, which included sawmill off-cuts and 'pulp' grade forestry timber from local forestry contractors. These loads were bought on an ad-hoc basis with the price being negotiated per batch, the costs ranged from £5pt up to £22pt. The material was stacked at the fuel depot to dry for approx. 6 months before chipping.

Feedstock at Ringstone Hill Farm

YH 6.2 Chipping

Silvapower Ltd have the use of a dedicated woodfuel specification chipper, especially designed to produce chip for biomass boilers. The chipper is a Hiezohack HM14-800K with an infeed capacity of 1200mm x 800mm which will enable the company to process most woody material especially 'street tree' residue and other Arbor arisings. The chipping process also allows further drying to take place and reduces the moisture content (MC) to approx. 20-30% after a couple of months.

Chipping operation

YH 6.3 Fuel storage

Once chipped the woodfuel is kept undercover in barns or sheds (see page 1). Silvapower Ltd are in the process of developing 4 woodfuel stores around South Yorkshire, to meet the raising demand for woodfuel and to provide local deliveries to the woodfuel cluster. Typical farm barns of approx. 25m x 15m x 6m are ideal and can be added to if a modular design is used. Essentially the storage needs to keep the wet off the chip and have good air flow, to allow the chip to dry.

Fuel shed

YH 6.4 Delivery

Wood chip tends to be delivered using tipping back trailers or wagons. If the fuel reception hopper is not subterranean, then a high lift or scissor action trailer will be required.

The company also undertakes contract chipping of other peoples feedstock and are involved in the supply of wood pellets to several sites in South Yorkshire.

High-tipping trailer delivery

North East Case Study 1
Groundwork, South Tyneside

Groundwork South Tyneside, an environmental regeneration trust, is housed in an environmentally-friendly office building at Hebburn, Tyne and Wear, known as the Eco-Centre. The building is entirely constructed from materials that are recycled or from sustainable sources. Most of the space heating is provided by ground source underfloor heating, with electricity generation from photovoltaic solar and wind power. A wood pellet fired stove has recently been added to the new reception area at the Eco-Centre.

NE 1.1 Fuel Supply – wood pellet

The stove uses 6mm or 8 mm wood pellets, which are presently available from a limited number of suppliers and distributors. The UK pellet supply industry is small in scale, and presently most pellets are imported – although the number of domestic pellet manufacturers is gradually increasing. This installation uses pellets supplied in 15kg bags.

NE 1.2 Technology

The Enviro Evolution EF5 pellet stove has a maximum output of 9 kW and can be turned down to 2 kW. It holds about 40 kg of 6 mm wood pellets, enough for around 5 days' continuous use. An electric ignitor ensures rapid starting at the press of a button, and an air wash system keeps the front glass panel clean. The stove is suitable for connection to an external thermostat. Made in Canada, it is widely available in the UK from a range of distributors.

Key facts	
Size of building	Small reception area
Size of heater	9kW
Output *pa*	~3 MWh
CO_2 saved *pa*	~0.9 tonnes
Fuel	Wood pellet
Fuel delivery	Weekly (by hand)
Technology	Heating stove
Capital cost	£1800
Fuel cost	4p / kWh
Running cost	Competitive with oil

NE 1.3 Costs and contract options

The retail price of this stove is about £1,800 (installation extra). It is available painted black or in brushed stainless steel. Running costs for small domestic-scale pellet heating systems are estimated to be comparable to oil-fired heating, which equates to around 4p/kWh at present. Costs are expected to fall over time, while the price of heating oil will increase in real terms.

Automated wood pellet stove

This model of stove is designed to heat a space of up to about 166 square metres. In this particular installation, it is relatively lightly used, and is estimated to save around 0.9 tonnes of CO_2 per annum.

Problems and Solutions

Installation of the flue required careful coordination between the stove installers, the architect and the roofing contractors, in order to optimise design and efiiciency.

Fuel supply – for the small user, costs may vary widely depending upon supplier and quantity. In general, it should be possible to match the fuel cost of heating oil, and the cost advantage is expected to become more apparent over the next few years.

North East Case Study 2
Cassop Primary School, County Durham

Situated about 7 miles from the City of Durham, Cassop Primary School is a ground-breaking village school which integrates "Education for Sustainable Development" into all its work. The school buildings, which mostly date from 1921 and were extended to 1250 square metres in 1970, were previously heated by oil. With its own 50 kW wind turbine and solar panels (both thermal and photovoltaic) Cassop School was already in the forefront of renewable energy utilisation and teaching. In 2004 it installed a wood pellet fired heating and hot water system, consistent with the Durham County Council (DCC) policy of phasing out coal and oil heating and introducing biomass heating where possible. Boiler suppliers 3G Energi, based in the Borders town of Kelso, with DCC's Corporate Services Design Team won the Energy Efficiency prize in the annual County Durham Environment Awards for their work on designing and installing the system.

NE 2.1 Fuel Supply – wood pellet

The system is fuelled with 8mm wood pellets made from clean post-consumer wood by Premier Waste, Coxhoe, County Durham. Premier's depot is situated only one mile away, so there are significant savings in fuel transport, time and energy. Monthly fuel deliveries (less frequent in the summer months) comprise about 8 to 9 tonnes of pellets, conveyed pneumatically using a "blower" truck that can fill the fuel store from the roadside.

NE 2.2 Technology

The heating system uses an Austrian KÖB Pyrot 220 kW boiler in conjunction with a 2,200 litre heat storage accumulator tank. The boiler includes automatic ignition and modulating control as standard and features flue gas recirculation and automatic cleaning options. A 30 square metre fuel store was created from the old coalhouse, and a spring extractor and auger system installed to transfer the pellets to the boiler. Durham County Council requested that the boiler and feed system be supplied with a conversion kit to allow woodchips to be used as an alternative fuel, should reliable supplies become available in the future. The boiler is operated in an "always on mode", sensing the heat load from the accumulator temperature.

NE 2.3 Costs and contract options

The retail price of this boiler was about £37,000, plus installation and associated costs, making a total of around £68,000. Fuel costs to date have been competitive with previous years' annual oil bills - which averaged about £4000/year between 2000 and 2003. Significant cost savings are expected in the future as heating oil rises in price. Fuel consumption was previously around 22,000 litres of oil per year, equivalent to about 225 MWh. The system is estimated to save approximately 66 tonnes of CO_2 per annum.

Key facts	
Size of building	1250 square metres
Size of boiler	220 kW
Output *pa*	~225 MWh
CO_2 saved *pa*	~66 tonnes
Fuel	Wood pellet
Fuel delivery	Approx. monthly
Technology	Multi-biomass boiler
Capital cost	£68,000
Fuel cost	1.8p / kWh
Running cost	Competitive with oil

220 kW wood pellet boiler

Problems and Solutions

The boiler was almost too large to fit through the existing doorway. Space is an important consideration when retrofitting into existing boiler plant - including space for unloading of equipment on site. With hindsight, an enlarged fuel store would have been an improvement, requiring less frequent deliveries.
The school caretaker is responsible for a daily visual check on the boiler and weekly cleaning of the ashbox. He shuts down the boiler for a thorough clean every half-term, and was pleasantly surprised to find that this task takes less than 30 minutes, creating minimal dust.

