Above ground hoppers

- High tip trailer or front loader delivery required
- Suitable for situations where space is limited

Hook lift bins

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

2.3 Boiler feed system

The vast majority of wood fuel boilers will have some method of automatically feeding the fuel from the storage facility to the boiler. Most storage facilities will have a mechanism for moving the chip such as a walking floor or an articulated arm which will move the chip to an auger which will feed direct to the boiler. The feed mechanism will normally have some form of fire protection to prevent back burn into the fuel store. In its simplest form this can be a tank of water connected by a pipe to the auger that has a wax plug which will melt and flood the auger in case of a back burn. Some systems have a more sophisticated system of a fire shutter situated between two augers.

Key Considerations

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

Wood ash can be a useful product

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

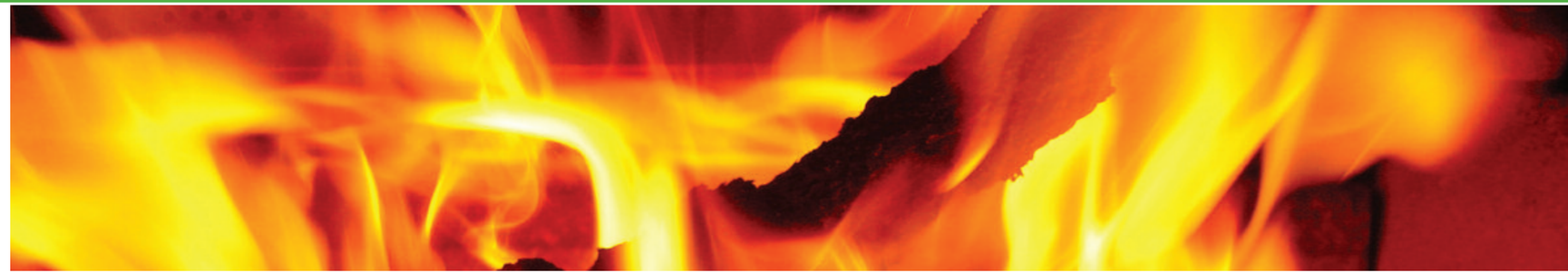
How much storage space will I need?

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 wood fuel

It is important to appreciate that storage facilities need to be in close proximity to the boiler, unlike oil and gas systems, to permit mechanical transfer of fuel to the boiler. Ongoing supply of fuel will be easier if the storage system is capable of receiving more than a full load of wood chip to take account of void spaces and to provide a buffer in case the fuel runs out before the delivery arrives.

South East England
Forestry Commission England



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.

Key Considerations

- Will the installation cause a visual impact?
- Will traffic to the site increase; how frequently 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?

Authorities Involved in Regulating Wood 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

5.3 Emissions

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 an exempt appliance.
Many 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).

Within a smokeless zone 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.
The list of smoke control areas can be found here:
http://uksmokecontrolareas.co.uk/locations.php
In addition a list of exempt appliances can be seen here:
http://uksmokecontrolareas.co.uk/appliances.php

5.4 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 came into force on 6th April 2006. For the latest information visit http://www.communities.gov.uk/planningandbuilding/buildingregulations/

Wood fuel heating

1. Types of combustion technology

Four types of combustion systems are available, the inclined or step grate, the ramfeed 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 (time, turbulence and temperature), the burning operation should be smoke free.

2. Fuel handling

There are three discrete 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 and the on-going operation of the boiler.

	Stoker burner	Inclined grate	Underfeed stoker
Output (kW)	<100kW	>100kW	3MW
Capital cost	medium	high	low
Efficiency	–	82-86%	90%
Fuel moisture	<35%	Up to 70%	<35%
Chip size range	narrow	wide	narrow
Ash removal	manual	automatic	automatic
Load response	rapid	slow	rapid
Retrofit possible	yes	no	yes

2.1 Fuel reception

Delivery vehicles must have easy access and tipping or transfer of fuel must be quick and simple.

2.2 Fuel Storage

The size of the fuel store dictates the frequency of fuel deliveries and must be calculated to suit the boiler and fuel type. The usable capacity in the fuel store must be based on the output of the boiler during the coldest time of the year. In addition the fuel store capacity must also take into consideration the fuel delivery mechanism, as delivery of part loads will increase the frequency of deliveries and thus increase the cost of fuel. When utilising wood pellets the fuel store can be smaller as pellets have an energy density three times greater than wood chip.

