

## Wood fuel heating for public buildings



### practical advice on

- planning issues
- fuelling options
- boiler systems
- 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<sub>2</sub>. 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 approached the National Non-Food Crops Centre in January 2004 with a proposal to prepare practical advice on implementation of wood-based heating systems. With the help of many local consultants, businesses and individuals within local and regional government, as well as the sponsorship of Government Office and the Forestry Commission, we have put together this booklet. We hope it will prove a useful tool for anyone who is interested in practical means to achieve more sustainable buildings.

Jeremy Tomkinson  
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### Who is this for?

This booklet has been produced to show the potential for generating heat from wood fuelled systems in the 21<sup>st</sup> century. If you are involved in the planning of new public 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.

# Contents

CONTENTS		1
CHAPTER 1	- INTRODUCTION	2
CHAPTER 2	- FUELLING OPTIONS	4
CHAPTER 3	- TECHNOLOGY OVERVIEW	7
CHAPTER 4	- COSTS	9
CHAPTER 5	- CONTRACT OPTIONS	10
CHAPTER 6	- PLANNING AND REGULATORY ISSUES	12
CHAPTER 7	- CASE STUDIES	14
CHAPTER 8	- GRANTS FOR WOOD FUELLED HEATING	18
CHAPTER 9	- USEFUL CONTACTS	21
CHAPTER 10	- REFERENCES AND USEFUL WEBSITES	26

# Benefits of wood-fuelled heating

## Reduces

- CO<sub>2</sub> 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 through using waste wood



## 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



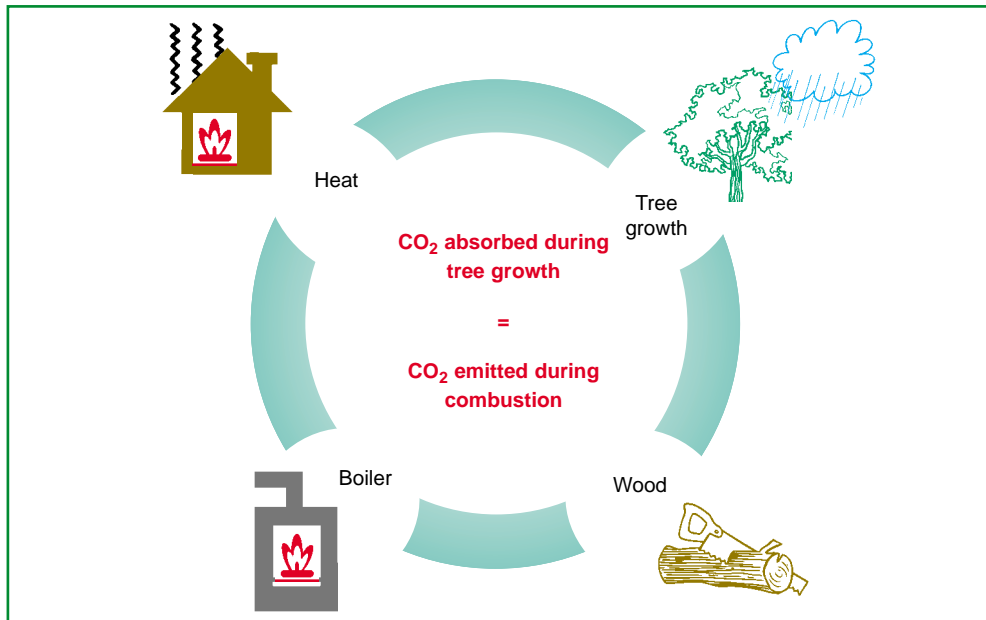
# Chapter 1 – Introduction

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

The CO<sub>2</sub> 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<sub>2</sub> generated during planting, harvest, processing and transport of the wood, replacement of fossil fuel with wood fuel will typically reduce net CO<sub>2</sub> emissions by over 90%, assuming that the wood supply is managed sustainably.

Typical CO <sub>2</sub> emissions from different fuels	
Fuel Type	Kg CO <sub>2</sub> 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



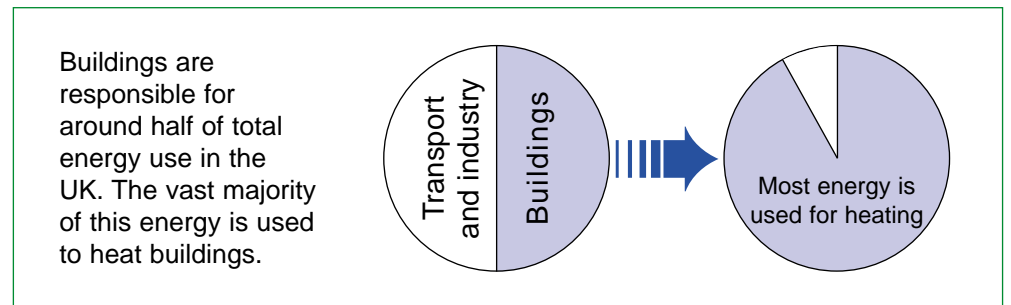
## 1.1 The Global Picture

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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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.