North East Case Study 3
Blyth Star Enterprises, Northumberland

Blyth Star Enterprises is a community based service offering employment opportunities to people with long-term mental health problems. The Blyth Star Kindling Project converts low-grade Forest Stewardship Council certified timber into hundreds of thousands of bags of firewood per year, for both local and bulk distribution. The project provides a real work environment for people with mental health problems, and has created several additional jobs. In 2004, Blyth Star installed a manually-fed wood-fired heater to replace oil-fired heating in their 15,000 ft^2 (1400 m^2) industrial unit at West Sleekburn in southeast Northumberland.

NE 3.1 Fuel Supply – wood offcuts

The heating system is fuelled with unmerchantable off-cuts (knotty or irregularly shaped pieces). There is a plentiful supply of such scrap material within the factory after the air-dried round wood timber has been processed.

NE 3.2 Technology

The installation comprises a Talbotts T-500 warm air heater with an output of 150 kW. This is the largest of a range of warm-air heaters (25 – 150 kW), which are simple manually-fed units designed for fuelling with wood off-cuts. Designed for small-to-medium producers of wood waste, for disposal and workshop heating, these heaters are of robust construction with a firebrick-lined combustion chamber. Blyth Star's unit operates continuously with day and night shifts during the working week, but is easy to re-light after the weekend using kindling wood. In general, it requires refuelling about every three hours.

Key facts	
Size of building	1400 square metres
Size of heater	150 kW
Output *pa*	~250 MWh
CO_2 saved *pa*	~75 tonnes
Fuel	Wood off-cuts
Fuel delivery	Every 3 hours
Technology	Solid fuel heater
Capital cost	£12500
Fuel cost	Zero
Running cost	Zero

NE 3.3 Costs and contract options

The system was installed with grant and consultancy support through the Energy for Enterprise scheme, a service funded by the European Regional Development Fund and administered by regional consultants North Energy. With wood fuel costing virtually nothing, the capital cost of the heater (about £12,500) would be recovered in fuel savings in less than 3 years (without grant support). With grant support, an even faster payback is expected. Blyth Star are now interested in supplying wood fuel to other heat users on their industrial estate, since there is no mains gas connection to this area. They are also proposing to install a second automatic-feed heater for a greenhouse and nursery project.

The wood-fired heater replaces a conventional oil-burning system that consumed about 25,000 litres per annum. Although wood consumption is not monitored, the system is thought to burn about 50 tonnes of scrap wood annually, and to save roughly 75 tonnes of CO_2 per annum.

Wood-fired heater

Problems and Solutions

Neil Hedley, Kindling Production Manager at Blyth Star Enterprises, says there have been no problems at all with installation and operation. The boiler installers sorted out the siting of the exhaust flue. Fuel supply is ready at hand and, best of all, free!

North East Case Study 4
Kielder District Heating, Northumberland

Kielder village, a remote community of 200 in the heart of Kielder Forest, Northumberland, is the site of the first wood-fired community heating scheme in England. Commissioned in 2004, a central boiler house provides heat, through a system of insulated district heating pipe, to a range of buildings including the Kielder Castle visitor centre, a primary school and youth hostel, workshops and six new houses. The project was developed by Tynedale Council in partnership with Forestry Commission and the Kielder community company - and 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.

NE 4.1 Fuel Supply – wood chips

Fuel for the Kielder boiler is sourced from dead trees and other unmerchantable timber of poor quality. After drying for about 12 months outdoors to a moisture content of 20-30%, the wood is chipped into a main fuel store that holds up to 450 cubic metres (70-120 tonnes). While the main fuel store is replenished 3 to 4 times a year, wood chip are delivered to the boiler house weekly, using a 2.5 tonne (16 cubic-metre) trailer with a "push-off" action.

NE 4.2 Technology

The KÖB Pyrot 300 kW boiler was imported from Austria, and is one of the cleanest and most technically advanced models presently available. Its microprocessor-controlled rotary firebox allows adaptation to burn all kinds of dry or damp wood fuels (chips, sawdust shavings, pellets, briquettes, forestry wood shavings), and it has an efficiency of 87% (measured as heat output to wood fuel energy input). The boiler house store has a moving floor that carries the woodchips onto a corkscrew-like auger, which in turn conveys the chips into the boiler. Hot water is piped to the 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 energy service company (ESCO) sends them monthly heating bills.

NE 4.3 Costs and contract options

The total cost of the Kielder system incorporated many exceptional charges, including the laying of heat pipe and the need to construct a special boiler house with interim fuel store. Further community heating systems based upon the Kielder design and experience are expected to be considerably cheaper. The community ESCO makes a modest profit based upon heat charges of 3p/kWh, but the capital costs of the project required public sector funding. The boiler produces very little noise, smoke or ash, and visitors sometimes cannot even tell when it is running! Exhaust emissions comprise mainly water vapour: total emissions are expected to be less than a single household coal fire. The few wheelbarrow loads of ash produced each year are used as a fertiliser to mix with compost for the village gardens and allotments. Although sufficient operational data are not yet available, the Kielder heating scheme is expected to save up to 300 tonnes of CO_2 per annum.

Inside the Kielder boiler house

Key facts	
Size of building	4 commercial/public buildings and 6 homes
Size of boiler	300 kW
Output *pa*	~1000 MWh
CO_2 saved *pa*	Up to 300 tonnes
Fuel	Wood chip
Fuel delivery	Weekly
Technology	Multi-biomass boiler
Capital cost	£300,000+
Fuel cost	3p / kWh
Running cost	Cheaper than oil

Problems and Solutions

Project evaluation has highlighted boiler efficiency and quality fuel supply as two key factors contributing to the success of the Kielder heating scheme. Technical performance of most of the equipment has been excellent.
The most significant area for concern is the distribution of heat around the pipe network. The recovery of "chargeable" heat has not been as high as anticipated, with implications for the profitability of the ESCO. Investigations so far suggest that this due to poor jointing between sections of the mains heating pipes.

North West Case Study 1
Kingsmead School, Northwich

In Spring 2003, Cheshire County Council took the decision to provide a new Primary School to serve the needs of Kingsmead area of Northwich in Cheshire which was to encompass the principles of sustainability whilst providing an exemplar design to meet the 'Classrooms of the Future' vision.

This 'Intelligent' building fully considers minimising energy use and its principles of sustainable design and construction are apparent at every level. The building design concept incorporates super-insulating properties, natural ventilation throughout the school and incorporates rainwater harvesting system for flushing toilets, and the school uses sustainable urban drainage systems, recycled materials within the building fabric and locally sourced products and materials.

Furthermore, the school incorporates renewable energy technologies such as photovoltaic panels, solar thermal panels and the Talbotts C1-B Biomass boiler heating system and fuel storage bunker.

NW 1.1 Technology

Talbott's Heating are the supplier of the C1-B biomass boiler. Cheshire County Council took the conscious decision to commission a British manufacturer to complement the project's sustainable ethos of locally sourced procurement and also to ensure accessible and reliable maintenance should there be any technical hitches later in the projects life.

By installing a biomass boiler, Kingsmead Primary School has moved away from fossil fuel to locally sourced biomass fuel, which assists in achieving Cheshire County Council's environmental policy. The boiler provides the heating and domestic hot water demands for the school. The Talbott 50kW unit includes a 10m^3 storage bunker which offers flexible fuel loading from an integrated bunker fill vacuum system on inlet for a blower delivery facility.