Underground bunkers

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

3. Costs

3.1 Capital costs

The capital costs of wood-fuelled systems are higher than for oil or gas, but the outlay can be 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 £350-950 per output kW, but for systems over 500kW, capital costs fall to £350-450 per kW. This covers the core components; the boiler and handling system, flow and return systems and piping. Pellet systems tend to be cheaper. The capital costs of installation of a wood-fired heating system are variable and additional costs, such as a fuel reception facility and boiler house etc, may add to them. These figures should therefore be seen as a guide only. It is also worth noting in recognition of the potential of wood fuel to reduce carbon emissions, there are a number of schemes that will give grant support to help cover capital outlay on renewable energy sources (see fact sheet on Grants for Wood and Wood Fuelled Heating).

3.2 Fuel costs

The price of wood chip varies from 1.8-3.0 p per kWh (input). Typically it costs from £70 -£110 per tonne depending on the moisture content, the source of the wood and the distance it has to travel. The price of wood pellets varies between about 3.1 and 4.5 p per kWh (input), typically costing between £150 and £200 per tonne depending largely on the distance it has to travel. The higher cost is often acceptable as pellet boilers tend to require less initial capital outlay.

3.3 Ongoing, maintenance and service costs

Modern smaller installations are generally fully automated and require minimal attention, whereas larger installations tend to require more regular monitoring and maintenance. 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 £600-1000. Breakdown and general repair costs are usually estimated annually at around 3% of the system's capital costs.

The main task for boiler operators will be the removal of ash. If a system is running on a good quality fuel this should only take half an hour every month or so. Some large scale systems will have an automatic de-ashing system installed however this containerised ash will still require disposal.

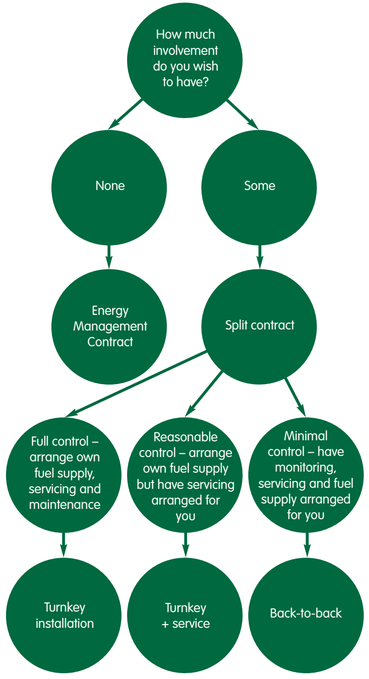
Critical factors affecting cost

- Scale of system: the bigger the cheaper (£/kW installed)
- Engineering fuel storage and reception area
- Access to grants

	CO_2 (kg CO_2 per kWh)	Fuel Cost (p/kWh)
Mains gas	0.19	1.7 – 4.2
Oil	0.28	2.9 – 5.7
Electric	depends on method of generation	8.1 – 14.0
Wood Chip	**0.025**	**1.8 – 3.0**
Wood Pellet	**0.055**	**3.1 - 4.5**

4. 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. This is by no means an exhaustive list and many suppliers are happy to negotiate a contract based on your specific needs



4.1 Turnkey Installation Services

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

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.

4.2 Turnkey and Service

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.

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.

4.3 Back-to-Back:

Turnkey, operations, maintenance and fuel supply

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.

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.

Key considerations

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

4.4 Energy management contract

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 for example oblige the ESCo to source a large percentage of the fuel locally.

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.

4.5 Split contract

Services A split contract is offered between the boiler supplier and the fuel supplier. The boiler supplier installs and looks after the day-today running of the boiler and the fuel supplier provides the fuel and arranges deliveries etc. However if issues arise with the fuel, 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 be resolved without the users involvement.

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. Planning and regulatory issues

Many wood chip heating installations do not require 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
- N oise from engines, boilers, handling equipment and traffic
- Delivery infrastructure

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 conservation areas or listed buildings, can raise specific issues.

5.1 Fuel storage and delivery

5.1.1 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 approximately nine agricultural trailer loads per month, equivalent to 9 tonnes. Good access for heavy vehicles will be essential to minimise disruption to local road networks and surrounding communities.

5.1.2 Storage

Subterranean bunkers are not visible from the ground and are therefore not likely to incur any planning issues.

Above ground storage - visual impact may be an issue, therefore may require screening, and must be secure against unauthorised entry.

5.2 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