Wood chip fired heating could be widely used for public buildings with heating requirements of 30kW and above. 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<sub>2</sub> 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<sub>2</sub> 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. Typically these authorities are attempting to reduce their greenhouse gas emissions by 15% of 1990 levels by 2006.

Many authorities within the Yorkshire and Humber Region 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?

## The Barnsley experience

41% of Barnsley Metropolitan Borough Council's heat energy still comes from solid fuel. Conversion to biomass heating would reduce this significant source of greenhouse gas emissions to almost zero.

To put this in context, Barnsley needs to reduce CO<sub>2</sub> emissions by a further 20,000 tonnes in order to meet Government's long term targets. By replacing coal-fuelled systems with wood-fuelled heating, 8,000 tonnes of coal can be saved within the authority and the targets for 2050 can be met nearly half a century early.

Studies on a Public Building reveal that, over time, the fuel cost for a 'Wood Chip' boiler has cost profile some 60% that of gas (based on present day prices).

## 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 chips are suited to 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.



Wood chip derived from forestry co-products

#### 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 biodiversity.



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 Reclaimed timber, pallets and sawmill residues

Clean wood waste i.e. untreated reclaimed timber from demolition sites, waste pallets and wood industry by-products can be used as fuel. Many waste recycling/disposal companies now separate out this material prior to waste going to landfill. Making contact with a local recycling/disposal company will indicate the kinds of volume of suitable material that they produce each year. Sawmill by products such as “slab wood off cuts” can be readily converted into wood chip.



Wood waste from demolition sites

#### The “closed cycle”

Waste timber 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 wood waste 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 waste 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, two other wood fuels are commonly used for heating, wood pellets and logs. Wood pellets are mainly produced from untreated wood waste such as sawdust, pulverised pallets or reclaimed timber.

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.

A guide to wood pellet heating is available at [www.xco2.com](http://www.xco2.com)

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 pellets



Logs

## 2.3 Security of fuel supply

There is an abundant supply of wood based material available in the Yorkshire and Humberside region which could be used as fuel.

### 2.3.1 Forestry and SRC

A study was recently undertaken by Forest Research to establish the current resource of wood fuel from traditional forest products, arboricultural thinnings, sawmill residues and energy crops. This estimated that there are approximately 331,000 oven dried tonnes (ODT) of wood fuel available within Yorkshire and Humberside. Around 220,000 tonnes already has a market, but the remaining 110,000 tonnes could potentially be used as wood chip fuel. This could produce over 500 million kWh of heat annually.\* In practical terms this could heat some 4.6 million m<sup>2</sup> of public space or over 320 buildings the size of Worcestershire County Hall, and avoid 140,000 tonnes of CO<sub>2</sub> 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 Waste wood

Further to the supply identified above, the waste wood resource is substantial: 1 - 1.5 million tonnes per year in England in the municipal waste stream alone. For instance, the tonnage of waste 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 (62 County Halls) and displace 27,000 tonnes of CO<sub>2</sub> emissions\*.

\* 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 (see case study 1).

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?
- What happens to waste wood within your 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.



An underfeed stoker

Properties of available combustion systems				
	Inclined grate	Ram-feed stoker	Underfeed stoker	Pre-combustor
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

Hook lift bins



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

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.

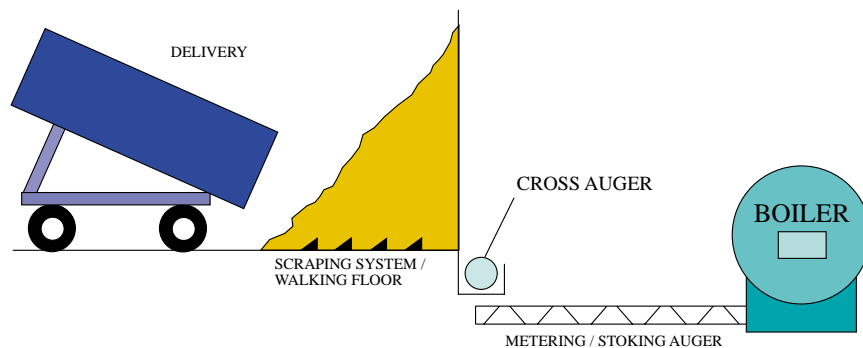


Table illustrating typical volumes needed to feed different sizes of boiler

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

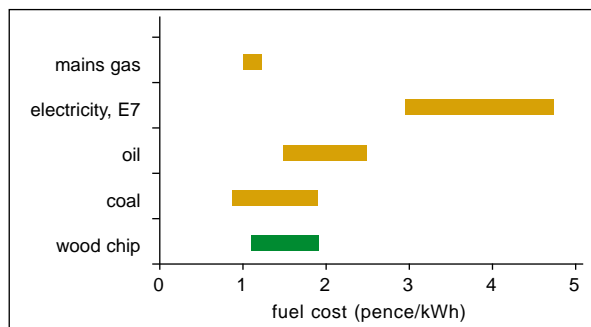
Wood-chip fired heating systems of less than 500kW cost between £180-250 per output kW, but for systems over 500kW, capital costs fall to £150-230 per kW. This covers the core components; the boiler and handling system, flow and return systems and piping. The capital costs of installation of a wood-chip 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.