Boiler specification	
Supplier	Talbots heating
Max Biomass Boiler output	60 kW
Total heating load	150 kW
Biomass as proportion	40%
Total potential heating energy requirement	35,000 kwh/yr
Storage bunker	10m^3
Total potential biomass energy proportion	60%

The system is fully integrated with the comprehensive Building Management System which co-ordinates the energy sources form the biomass boiler and the solar heating panels. Around 60% of the heat demand of the school is met by the biomass boiler. The boiler is 80% efficient and has full modulating capacity to meet the variable heating load of the building.

NW 1.2 Fuel Supply

The Tabott's boiler has been designed to tolerate any biomass fuel fed by an auger screw. Since the school has been opened the biomass boiler has been configured to burn processed wood pellets supplied by EGNI of Anglesey, North Wales. However, the overall aim of the project was to move to a locally produced wood chip. This product has recently been identified and secured. From November 2005, Kingsmead School will be burning a wood chip which has been derived from waste wood collected from the region and supplied by Hadfield Wood Recyclers of Droylesden near Manchester. Fuel will be delivered by existing vehicle movements through the mid Cheshire area.

An Exemplar in Sustainability

Completed in July 2004, Kingsmead School has opened its doors to children in September and has already attracted much interest and media attention. It has won many awards and recognition including the Civic Trust Award, small project of the year in the national Quality in Construction Awards and is a finalist in the Prime Minister's Better Public Buildings Award for 2005.

The building is the first in Cheshire to use biomass technology and will hopefully stimulate interest for other public and private sector projects. The availability and cost effectiveness of fuel will be an important element that will hopefully stimulate further projects across the region.

Tours of the school are available by appointment, please email Angie@epplus.org.uk for availability.

North West Case Study 2
The Barn Visitor Centre & Headquarters of the Wildlife Trust, Preston

The Barn, situated in the 600 acre Cuerdon Valley Park, is a purpose-built, two storey office and visitor centre for The Wildlife Trust built in 2003 with a combined woodchip burner and solar panel heating system. The building also utilises recycled materials in its construction as well as a subterranean Gramm rainwater harvest tank for all non-drinking water requirements.

The biomass route was chosen over conventional technologies because of the availability of a sustainable supply of woodchip generated as a result of woodland management carried out by Cuerden Valley Park Trust who are based in the building.

NW 2.1 Fuel Supply

The boiler is supplied with woodchip previously dried by mechanical means in a covered, open sided barn. A 5m^3 capacity hopper is top-loaded by tractor once a week and the chips are automatically auger fed to the burner head. The unit burns 30-35 tonnes of woodchip providing heat and hot water over an eight month period during the colder months, the rest of the year needing only the combination of solar panels and thermostatically controlled immersion heater to provide hot water. It is during this 'rest' period that the boiler is serviced.

NW 2.2 Costs

Key facts	
Size of building	940m^2
Boiler capacity	80 kW
Boiler output	
Fuel	Wood chip
Fuel delivery	Weekly
Capital cost	£20,291 (Biomass and solar)
Fuel cost	£36/tonne (30-35 tonnes/yr)

NW 2.3 Technology

An Ala-Talkkari 80Kw Veto stoker woodchip burner with externally mounted 5m^3 woodchip hopper is combined with Viessmann solar panels in an unvented system providing heat during the colder months and hot water throughout the year. The whole system is regulated by a conventional Honeywell Aquatrol 2000 control unit.

Problems and Solutions

The boiler is more labour intensive than conventional gas systems; fuel levels, chip length and moisture content need to be maintained in order to achieve efficient burning. Fire walls must be mechanically cleaned, ash must be removed and disposed of on a regular basis, airborne particulates as a result of cleaning need to be vented and there is no automatic ignition, although later models now have this facility.

Provided the maintenance regime is followed, there is very little to go wrong with this system and there are obvious indicators such as quality of fuel/ash, flue temperature and level of pitch/tar deposits which make fault diagnosis relatively easy. At a time when fossil fuels are becoming increasingly expensive and the nation becomes totally reliant upon imports, it makes sense economically and environmentally for the Trust to champion the use of sustainable fuels.

Chapter 8 – Grants for wood fuelled heating

There are various sources of grant aid for feasibility studies, planning, installation and management of wood fuelled heating systems. The financial contribution will depend on the size of the installation, type of technology, anticipated environmental benefits and location. When applying for financial assistance it is important to consider the length and complexity of the application process, the timescales and deadlines for applications. To assist with your decision we have outlined the various options below, however please note programmes are constantly changing so please refer to the web links for up to date information.

8.1 Implementation

Energy-Efficiancy Loans

Details:
Available for SMEs with a trading record of more than 12 months. Available for all energy saving investments, including building technologies and industrial process technologies.

Scale of funding:
0% interest loans available from £5,000 to £50,000 for the purchase of energy-saving equipment.

Application process:
The three page application form requires applicant details, project details, equipment details and installation costs, an energy saving assessment and borrowing profile.

Contact details:
Action Energy
C/o The Carbon Trust, 9th Floor, 3 St Clement's Inn
London WC2A 2AZ

Tel: 0800 585794
Web: http://www.actionenergyloans.org.uk/

ClearSkies Renewale Energy Grants - Householders

Details:
Funding available to support the installation of renewable energy sources, to encourage householders to realise the benefits of renewable energy. Due to the success the scheme has been extended until March 2006.

Scale of funding:
£600 for room heaters / stoves with automated wood pellet feed or £1,500 for wood-fuelled boiler systems, regardless of technology used.

Application process:
The five page application form requests applicant details, installation and installers details, system details, grant requested, quotation and compliance. Once submitted a grant offer will be sent, upon completion the applicant must lodge the claim within 1 year of the offer letter.

Contact details:
Clear Skies
BRE Ltd. Building 17, Garston, Watford WD25 9XX
Tel: 08702 430930
Email: info@clear-skies.org
Web: http://www.clear-skies.org

ClearSkies Renewable Energy Grants - Schools and Communites

Details:
Funding available to support the installation of renewable energy sources, to encourage communities to realise the benefits of renewable energy. Due to the success the scheme has been extended until March 2006.

Scale of funding:
The lower of 50% of installed cost or £100,000 regardless of technology.

Application process:
The ten page application form requires the following; applicant details, finance and agent details, installation and installers details, system details, details of match funding and income generation, grant requested, quotation, compliance and scheme concepts and designs. Applications are assessed quarterly by the selection panel and if successful funds must be claimed within 24 months.

Contact details:
Clear Skies
BRE Ltd. Building 17, Garston, Watford WD25 9XX
Tel: 08702 430930
Email: info@clear-skies.org
Web: http://www.clear-skies.org

Community Energy Programme

Details:
Details for the 2006 rounds are yet to be confirmed; however funding is likely to be available for development and implementation of community or district heating systems.

Scale of funding:
Yet to be confirmed for 2006 funding rounds, however previous rounds have funded up to 50% funding for development or 40% funding for installation, expansion or refurbishment.