Bar chart illustrating range of typical prices for different heating fuels.

Wood chip competes favourably with most fossil fuel sources.

### 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 <i>pa</i>

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 <sub>2</sub> (kg CO <sub>2</sub> per kWh)	0.19	0.29	0.28	0.194	0.025
Fuel cost (p /kWh)	0.9 - 1.2	1.5-2.4	1.4-2.4	2.6 – 3.4	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

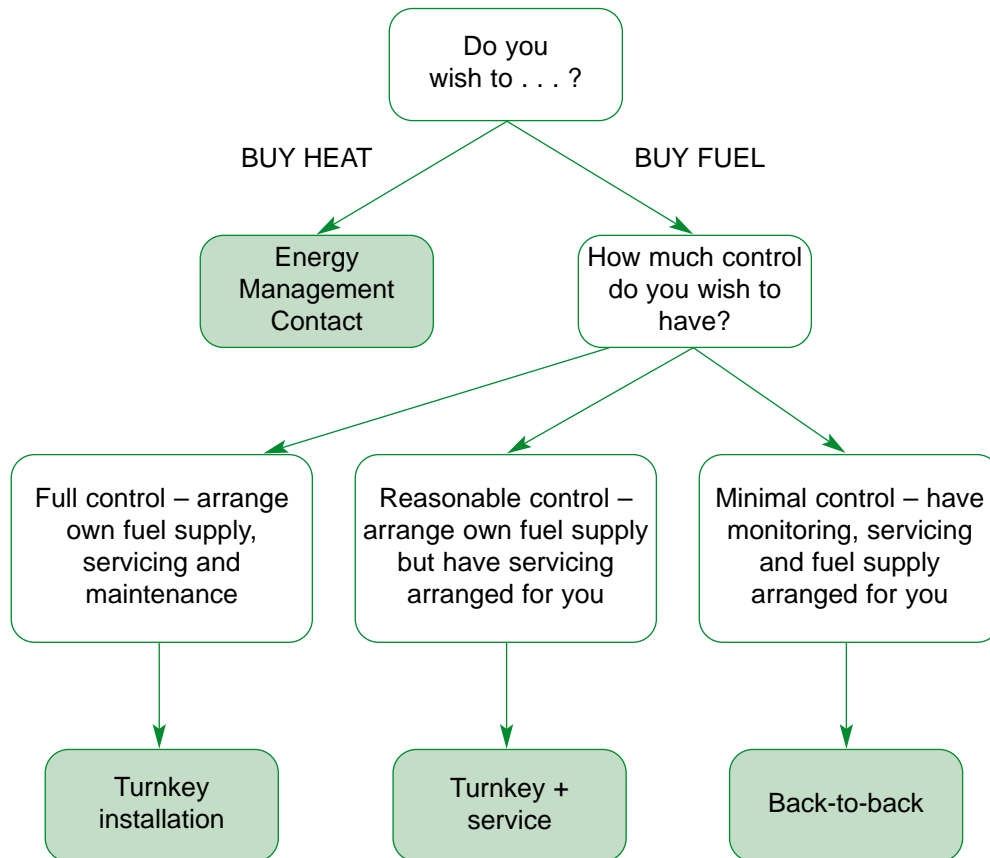
\* See Chapter 10 (10.4.2) for assumptions underlying calculations

### 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

#### 5.1.1 Services:

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 Guidance Note specifically relating to wood fuel (PPG 22: Annex on Woodfuel Biomass Energy) 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 authorisation

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.

### 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

### 7.1 Case Study 1 – RSPB Old Moor Wetland Centre S. Yorks

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 building	m <sup>2</sup>
Size of boiler	100kW
Output <i>pa</i>	to be assessed
CO <sub>2</sub> saved	to be assessed
Fuel (moisture)	Sawmill offcut (25-30%)
Fuel delivery	5m <sup>3</sup> 2 x per week
Technology	Underfeed stoker
Capital cost	£69,000
Grant aid	£34,500
Fuel cost	£4,300 <i>pa</i>

#### 7.1.1 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<sup>3</sup>. 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.

\* See Chapter 10 (10.4.2) for assumptions underlying calculations

#### 7.1.2 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.

#### 7.1.3 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



The KWB boiler system

## 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 1,250m<sup>2</sup>, comprising 700m<sup>2</sup> of office space and 550m<sup>2</sup> 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	1,250m <sup>2</sup>
Size of boiler	150kW
Output <i>pa</i>	300,000kWh
CO <sub>2</sub> saved <i>pa</i> *	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 underlying calculations

### 7.1.4 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.

### 7.1.5 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 underlying calculations

### 7.1.6 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

## 7.3 Case Study 3 – Worcestershire County Hall

In May 2002, Worcestershire County Council's (WCC) County Hall, which was built in the 1970's, installed a renewable heating system, fuelled by locally sourced wood chip. The project is regarded as the first step in developing a home grown energy market and there is hope that this success will stimulate the uptake of the technology across the county. Key rationale behind the decision to convert to 'green fuel' included:

- the opportunity for reduced CO<sub>2</sub> emissions, using the County Hall to lead by example;
- to minimise infrastructure costs and benefit the local economy;
- to optimise management arrangements for the operation of the system.

Key facts	
Size of building	17,400m <sup>2</sup>
Size of boiler	700kW
Output <i>pa</i>	1-1.3 GWh
CO <sub>2</sub> saved <i>pa</i> *	300 tonnes
Fuel	Forestry + SRC
Fuel delivery	35m <sup>3</sup> 2 x per week
Capital cost	£150,000
Grant aid	0

\* See Chapter 10 (10.4.2) for assumptions underlying calculations

A 700kW, fully automatic, wood-fuelled boiler was installed which uses 600 tonnes of wood annually supplied from local forestry operations and potentially short rotation coppice grown by local farmers. Sourcing the fuel locally has the benefit of generating additional income and supporting employment within the local economy.

### 7.3.1 Fuel supply – wood chip

Wood chip is sourced from a local farmer supply ring. The fuel is delivered in 35m<sup>3</sup> 'hook-lift' containers with an internal discharge mechanism so that fuel reception, storage and handling are integrated into a containerised system. The containers are delivered full of fuel onto permanent stands no more than twice each week, avoiding the need for tipping or underground bunkers. They automatically discharge onto a transfer screw and from there to the stoking auger and onto the grate.

#### Solutions to problems

- Planners insisted fuel containers must be screened by brick walling and steel gates.
- Local residents were concerned that pollution and additional traffic problems would arise from the installation, however no complaints have been received since the system began operation.

### 7.3.2 Technology

A Compte Compact C70DHV boiler was installed to provide base-load heating throughout the autumn, winter and spring for the entire 17,091m<sup>2</sup> of the County Hall and 275m<sup>2</sup> of the adjacent records office. Ash is automatically extracted from the system into 1,100 litre steel ash bins, ash can then either be emptied by a waste disposal contractor or spread on local land as a fertiliser.

### 7.3.2 Costs and contract options

The cost of the installation was around £150,000, comprising £130,000 for the boiler and fuel handling system and a further £20,000 to cover construction and other costs. In effect the fully functional installation cost £214 per kW

The heating system is owned, monitored and maintained by Eenergy, however on-site staff manage the day-to-day running of the plant. The fuel is supplied from sustainably managed local resources under a 10-year ecoheat renewable energy supply contract. Renewable heat is metered and sold to the WCC at a competitive tariff.

The boiler plant delivers between 1-1.3 million kWh/year of renewable heat to the building, displacing some 550 tonnes of CO<sub>2</sub> emissions each year. Currently the heat-demand of the building is approximately 1,600 MWh/yr; the heating regime has been modified to make maximum use of the wood-fired boiler with the aim to provide 75 per cent of the total heat load from this source.



The Compte Compact C70 DHV Boiler

## 7.4 Case Study 4 – Kirk Balk Secondary School (Wood Pellet Trial)

In 1996 new coal fired boilers were installed at this site replacing old sectional cast iron boilers dating from the early 1960's.

During 1998 the underfeed stokers on two of the three Hartley and Sugden Supercolifax boilers (each rated at 732 kW) were converted to fully modulating utilising EMS Technology. The control panels for the boilers were revamped to include small TREND Outstations configured, programmed and commissioned by Barnsley Councils' expert engineering staff.

The results far exceeded all expectations. No longer were 'clinkers' formed within the boilers; indeed the fuel was reduced to a fine powdered ash (such had never previously been experienced on any BMBC solid fuel fired site all of which use high swelling coal).

Combustion efficiency was raised to a staggering 86% - better even than a high efficiency gas boiler.

Based on this previous level of success Kirk Balk School was the obvious candidate to trial wood fuel in any form.

### 7.4.1 Fuel supply – wood chip

Initially a 12mm diameter hardwood chip was identified to trial. The initial pneumatic delivery of 6 tonnes suffered a high degree of degradation through the delivery system such that the material finally deposited was about 70% dust. However it was still possible to burn it at 90% efficiency!

A small quantity of screened wood chip was then tested to test if the feed worm could deal with it – it did opening up other prospects for a future time.

The second delivery of 5 tonne of 6mm softwood pellet was delivered without any detectable degradation and combusted well producing similar efficiencies.



The converted boilers at Kirk Balk School

### 7.4.2 Costs

Currently wood pellet is the most expensive form of wood fuel. The current trial is based on a delivered rate of £106 / tonne which equates to £176 / tonne heat equivalent compared to coal at around £70 / tonne. However there are other advantages which mitigate this cost to a significant degree.

Key facts	
Size of building	10,700m <sup>2</sup>
Size of boiler	732kW
Output <i>pa</i>	1,720 MWh
CO <sub>2</sub> saved <i>pa</i> *	473 tonnes (potential)
Fuel (moisture)	Pellet (10-15%)
Fuel delivery	Pneumatic
Capital cost	nil
Grant aid	Fuel cost subsidy
Fuel cost	£106/Tonne

\* See Chapter 10 (10.4.2) for assumptions underlying calculations

### Advantages

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



Kirk Balk School

## 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.

### 8.1 Implementation

ClearSkies Renewable Energy Grants – Household

Details:

Encourage householders to realise the benefits of renewable energy by aiding the installation of renewable energy sources.