Application process:
For information on bidding rounds and deadlines please refer to the web address listed below. Applications are assessed by an advisory panel who meet on a quarterly basis.
Contact details:
Energy Saving Trust
21 Dartmouth Street, London SW1H 9BP
Tel: 0870 8506085
Email: communityenergy@est.co.uk
Web:
http://www.est.org.uk/housingbuildings/funding/community/

Community Renewable Initiative

Details:
In each of 10 regions of England, a partnership of organisations has been formed to help localities devise their own ideas and developments for renewable energy.

Scale of funding:
No direct funding is available but the Community Renewables Initiative provides free advice to help track down suitable funding and assist with applications. Guidance is offered at all stages, from planning through to implementation.

Contact details:
Regional Enquiry Service
Yorkshire Renewable Energy Network
Hebble End Mill, Hebden Bridge, West Yorkshire HX7 6HJ
Tel: 0845 3304930
Email: info@yren.org.uk

National Enquiry Service
Community Renewables Initiative
Tel: 01242 533260
Email: cri@countryside.org.uk

Enhanced Capital Allowance (ECA) Scheme

Details:
The Enhanced Capital Allowance scheme encourages businesses to invest in low carbon technologies. The scheme was update in March 2001 to include the Energy Technology Products list, which now includes biomass boilers.

Scale of funding:
The ECA allows businesses to claim 100% first year capital allowances on investments in energy saving technologies and products. Businesses are now able to write off the whole cost of their investment against their taxable profits of the period during which they make the investment.

Application process:
Claims for ECA's are made on the Corporation Tax Return for companies and the Income Tax Return for individuals and partnerships.

Contact details:
The Carbon Trust
8th Floor, 3 Clement's Inn, London WC2A 2AZ
Tel: 0800 085 2005
Email: info@thecarbontrust.co.uk
Web: http://www.eca.gov.uk

Woodland Harvesting, Processing and Marketing Grant

Details:
It has the objective of providing targeted assistance to (1) improve and rationalise the harvesting, processing and marketing of forestry products, (2) promote new outlets for the use and marketing of forestry products and (3) to establish associations of forest holders set up in order to help their members improve the sustainable and efficient management of their forests.

Scale of funding:
For investments in harvesting, processing and marjeting, for example cost of wood fuel processing and handling machinery, such as chippers, fire wood processors and splitters, log handlers, etc, commissioning, developing and undertaking marketing studies and strategies, demonstration and development of new technology and products, the grant will fund 30% of total eligable costs. For the stablishment of Producer groups, Marketing Groups, Co-operatives and Woodland Associations, the grant will be 50% of total eligable costs. The minimum level of support is £2,000 per application and the grant ceiling is £50,000 per application.

Application process:
The application form requires applicant details, project outline, project details, justification for grant aid and estimated project costs. All applications must be accompanied by a detailed business plan and where applicable copies of planning permission and related consents should be included. In order to achieve the best value for the use of public funds, the scheme aims to fund 'additional activity' - in other words, activity which would not have gone ahead at all, or at the same scale, or at the same speed without grant aid.

Contact details:
Forestry Commission
Yorkshire and the Humber Conservancy
Wheldrake Lane, Crockey Hill
York YO19 4FF
Contact: Jeremy Dick
Tel: 01904 448778
Email: jeremy.dick@forestry.gsi.gov.uk
Web: www.forestry.gov.uk

8.2 Research and Development

The Carbon Trust - Research, Development and Demonstration Projects

Details:
Support for research, development and demonstration projects. Funding is available for projects with the potential to reduce greenhouse gas emissions.

Scale of funding:
Up to £250k can be applied for, providing the project demonstrates innovation, clear demand and benefits to the UK. Grant funding under this scheme can contribute between 25 – 75% of project costs depending on circumstances.

Application process:
The application process is in two stages; initial application and full proposal. The initial application can be made online and if successful a full proposal will be required 7-8 weeks later.

Contact details:
The Carbon Trust
8th Floor
3 Clement's Inn
London
WC2A 2AZ
Tel: 0800 085 2005
Email: info@thecarbontrust.co.uk
Web: http://www.thecarbontrust.org.uk

Innovation Programme

Details:
The Innovation Programme offers funding and technical support to local authorities, housing associations and their project partners who are addressing the threat of climate change in innovative ways. Two routes of funding are available; for feasibility studies and implementation projects.

Scale of funding:
For feasibility studies up to 70% of the costs to a maximum of £10k for innovation and £3k for replication projects.

Application process:
A key contact will be allocated to guide you through application. Fourteen pages of guidance are provided for a seven page application form. Applications are submitted in two stages, a draft for comment followed by the final submission two weeks later. Details required include; a general project overview, aims and objectives, an action plan and costings. All applications must be accompanied by a Letter of Support.

Contact details:
Innovation Programme
Energy Saving Trust
c/o Future Energy Solutions
153 Harwell, Didcot
Oxfordshire OX11 0QJ
Tel: 01235 432432
Email: Innovation.programme@aeat.co.uk
Web:
http://www.est.org.uk/housingbuildings/funding/innovative/

Chapter 9 – Useful contacts

Disclaimer: This is not an exhaustive list, inclusion does not constitute recommendation.

9.1 Consultants

Bio-Renewables Ltd
ADAS Arthur Rickwood
Mepal, Ely
Cambridgeshire
CB6 2BA
Tel: 01354 692531
Fax: 01354 694488
Email: enquiries@bio-renewables.co.uk
Web: www.bio-renewables.co.uk

Provide a renewable energy consultancy service which includes; feasibility studies, planning, fuel sourcing, project development and installation.

Bowland Bioenergy
Mead House
Chipping, Preston
Lancashire PR3 2TQ
Tel/fax: 01995 61829
Email: mike.ingoldby@netnow.co.uk

A single point of contact for advice, fuel supply, biomass system supply, installation and after sales service

Hammond Suddards
2 Park Lane
Leeds
LS3 1ES
Tel:0870 839 0000
Email: enquiries@hammonds.com
Web: www.hammondsuddardsedge.com

A leading law firm committed to the local market, provide a no-nonsense business approach to achieve their client's commercial objectives

Econergy
Unit 12 St Georges Tower
Hatley St George
Sandy
Bedfordshire SG19 3GH
Tel: 0870 054 5554
Fax: 0870 054 5553
Email: heat@econergy.ltd.uk
Web: www.econergy.ltd.uk

Consultants and engineers for wood fuelled heating systems, from planning and design through to installation and maintenance

Entec UK Ltd
Northumria House
Regent Centre
Gosforth
Newcastle-upon-Tyne NE3 3PX
Tel: 0191 272 6100
Fax: 0191 272 6592
Email: info@entecuk.co.uk
Web: www.entecuk.co.uk

Capabilities and experience extend across the full range of power production and distribution technologies, including wind, biomass, energy from waste and landfill gas, CHP and conventional fossil fuels.

ESD Ltd
Overmoor
Neson
Corsham
Wiltshire SN13 9TZ
Tel: 01225 812102
Fax: 01225 812103
Email: enquiry@esd.co.uk
Web: www.esd.co.uk

Undertake feasibility and project management work regarding biomass

Future Energy Solutions
AEA Technology
The Gemini Building
Fermi Avenue
Harwell International Business Centre
Didcot OX11 0QR
Tel: 0870 1906374
Fax: 0870 1903618
Email: giles.barwell@aeat.co.uk
Web: www.future-energy-solutions.com

A leading specialist in sustainable energy, helping developers, policy makers and industry meet targets and grasp opportunities

North Energy Associates
Old Queen's Head Yard
7B Oldgate
Morpeth
Northumberland NE61 1PY
Tel: 01670 516949
Fax: 01670 510300
Email: enquiries@northenergy.co.uk
Web: www.northenergy.co.uk

An expert renewable energy consultancy that undertakes feasability studies, research and practical projects in a range of energy, electricity and carbon management applications, including wood fuel for heating.