Scale of funding:

£50 per kWth installed, Installations larger than 30 kWth are allowable but capacity above that level will not incur a grant.

£500 – 5000, dependant on the technology installed

Application process:

Application form (5 pages) requires 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 lodges the grant 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](mailto:info@clear-skies.org)  
Web: <http://www.clear-skies.org>

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ClearSkies Renewable Energy Grants – Schools and Communities

Details:

Encourage communities to realise the benefits of renewable energy by aiding the installation of renewable energy sources.

Scale of funding:

50% or £100,000, the lower rate is paid regardless of technology used

Application process:

The ten page application form requires the following information; applicant details, finance and agent details, match funding and income generation, installation and installers details, system details, grant requested, quotation, compliance and scheme concepts and designs. Applications are assessed quarterly by the Selection Panel, if successful the Grant must be claimed with 24 months of the application letter

Contact details:

Clear Skies  
BRE Ltd, Building 17, Garston, Watford, WD25 9XX  
Tel: 08702 430930  
Email: [info@clear-skies.org](mailto:info@clear-skies.org)  
Web: <http://www.clear-skies.org>

Community Energy Programme – Development Grants

Details:

Development grants are awarded to assess whether community or district heating is the right option for your housing or business stock. Financial assistance is offered for feasibility studies etc

Scale of funding:

Up to 50% funding to help develop a community heating system

Application process:

For information on bidding rounds and deadlines please refer to the website below. Decisions can be expected within 7 weeks for projects up to £24,999 or six weeks after the close of the bidding round for larger projects

Contact details:

Energy Saving Trust  
21 Dartmouth Street, London, SW1H 9BP  
Tel: 0870 850 6085  
Email: [communityenergy@est.co.uk](mailto:communityenergy@est.co.uk)  
Web: <http://www.est.co.uk/communityenergy/aboutenergy/>

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Community Energy Programme – Capital Grants

Details:

Capital grants are awarded for installation, extension or refurbishment of current systems

Scale of funding:

Up to 40% funding is provided for implementing your community heating system

Application process:

For information on bidding rounds and deadlines please refer to the website below. Applications will then be assessed by the Advisory panel who meet quarterly

Contact details:

Energy Saving Trust  
21 Dartmouth Street, London, SW1H 9BP  
Tel: 0870 850 6085  
Email: [communityenergy@est.co.uk](mailto:communityenergy@est.co.uk)  
Web: <http://www.est.co.uk/communityenergy/aboutenergy/>

Action Energy Loan

Details:

Available for SME's 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:

Application form (3 pages) requires applicant details, project details, details of equipment and installation costs, energy saving assessment and borrowing profile

Contact details:

Action Energy  
c/o The Carbon Trust, 9<sup>th</sup> Floor, 3 Clement's Inn, London, WC2A 2AZ  
Tel: 0800 58 57 94  
Web: <http://www.actionenergyloans.org.uk/>

Bio-energy Capital Grants Scheme – Offshore Wind, Energy Crops, Community and Household and Biomass Heat/CHP

Details:

Although the scheme has now closed, funding is available from delegated organisations for the development of energy crops and stimulation of early deployment of biomass fuelled heat and electricity generation projects. Grants are awarded towards the cost of equipment in complete installations

Scale of funding:

Applicants must bid for the minimum grant that will enable their project to proceed; the grant can not exceed 40% of eligible costs

Application process:

Funding must be contractually committed within three years and spent by March 2010

Contact details:

Bioenergy Capital Grants  
DTI Sustainable Energy Policy Unit, Room 1138, 1 Victoria Street, London, SW1H 0ET  
Web: <http://www.dti.gov.uk/renew/eoi.htm> or [http://www.dti.gov.uk/renew/form\\_guide.pdf](http://www.dti.gov.uk/renew/form_guide.pdf)

Bio-energy Infrastructure Scheme

Details:

Will provide grants to farmers, foresters and businesses to help develop the supply chain required to harvest, store, process and supply energy crops and forestry woodfuel to energy end-users

Scale of funding:

A yearly sliding scale from 100% to 60% for producer group admin set-up costs, 40-50% for specialist capital

items and 25-100% for training costs. Actual grant rates will depend on type of biomass and location. Maximum grant ceiling of £200,000 per producer group or business. Grants must be allocated within three years of the start of the scheme.

Application process:

Awaiting approval from EC, hoping for launch in late Summer 2004  
Will be a one-off four month application window starting when scheme is launched. Applicants will complete an application form and provide a business plan. All applications will be assessed competitively against each other, with decisions made within three months of the end of the application window.

Contact details:

Defra  
Crops for Energy Branch, Area 5A, Ergon House, Horseferry Road, London, SW1P 2AL  
Tel: 0207 2385317  
Email: [industrialcrops@defra.gsi.gov.uk](mailto:industrialcrops@defra.gsi.gov.uk)  
Web: <http://www.defra.gov.uk/farm/acu/energy/infrastructure.htm>

Community Renewables Initiative

Details:

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

No direct funding is available. The Community Renewables Initiative is simply available to help you track down suitable funding and assist with applications as appropriate. 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, W. Yorks, HX7 6HJ  
Tel: 0845 3304930  
Email: [info@yren.org.uk](mailto:info@yren.org.uk)

National Enquiry Service, Community Renewables  
Initiative  
Tel: 01242 533260  
Email: [cri@countryside.org.uk](mailto:cri@countryside.org.uk)

### 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](mailto:Innovation.programme@aeat.co.uk)  
Web: [http://www.practicalhelp.org.uk/initiatives/initiative.cfm?initiative\\_id=16](http://www.practicalhelp.org.uk/initiatives/initiative.cfm?initiative_id=16)

## 8.2 Research and Development

### Innovation Programme

#### Details:

Two routes of funding are available through the Energy Saving Trust for feasibility studies and implementation projects that reduce carbon emissions

#### Scale of funding:

Up to 70% of project costs are available to a maximum of £10k, for implementation grants up to 50% of costs are available to a maximum of £90k.

#### Application process:

You will be allocated a key contact who will assist you through the application process and beyond. Fourteen pages of guidance are provided to help you complete the seven page application form, details required include; a general project overview, aims and objectives, action plan and costings. All applications must be accompanied by a 'Letter of Support'

## 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](mailto:enquiries@bio-renewables.co.uk)

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

Hammond Suddards  
2 Park Lane  
Leeds  
LS3 1ES  
Tel: 0870 839 0000  
Email: [enquiries@hammonds.com](mailto:enquiries@hammonds.com)  
Web: [www.hammondsuddardsedge.com](http://www.hammondsuddardsedge.com)

A leading European law firm committed to the local market, provide a non-nonsense business approach to achieve their client's commercial objectives

Econergy  
69 Hampton Park  
Bristol  
BS6 6LQ  
Contact: Robert Rippengal  
Tel: 0870 054 5554  
Fax: 0870 054 5553  
Email: [heat@econergy.ltd.uk](mailto:heat@econergy.ltd.uk)  
Web: [www.econergy.ltd.uk](http://www.econergy.ltd.uk)

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

ESD Ltd  
Overmoor  
Nelson  
Corsham  
Wiltshire  
SN13 9TZ  
Contact: John Malone  
Tel: 01225 816642  
Web: [www.esd.co.uk](http://www.esd.co.uk)

Undertake feasibility and project management work regarding biomass

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](mailto:gallantinec@pbworld.com)  
Web: <http://www.pbworld.com/power>

Cover all renewable energy advisory requirements

Renewable Fuels Ltd  
The Harrop's  
The Menagerie  
Escrick  
York  
YO19 6ET  
Contact: Robert Smith  
Tel: 01904 720575  
Fax: 01904 720578  
Email: [bob.smith@logg.co.uk](mailto:bob.smith@logg.co.uk)  
Web: [www.logg.co.uk](http://www.logg.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  
Contact: Dr Robin Cotton  
Tel: 01398 351166  
Fax: 01398 351115  
Email: [robin@rhpl.co.uk](mailto:robin@rhpl.co.uk)  
Web: [www.rhpl.co.uk](http://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

Wilbraham & Co  
 Minerva House  
 East Parade  
 Leeds  
 LS1 5PS  
 Tel: 0113 243220  
 Fax: 0113 244 9777  
 Email: [Wilbraham@wilbraham.co.uk](mailto:Wilbraham@wilbraham.co.uk)  
 Web: [www.wilbraham.co.uk](http://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](mailto:thepartners@wrigleys.co.uk)  
 Web: <http://www.wrigleys.co.uk>

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

## 9.2 Equipment Suppliers

3G Energi  
 Allesudden, Charlesfield  
 St. Boswells, Melrose  
 TD6 0HH  
 Contact: Gavin Gulliver-Goodall  
 Tel: 01835 824201  
 Fax: 0870 8314098  
 Email: [gavin@3genergi.co.uk](mailto:gavin@3genergi.co.uk)  
 Web: [www.3genergi.co.uk](http://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.

Alstom Power  
 PO Box 1  
 Waterside South  
 Lincoln  
 LN5 7FD  
 Tel: 01522 584164  
 Web: <http://www.power.alstom.com>  
 Suppliers of a vast range of boiler systems

Bioflame Engineering  
 Manor Farm  
 Levisham  
 Pickering  
 North Yorkshire  
 YO18 7JN  
 Contact: Victor Buchanan  
 Tel: 01653 668223  
 Fax: 01653 666356  
 Web: [www.bioflame.com](http://www.bioflame.com)  
 Manufacturer of biomass burners

Dragon Energy from Waste  
 Station Road  
 Sibsey  
 Boston  
 Lincolnshire  
 PE22 0SA  
 Contact: Peter Mowbray  
 Tel: 01205 750516  
 Email: [peter@dragonheat.co.uk](mailto:peter@dragonheat.co.uk)  
 Web: <http://www.dragonheat.co.uk>  
 Hot water from any waste. Payback within 2 years.