PB Power Ltd
Amber Court
William Armstrong Drive
Newcastle Business Park
Newcastle-upon-Tyne NE4 7YQ
Tel: 0191 2261899
Fax: 0191 2262104
Email: gallantinec@pbworld.com
Web: www.pbworld.com/power

Cover all renewable energy advisory requirements including design, engineering and project management

Renewable Fuels Ltd
The Harrop's
The Menagerie
Escrick
York YO19 6ET
Contact: Robert Smith
Tel: 01904 720575
Fax: 01904 720578
Email: info@renewablefuels.co.uk
Web: www.renewablefuels.co.uk

Can provide specialist advice on planning, economics, supply logistics, contract management, and fuel handling and processing systems and logistics

Renewable Heat and Power Ltd
Pinkworthy Barn
Oakford
Tiverton
Devon EX16 9EU
Tel: 01398 351166
Fax: 01398 351115
Email: admin@rhpl.co.uk
Web: www.rhpl.co.uk

Consultants, developers and contractors for automatic wood heating installations and wood fuel supply. Suppliers of small scale pelletisation plant and wood pellets

TNEI
2nd Floor, Kelburn House
7 - 19 Mosely Street
Newcastle-upon-Tyne
NE1 1YE
Tel: 0191 233 9300
Fax: 0191 233 9309
Web: www.tnei.co.uk

Offering a broad range of capabilities, TNEI provides consultancy in strategy and project development to the environmental, new and renewable energy sectors

Wilbraham & Co
Trafalgar House
29 Park Place
Leeds
LS1 2SP
Tel: 0845 404 2404
Fax: 0845 404 2424
Email: enquiries@cobbetts.co.uk
Web: www.wilbraham.co.uk

Solicitors, providing advice on all elements of planning and environmental legislation relating to energy generation and electricity transmission

Wrigleys
19 Cookridge Street
Leeds
LS2 3AG
Tel: 0113 2446100
Fax: 0113 2446101
Email: thepartners@wrigleys.co.uk
Web: www.wrigleys.co.uk

Solicitors, advising on planning, taxes and legislation relating to energy generation and utilisation.

9.2 Equipment Suppliers

3G Energi
3 The Knowles
Kelso TD5 7BH
Tel: 01573 229198
Fax: 0870 7062555
Email: info@3genergi.co.uk
Web: www.3genergi.co.uk

UK importers of Kob and Kunzel wood fuelled central heating boilers (domestic and commercial); logs, pellet and woodchip. Design and installation packages are available.

Bioflame Ltd
South View Yatts
Pickering
North Yorkshire
YO18 7JN
Tel: 01751 472831
Email: enquiries@bioflame.com
Web: www.bioflame.com

Biomass system supply and installation, and provision of advice through all stages, from planning to installation

Dragon Heat
Station Road
Sibsey
Boston
Lincolnshire
PE22 0SA
Tel: 01205 750516
Email: peter@dragonheat.co.uk
Web: www.dragonheat.co.uk

Biomass heating system manufacturer, providing support from selection to installation

Econergy
Unit 12 St Georges Tower
Hatley St George
Sandy
Bedfordshire SG19 3GH
Tel: 0870 054 5554
Fax: 0870 054 5553
Email: heat@econergy.ltd.uk
Web: www.econergy.ltd.uk

Specialise in the specification and supply of turnkey biomass heating systems. Also source, process and supply woodfuel and offer Contract Energy Management services.

Ian Chappell Boiler Services
56 Bridge Street
Berwick-upon-Tweed
Northumberland
TD15 1AQ
Tel: 01289 306910
Email: igchappell@aol.com
Web: hometown.aol.co.uk/igcboilerservice/index.html

Manco Energy Ltd
Market Weighton Road
North Newbald
East Yorkshire
YO43 4SP
Tel: 01430 828660
Fax: 01430 828661
Email: info@mancoenergy.com
Web: www.mancoenergy.co.uk

Able to supply a range of biomass boilers, for log, wood chip and wood pellets. Design and installation available for boilers from 15 kW to 10 MW. Agents for Benekov, Viadrus, Lin-Ka boilers and Edilkamin pellet stoves. Boiler finance available, we are also able to operate as an ESCO

Murray Carter Ltd
Ingerthorpe Hall Farm
Markington
Harrogate
N.Yorks
HG3 3PD
Tel: 01765 677887
Fax: 01765 677898

Supplies planting and harvesting equipment and small scale gasification and pellet burning appliances

Stanegate Stoves and Cookers
The Old Glass Works
Lemington
Newcastle-upon-Tyne
NE15 8SX
Tel: 0191 267 7100
Fax: 0191 267 7811
Web: www.worldofstoves.com

Talbott's Heating Ltd
Drummond Road
Astonfields Industrial Estate
Stafford
Staffordshire
ST16 3HJ
Tel: 01785 213366
Fax: 01785 256418
Email: enquiries@talbotts.co.uk
Web: www.talbotts.co.uk

Established biomass fuelled Energy System Manufacturers. Units available from 25kW to 12MW.

Teisen Products Ltd
Bradley Green
Redditch
Worcestershire
B96 6RP
Tel: 01527 821621
Fax: 01527 821665
Email: peter.teisen@btinternet.com
Web: www.farm2000.co.uk

Production and installation of wood, straw, woodchip and waste fired boilers with capacities up to 300kW, batch loaded and automatically stoked. Also offer advice on design and installation.

Toasty Heating Ltd
Lee Moor Farm
Rennington
Alnwick
Northumberland NE66 3RL
Tel: 01665 577253
Email: ian@toastyheating.co.uk
Web: www.toastyheating.co.uk

Refuell Ltd
The Old Rectory
South Thoresby
Alford
Lincolnshire
LN13 0AS
Tel: 01507 481063
Fax: 01507 480597
Email: Helen@Refuell.co.uk

Supply, installation and maintenance of automatic wood fuelled heating systems from 5kW to 3MW, domestic to industrial scale.

Wood Energy Ltd
Pinkworthy Barn
Oakford
Devon
EX16 9EU
Tel: 01398 351349
Fax: 01398 351115
Email: admin@woodenergyltd.co.uk
Web: www.woodenergyltd.co.uk

Design, installation and service of automatic wood-fired heating systems using wood chip or pellets

9.3 Fuel Suppliers

Coppice Resources Ltd
LS8 Armstrong House
First Avenue
Doncaster Finningley Airport
Doncaster DN9 3GA
Tel: 01302 623220
Fax: 01302 623221
Email: info@coppiceresources.co.uk
Web: www.coppiceresources.co.uk

Commercial growers of SRC as a wood fuel, also equipment suppliers and provide advice on plant design

Forest Enterprise
9 Clifton Moor Business Village
James Nicholson Link
Clifton Moor, York
YO30 4XG
Tel: 01904 696300
Email: alan.corson@forestry.gsi.gov.uk
Web: www.forestry.gov.uk

Able to supply details on fuel supply from the Forestry Commission estate and general information on specifications of fuelwood.