Econergy  
 69 Hampton Park  
 Bristol  
 BS6 6LQ  
 Contact: Robert Rippengal  
 Tel: 0870 054 5554  
 Fax: 0870 054 5553  
 Email: [heat@econergy.ltd.uk](mailto:heat@econergy.ltd.uk)  
 Web: [www.econergy.ltd.uk](http://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.

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

Murray Carter  
 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

Talbott's Heating Ltd  
 Drummond Road  
 Astonfields Industrial Estate  
 Stafford  
 Staffordshire  
 ST16 3HJ  
 Contact: Amy Talbott  
 Tel: 01785 213366  
 Fax: 01785 256418  
 Email: [amy.talbott@talbotts.co.uk](mailto:amy.talbott@talbotts.co.uk)  
 Web: [www.talbotts.co.uk](http://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  
Contact: Peter Teisen  
Tel: 01527 821621  
Fax: 01527 821665  
Email: [peter.teisen@btinternet.com](mailto:peter.teisen@btinternet.com)  
Web: [www.farm2000.co.uk](http://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.

Refuell Ltd  
The Old Rectory  
South Thoresby  
Alford  
Lincolnshire  
LN13 0AS  
Tel: 01507 481063  
Email: [Helen@Refuell.co.uk](mailto: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  
Contact: Dr Robin Cotton  
Tel: 01398 351349  
Fax: 01398 351115  
Email: [robin@woodenergyltd.co.uk](mailto:robin@woodenergyltd.co.uk)  
Web: [www.woodenergyltd.co.uk](http://www.woodenergyltd.co.uk)

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

### 9.3 Fuel Suppliers

Coppice Resources Ltd  
Thornbury Hill  
Firbeck  
Rotherham  
S81 8JW  
Contact: Mark Paulson  
Tel: 01709 797900  
Fax: 01709 979901  
Email: [info@coppiceresources.co.uk](mailto:info@coppiceresources.co.uk)  
Web: <http://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  
Contact: Alan Corson  
Tel: 01904 696300  
Email: [alan.corson@forestry.gsi.gov.uk](mailto:alan.corson@forestry.gsi.gov.uk)  
Web: [www.forestry.gov.uk](http://www.forestry.gov.uk)

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

Manco Energy Ltd  
Bridgeholm  
Riverhead  
Market Weighton  
YO43 4LY  
Tel: 01430 876513  
Email: [info@mancoenergy.com](mailto:info@mancoenergy.com)  
Web: [www.mancoenergy.co.uk](http://www.mancoenergy.co.uk)

Can supply all types of wood fuel to meet your needs; also a range of boilers and stoves available.

Refuell Ltd  
The Old Rectory  
South Thoresby  
Alford  
Lincolnshire  
LN13 0AS  
Tel: 01507 481063  
Email: [Helen@Refuell.co.uk](mailto:Helen@Refuell.co.uk)  
Suppliers of wood chip and pelleted fuels.

Renewable Energy Growers Ltd  
Manor Park  
East Drayton  
Retford  
Notts  
DN22 0LG  
Tel: 01777 248684  
Fax: 01777 248076  
Email: [info@energycrop.co.uk](mailto:info@energycrop.co.uk)  
Web: [www.energycrop.co.uk](http://www.energycrop.co.uk)

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

Silvapower  
Rossington Hall Gardens  
Great North Road  
Doncaster  
DN11 0HP  
Contact: Richard Wagstaff  
Tel: 07802 655851  
Supplier of wood chips for biomass to installations in South Yorkshire, Derbyshire and beyond.

### 9.3.1 For assistance sourcing fuel:

Renewable Fuels Ltd  
The Harrop's  
The Menagerie  
Escrick  
York  
YO19 6ET

Contact: Robert Smith  
Tel: 01904 720575  
Fax: 01904 720578  
Email: [bob.smith@logg.co.uk](mailto:bob.smith@logg.co.uk)  
Web: [www.logg.co.uk](http://www.logg.co.uk)

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

South Yorkshire Forest Partnership  
Estate Office  
Thornccliffe Park  
Sheffield  
S35 2PH

Contact: Robin Ridley  
Tel: 0114 2571199  
Fax: 0114 2463346  
Email: [robin.ridley@syforest.co.uk](mailto:robin.ridley@syforest.co.uk)  
Web: [www.syforest.co.uk](http://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.

Yorwoods  
3/4 The Courtyard  
Sycamore Business Park  
Dishforth Road  
Copt Hewick  
Ripon  
North Yorkshire  
HG4 5DF

Tel: 01765 609355  
Fax: 01765 609366  
Email: [info@yorwoods.org.uk](mailto:info@yorwoods.org.uk)  
Web: [www.yorwoods.org.uk](http://www.yorwoods.org.uk)

Working with all parts of the forest industry to improve sustainability in North Yorkshire

Forestry Commission – Technical Development  
Branch  
Rydal House  
Rugeley  
Staffordshire  
WS15 3HF

Contact: Andy Hall  
Tel: 01889 586844  
Email: [andy.hall@forestry.gsi.gov.uk](mailto:andy.hall@forestry.gsi.gov.uk)

Support the technical aspects of biomass harvesting and heat generation.