Hadfield Wood Recyclers
Lumm Farm
Lumb Lane, Littlemoss
Droylsden
Manchester
M43 7LB
Contact: Stuart Howarth
Tel: 0161 370 2360
Fax: 0161 371 8181
E-mail : woodbox@hadfield.co.uk
www.hadfield.co.uk

A.W. Jenkinson Forest Products
Clifton Moor
Clifton, Penrith
Cumbria CA10 2EY
Tel: 01931 712644
Fax: 01931 712641
www.awjenkinson.co.uk

Manco Energy Ltd
Market Weighton Road
North Newbald
East Yorkshire
YO43 4SP
Tel: 01430 828660
Fax: 01430 828661
Email: info@mancoenergy.com
Web: www.mancoenergy.co.uk

Can supply a range of biomass fuels such as round wood, wood chips, 8 and 6mm wood pellets. Biomass supply chain services; with access to a high output Jenz 560 wood chipper, capable of meeting all wood chip standards; fuel transport and fuel storage.

Refuell Ltd
The Old Rectory
South Thoresby
Alford
Lincolnshire
LN13 0AS
Tel: 01507 481063
Fax: 01507 480597
Email: Helen@Refuell.co.uk

Suppliers of wood chip and pelleted fuels.

Renewable Energy from Agriculture
Cote Nook Farm
Sedgefield
Stockton-on-Tees
TS21 3HL
Tel: 01740 623300
Fax: 01740 621100
Email: admin@refa.org.uk
Web: www.refa.org.uk

A farmer controlled business growing and promoting energy crops in the UK.

Renewable Energy Growers Ltd
Unit 2, Market Weighton Business Centre
Becklands Park, York Road
Market Weighton
East Yorkshire YO43 3GL
Tel: 01430 871888
Fax: 01430 873888
Email: info@energycrop.co.uk
Web: www.energycrop.co.uk

A not-for-profit organisation representing energy crop growers across the UK. Assistant with grant applications, planting, agronomy, harvesting, and marketing fuel to end-users.

9.3.1 For assistance sourcing fuel:

Renewable Fuels Ltd
The Hackings
The Menagerie
Escrick
York YO19 6ET
Contact: Robert Smith
Tel: 01904 720575
Fax: 01904 720578
Email: info@renewablefuels.co.uk
Web: www.renewablefuels.co.uk

Provides a wide range of biomass fuel, interfacing with energy producers and primary fuel producers

South Yorkshire Forest Partnership
4 Park Square
Newton Chambers Road
Chapeltown, Sheffield
S35 2PH
Tel: 0114 2571199
Fax: 0114 2463346
Email: team@syforest.co.uk
Web: www.syforest.co.uk

Involved in forest regeneration across South Yorkshire. Offer a brokerage service, putting you in touch with suppliers of wood fuel and boilers as well as having some funds to assist eligible projects in the South Yorkshire area.

White Rose Forest
c/o Kirklees Countryside Unit
Kirklees Culture & Leisure Services
Stadium Business Complex, Stadium Way
Huddersfield, West Yorkshire
HD1 6PG
Tel: 01484 234079
Fax: 01484 234099
Email: guy.thompson@kirklees.gov.uk
Web: www.kirkleesmc.gov.uk

West Yorkshire-wide urban forestry initiative. Assistance towards tree planting and woodland management.

Yorwoods
Unit 9
Sycamore Business Park
Dishforth Road
Copt Hewick
Ripon
North Yorkshire
HG4 5DF
Tel: 01765 609355
Fax: 01765 607616
Email: info@yorwoods.org.uk
Web: www.yorwoods.org.uk

Working with all parts of the forest industry to improve sustainability in Yorkshire and the Humber region

Forestry Commission – Technical Development Branch
Rydal House
Rugeley
Staffordshire
WS15 3HF
Tel: 01889 586844
Email: andy.hall@forestry.gsi.gov.uk
Support the technical aspects of biomass harvesting and heat generation.

9.4 General Information

Combined Heat and Power Association
Grosvenor Gardens House
35/37 Grosvenor Gardens
London
SW1W 0BS
Tel: 0207 8284077
Fax: 0207 8280310
Email: info@chpa.co.uk
Web: www.chpa.co.uk

Defra – Energy Crops Section
Rural Development Service
Electra Way
Crewe
CW1 6GL
Tel: 01270 754000
Fax: 01270 754088
Email: organic-energy@defra.gsi.gov.uk
Web: www.defra.gov.uk

National Non-Food Crops Centre
Biocentre
Innovation Way
York Science Park
Heslington
York YO10 5DG
Tel: 01904 435182
Fax: 01904 435345
Email: enquiries@nnfcc.co.uk
Web: www.nnfcc.co.uk

Renewable Power Association
2nd Floor
17 Waterloo Place
London SW1Y YAR
Tel: 020 7747 1830
Fax: 020 7925 2715
Email: info@r-p-a.co.uk
Web: www.r-p-a.co.uk

9.5 Regional – Yorkshire & Humber

Defra - Rural Development Service
Government Buildings
Otley Road
Lawnswood
Leeds
LS16 5QT
Tel: 0113 230 3750
Fax: 0113 230 3790
General email: enquiries.yorkshumber@defra.gsi.gov.uk

Forestry Commission -
Yorkshire & the Humber Conservancy
Wheldrake Lane
Crockey Hill
York
YO19 4FF
Contact: Crispin Thorn
Tel: 01904 448778
Fax: 01904 448110
Email: fc.yath.cons@forestry.gsi.gov.uk
Web: www.forestry.gov.uk

Encourage the use of wood and other resources for renewable energy production in order to contribute to the Government's renewable energy targets, support sustainable woodland management and to contribute to rural development.

Future Energy Company (Yorkshire)
c/o Yorkshire Forward
Victoria House
Victoria Place
Leeds
LS11 5AE
Tel: 0113 3949600
Fax: 0113 2431088
Email: neil.hurford@yorkshire-forward.co.uk

Targeted at driving forward the commercialisation and delivery of sustainable energy.

Government Office for Yorkshire & the Humber
PO Box 213
City House
New Station Street
Leeds LS1 4US
Contact: Les Saunders
Tel: 0113 2835372
Fax: 0113 2836394
Email: les.saunders@goyh.gsi.gov.uk
Web: www.goyh.gov.uk

Yorkshire Forward
Victoria House
Victoria Place
Leeds LS11 5AE
Contact: Stephen Brown
Tel: 0113 3949881
Fax: 0113 2431088
Email: stephen.brown@yorkshire-forward.com
Web: www.yorkshire-forward.com

Yorkshire & Humber Assembly
18 King Street
Wakefield
West Yorkshire
WF1 2SQ
Contact: Sian Ferguson
Tel: 01924 331555
Fax: 01924 331559
Email: sian.ferguson@yhassembly.gov.uk
Web: www.yhassembly.gov.uk

Yorkshire Renewable Energy Network
Hebble End Mill
Hebble End
Hebden Bridge
West Yorkshire
HX7 6HJ
Tel: 01422 846648
Email: info@yren.org.uk
Web: www.yren.org.uk

9.6 Regional - North East

Biomass Implementation Group (BIG)
Environmental Industries Federation
Newburn Enterprise Centre
High Street, Newburn
Newcastle upon Tyne NE15 8LN,
Tel 0191 229 1824
Fax 0191 229 1825
Email: biomass@eif.org.uk
Web: www.eif.org.uk

BIG consists of those from both the business and the public sector with a common goal of helping the North East exploit the significant opportunities that biomass offers. Provides general advice on biomass support and services in the North East.

Defra - Rural Development Service
The Quadrant
Newburn Riverside
Newcastle upon Tyne NE15 8NZ
Tel: 0191 229 5500
Fax: 0191 229 5508
Email: enquiries.northeast@defra.gsi.gov.uk
Web: www.defra.gov.uk/rds/ne/

Foresty Commission
North East England Conservancy
1 Walby Hill
Rothbury, Morpeth
Northumberland NE65 7NT
Tel 01669 621591
Fax 01669 621454
Email: northeast.fce@forestry.gsi.gov.uk

Government Office for the North East
Citygate
Gallowgate
Newcastle NE1 4WH
Contact: Will Adams
Tel: 0191 202 3612
Fax: 0191 202 3738
Email: energynortheast@gone.gsi.gov.uk
Web: www.go-ne.gov.uk

North East Assembly
The Guildhall
Quayside
Newcastle upon Tyne NE1 3AF
Tel: 0191 261 7388
Fax: 0191 232 4558
Email: enquire@rane.gov.uk
Web: www.northeastassembly.gov.uk

North East Community Forests
Renewable Energy and Recycling Project
Stewart Park, The Grove
Marton
Middlesbrough TS7 8AR
Tel. 01642 835409
Email: jonathan.scurlock@necf.org.uk
Web: www.necf.org.uk

Facilitating the development of wood and other biomass fuels as a source of renewable energy, helping to meet regional targets for sustainable energy as well as waste management, recycling and forestry policy, and the greening of derelict land.

Northwoods
1 Walby Hill
Rothbury
Morpeth NE65 7NT
Tel. 01669 621489
Fax 01669 621522
Email: neil@northwoods.org.uk
Web: www.northwoods.org.uk/

We are the North East's Woodland Initiative, working closely with woodland owners, managers and those who work with wood and timber. We are developing wood fuel supply chains through the establishment of a fuel supply co-operative (NEWFuels), as well as providing practical training, business assistance and pre-feasability advice.

One NorthEast
Stella House
GoldCrest Way
Newburn Riverside
Newcastle upon Tyne NE15 8NY
Tel: 0191 229 6200
Fax: 0191 229 6201
Web: www.onenortheast.co.uk

REALL
Earth Balance
West Sleekburn Farm
Bomarsund
Bedlington
Northumberland NE22 7AD
Tel. 01670 823706
Email: reall@ccn.org.uk
Web: www.ccn-reall.fsnet.co.uk/

REALL (Renewable Energy at Local Level) is a partnership of community organisations, local authorities, businesses, agencies and other bodies which seek to promote the development and awareness of renewable energy initiatives by local groups in the rural areas of Northumberland and Durham.

9.7 Regional - North West

Forestry Commission
Peil Wyke
Bassenthwaite Lake
Cockermouth
CA13 9YH
Tel: 01768 76616
Fax: 01768 776557

North West Development Agency
Giant Basin
Potato Wharf
Castlefield
Manchester M3 4BN
Contact: Joe Flanagan
Tel: 0161 817 7424
Email: Joe.Flanagan@nwda.co.uk

North West Regional Assembly
Wigan Investment Centre
Waterside Drive
Wigan
WN3 5BA
Tel: 01942 737916

Government Office for the North West
Cunard Building
Water Street
Liverpool
L3 1QB
Contact: Helen Sweeney
Tel: 0151 224 6465
Email: Helen.sweeney@gonw.gsi.gov.uk

For assistance sourcing fuel:

Community Forests North West
Community Forest Centre
Dock Office
Trafford Road
Salford Quays
M50 3XB
Contact: Nigel Blandford
Tel: 0161 872 1660
Fax: 0161 872 1680
Email: nigel@redroseforest.co.uk
www.redroseforest.co.uk/woodland.html

Cumbria Woodlands
Lower Mill House
Staveley Mill Yard
Staveley, Kendal
Cumbria
LA8 9LS
Contact: Edward Mills/Neville Elstone
Tel: 01539 822140
Fax: 01539 822443
Email: info@cumbriawoodlands.co.uk
www.cumbriawoodlands.co.uk

Lancashire Woodland Project
Lancashire County Council
Environment Directorate
PO Box 9
Guild House, Preston
Lancashire PR1 8RD
Contact: Paul Bullimore
Tel: 01772 533917
Email: paul.bullimore@env.lancscc.gov.uk
Web: www.chpa.co.uk

Defra
Rural Development Service
Electra Way
Crewe
CW1 6GL
Tel: 01270 754000
Fax: 01270 754088
Email: enquiries.northwest@defra.gsi.gov.uk

Chapter 10 – References and useful websites

10.1 References List

Billins, P. 2004. What is Biomass? Where is it Going? British Biogen. 13-2-0004.
Ref Type: Conference Proceeding

Brassoud, J., Schroeter, C., Asplund, D., Planck, J., and Corthay, A. 2003. Consolidation of the Technical Review for the European Wood Fuel Industry.
Ref Type: Report

Butler, N. A. and Mortimer, N. D. 2003. Conisborough and Denaby Community Energy Project: Feasibility Studies of Wood-Fired Schemes. 24/1. Sheffield Hallam University.
Ref Type: Report

Carter, D. 2004. Perspectives of bio-energy. RDS Defra. 13-2-2004.
Ref Type: Conference Proceeding

CHPA. 2004. Support and Funding for CHP.
Ref Type: Data File

Cox, A. 2003. Low Carbon Heating with wood pellet fuel.

Defra. 2002. Bio-Energy: A growing energy supply. London, Defra. Available from: http://www.defra.gov.uk
Ref Type: Report

Defra. 2003. Bio-Energy Infrastructure Scheme. London, Defra. Available from: http://www.defra.gov.uk/acu/energy.htm
Ref Type: Report

Defra. 2003. Guidelines for Company Reporting on Greenhouse Gas Emissions. Annex 1 – Fuel Conversion Factors: Available from: http://www.defra.gov.uk/environment/envrp/gas/05.htm
Ref Type: Report.