### 9.4 General Information

British Biogen  
Rear North Street  
7<sup>th</sup> Floor, 63-66 Hatton Garden  
London  
EC1N 8LE  
Tel: 0207 8317222  
Web: <http://www.britishbiogen.co.uk>

Combined Heat and Power Association  
Grosvenor Gardens House  
35/37 Grosvenor Gardens  
London, SW1W 0BS  
Contact: David Green - Director  
Tel: 0207 8284077  
Email: [info@chpa.co.uk](mailto:info@chpa.co.uk)  
Web: <http://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](mailto:organic-energy@defra.gsi.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](mailto:enquiries@nnfcc.co.uk)  
Web: <http://www.nnfcc.co.uk>

### 9.5 Regional – Yorkshire & the Humber

Defra - Rural Development Service  
Government Buildings  
Otley Road, Lawnswood  
Leeds  
LS16 5QT  
Tel: 0113 230 3750  
General email: [enquiries.yorkshumber@defra.gsi.gov.uk](mailto:enquiries.yorkshumber@defra.gsi.gov.uk)  
Regional Manager – Mark Watson  
Tel: 0113 230 3900  
Email: [mark.watson@defra.gsi.gov.uk](mailto:mark.watson@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](mailto:fc.yath.cons@forestry.gsi.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.

Government Office for Yorkshire & the Humber  
PO Box 213  
City House, New Station Street  
Leeds, LS1 4US  
Contact: Les Saunders  
Tel: 0113 2800600  
Email: [ljsaunders.goyh@go-regions.gov.uk](mailto:ljsaunders.goyh@go-regions.gov.uk)

Yorkshire Forward  
Victoria House  
Victoria Place  
Leeds  
LS11 5AE  
Contact: Debbie Rosen  
Tel: 0113 3949765  
Email: [debbie.rosen@yorkshire-forward.com](mailto:debbie.rosen@yorkshire-forward.com)

Yorkshire & Humber Assembly  
18 King Street  
Wakefield  
West Yorkshire  
WF1 2SQ  
Contact: Sian Ferguson  
Tel: 01924 331563  
Fax: 01924 331559  
Email: [sian.ferguson@yhassembly.gov.uk](mailto:sian.ferguson@yhassembly.gov.uk)  
Web: [www.yhassembly.gov.uk](http://www.yhassembly.gov.uk)

## Chapter 10 – References and useful websites

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Ref Type: Report

Department of Trade and Industry. 2002. Guidance Notes for the Bio-Energy Capital Grant Scheme. London, DTI.  
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

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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. Financing Community Energy Schemes. EST.  
Ref Type: Conference Proceeding

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

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Ref Type: Conference Proceeding

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Ref Type: Report

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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

Cox, A. 2003. Low Carbon Heating with wood pellet fuel available at: [www.xCO2.com](http://www.xCO2.com)

## 10.2 Useful Websites

Biomass – All you need to know

<http://woodfuelwales.org.uk/biomass/>

British Biogen – Biomass Heating

<http://www.britishbiogen.co.uk/bioenergy/heating/heating.htm>

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/renewable/>

Econergy

<http://www.econergy.ltd.uk/>

Energy Saving Trust

<http://www.est.org.uk/>

Forest Research – Measurement and modelling or SRC

<http://www.forestry.gov.uk/srcsite/HCOU-5JENMU>

Forest Research: Woodfuel Resource – Study into the potentially available woodfuel resource of Great Britain

<http://www.woodfuelresource.org.uk/>

Renewable Energy – List of Publications

<http://test.netgates.co.uk/nre/pdf.html>

Renewable Energy Trust

<http://www.ruralenergy.co.uk/solarthermal.asp>

Renewable Energy World

<http://www.jxi.com/magsandj/rew/index.html>

Renewable Fuels Ltd

<http://www.logg.co.uk/>

Royal Commission on Environmental Pollution

<http://www.rcep.org.uk>

The Log Pile Project – Wood Pellets

<http://www.greenenergy.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<sub>2</sub> 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<sub>2</sub> used in harvest and transport of the wood.

### 10.4.2 Estimates of cost and CO<sub>2</sub> 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<sub>2</sub> emissions saved per kWh using wood are calculated relative to coal fuel (0.3kg CO<sub>2</sub>/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<sub>2</sub> that is saved is calculated according to the following formula:

$$\text{Cost saved/kgCO}_2 \text{ saved} = \frac{[(\text{kgCO}_2/\text{kWh})_{\text{coal}} - (\text{kgCO}_2/\text{kWh})_{\text{wood}}]}{[(\text{cost/kWh})_{\text{coal}} - (\text{cost/kWh})_{\text{wood}}]}$$

### 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<sup>2</sup> annually). The CO<sub>2</sub> savings are calculated relative to coal as in 10.4.2. Waste wood estimates are from WRAP Wood Market Study.

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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](mailto:enquiries@nnfcc.co.uk)  
<http://www.nnfcc.co.uk>