Department of Trade and Industry. 2004. New & Renewable Energy: Prospects for the 21st Century - The Renewables Obligation Preliminary Consultation. London, Department of Trade and Industry.
Ref Type: Report

Department of Trade and Industry. 2003. Global Watch Mission Report. Energy from Biomass – a mission to Austria and Denmark. London, DTI. Available from: http://www.britishbiogen.co.uk/Downloads/biomissrep.pdf
Ref Type: Report

Elsayed, M. A. and Mortimer, N. D. 2001. Carbon and Energy Modelling of Biomass Systems: Conversion Plant and Data Updates. Sheffield Hallam University.
Ref Type: Report

Elsayed, M. A., Mortimer, N. D., and Mortimer, N. D. 2003. Carbon and Energy Balances for a Range of Biofuels Options. Sheffield Hallam University, Resources Research Unit.
Ref Type: Report

Energy Saving Trust. 2003. Financing Community Energy Schemes. Energy Saving Trust.
Ref Type: Report

Energy Saving Trust. 2003. Community Energy Development Grant Guidance Notes. EST.
Ref Type: Report

Energy Saving Trust. 2003. Energy Services. EST.
Ref Type: Conference Proceeding

Energy Saving Trust. 2003. Community Energy: An Introduction. EST.
Ref Type: Conference Proceeding

Energy Saving Trust. 2003. Applying for a Capital Grant. EST.
Ref Type: Conference Proceeding

Integrated Resources Management. 2004. Biomass-to-Energy 2004 – North Lincolnshire. 13-02-2004 Available from: http://www.i-r-m.co.uk/february13/abstract/index.html
Ref Type: Conference Proceeding

Mortimer, N. D. 2002. Managing Intermittent Loads in District Heating by Energy Assessment Tools: Mildheat Project. Sheffield Hallam University.
Ref Type: Report

National Energy Foundation. 2004. Innovations in Wood Heating – Flimwell, East Sussex 23-1-2004. Available from: http://www.greenenergy.org.uk/logpile/conference.htm
Ref Type: Conference Proceeding

Rippengal, R. 2004. Wood Heating - an Introduction. Econergy. 13-2-2004.
Ref Type: Conference Proceeding

Strawson, J. 2004. Energy Crops in the UK and Lessons from Abroad. Renewable Energy Growers Ltd. 13-2-2004.
Ref Type: Conference Proceeding

Sustainable Development Commission (Scotland). 2005. Wood fuel for warmth.
Ref Type: Report

Wiltshire, R. 2003. The UK Potential for Community Heating with Combined Heat & Power. Building Research Establishment.
Ref Type: Report.

10.2 Useful Websites

Biomass – All you need to know
http://woodfuelwales.org.uk/biomass/

Biomass Task Force Study
http://www.defra.gov.uk/farm/acu/energy/biomass-taskforce/

Clear Skies – Renewable Energy Grants
http://www.clear-skies.org/

Defra – Bio-Energy
http://www.defra.gov.uk/farm/acu/energy/energy.htm

DTI – Renewable Energy
http://www.dti.gov.uk/renewables/

Econergy
http://www.econergy.ltd.uk/

Energy Saving Trust
http://www.est.org.uk/

Forest Research – Measurement and modelling of SRC
http://www.forestry.gov.uk/srcsite/HCOU-5JENMU

Forest Research: Woodfuel Resource
http://www.woodfuelresource.org.uk/

Planning Policy Statement 22
http://www.odpm.gov.uk/planning

Renewable Energy Programme Publications
http://test.netgates.co.uk/nre/pdf.html

Renewable Fuels Ltd
http://www.logg.co.uk

Renewable Power Association
http://www.r-p-a.org.uk

The Log Pile Project – Wood Pellets
http://www.nef.org.uk/logpile/

Yorkshire Renewable Energy Network
http://www.yren.org.uk/

10.3 List of Abbreviations

3 T's – Time, Turbulence and Temperature

BMBC – Barnsley Metropolitan Borough Council

CHP – Combined Heat and Power

DEFRA – Department for the Environment Food and Rural Affairs

DTI – Department of Trade and Industry

ERDP – England Rural Development Programme

GW Giga watt (10^9 Watts)

kW – Kilowatts (10^3 watts)

MW – Megawatts (10^6 watts)

ODT – Oven Dried Tonne (Wood at 0% moisture)

SME's – Small- or Medium-Sized Enterprises

SRC – Short Rotation Coppice

TW – Terawatts (10^{12} watts)

Wh – Watt hour

EMS – Energy Management System

MC – moisture content

10.4. Assumptions for Calculations

10.4.1 CO_2 emissions from different fuel types

The fossil fuel figures in first table are from Defra 2003.Guidelines for Company Reporting on Greenhouse Gas Emissions. The biomass figure is an estimate of CO_2 used in harvest and transport of the wood.

10.4.2 Estimates of cost and CO_2 emission savings

Capital costs are derived from capital costs quoted in "Costs of wood fuel heating" and experience in Barnsley http://woodfuelwales.org.uk/biomass/". Capital cost per kWh is calculated assuming delivery, over a 25 year lifetime, of 41,000 kWh per kW boiler capacity (based on average of figures from the Worcestershire County Hall experience - 1.15 GWh pa from a 700 kW boiler)

Fuel costs are calculated using the average of the range for each fuel quoted in "Costs of wood fuel heating" http://woodfuelwales.org.uk/biomass/ Coal costs based on local experience in Yorkshire.

No costs for maintenance, financing charges or breakdown costs are included, nor are the effects of the climate change levy or the potential for grants to cover installation of wood-fuelled systems.

CO_2 emissions saved per kWh using wood are calculated relative to coal fuel (0.3kg CO_2/kWh, based on Defra guidelines, see 10.4.1). Although these guidelines suggest renewable energy should have a zero conversion rate, a figure of 0.025 has been used (see 10.4.1).

The cost saving made for each kgCO_2 that is saved is calculated according to the following formula:

$$\text{Cost saved/kg}CO_2\text{ saved} = \frac{[(\text{kg}CO_2\text{/kWh})_{coal} - (\text{kg}CO_2\text{/kWh})_{wood}]}{[(\text{cost/kWh})_{coal} - (\text{cost/kWh})_{wood}]}$$

10.4.3 Estimates of security of fuel supply

Potential heat delivery from wood available within Yorkshire and Humberside is calculated assuming a calorific value of 20GJ/ODT and a conversion efficiency of 85%. The area of building potentially heated is based on Worcestershire County hall experience (92kWh/m^2 annually). The CO_2 savings are calculated relative to coal as in 10.4.2. Waste wood estimates are from WRAP Wood Market Study.

This booklet was prepared by the National Non-Food Crops Centre.

Government Office Yorkshire and Humberside, Framework for Change, Government Office for the North West, Government Office for the North East and the Forestry Commission sponsored its creation.

Authors: Lucy Hodsman
Maggie Smallwood
Cover design: Jim Semlyen and Bharat

We would like to express our thanks to the following individuals and organisations for their kind co-operation and assistance; Dick Bradford (Barnsley Borough Council), Robin Ridley (South Yorkshire Forest Partnership), Gareth Gaunt (Renewable Energy Growers Ltd), Robert Rippengal (Econergy), Dr Robin Cotton (Renewable Heat and Power Ltd), Crispin Thorn (Forestry Commission), Steve Dunkley (Framework for Change), Les Saunders (Government Office for Yorkshire and the Humber), Joanne Gilkes (RSPB Oldmoor), Helen Sweeney (Government Office for the North West), Ray Kessler (Government Office for the North West), Jonathan Scurlock (NECF), Chris Maxwell (EIF), Richard Pow (Forestry Commission) and Will Adams (Government Office for the North East).

Forestry Commission England

framework for change

energy Energy North East

one North East

NNFCC

For further information please contact:

The National Non-Food Crops Centre
Biocentre
York Science Park
Innovation Way
Heslington
York
YO10 5DG

Tel: 01904 435182
Fax: 01904 435345

enquiries@nnfcc.co.uk
http://www.nnfcc.co.uk