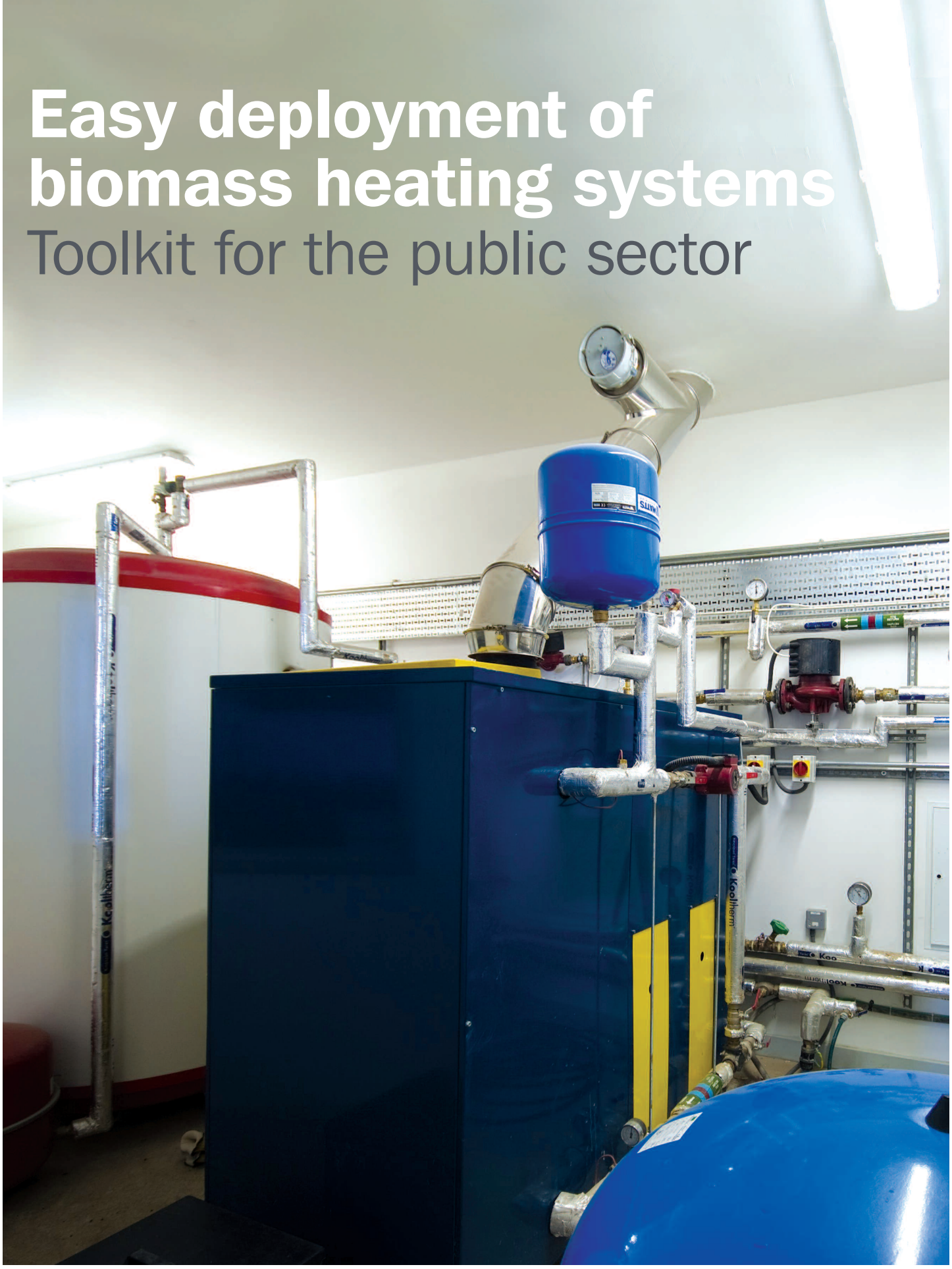
Easy deployment of biomass heating systems

Toolkit for the public sector



CLASP. Environment Resilience Resources & Support

THE MERSEY FOREST
more from trees

Foreword

What is this publication is about?

There has already been a great deal written on why to install biomass heating, biomass fuels, fuel delivery, and installing biomass systems. **So why another?**

Quite simply it wasn't put simply enough.

This publication assumes you understand the climate change issues, are committed to installing biomass heating, you are happy to source your fuel from one of the many local suppliers and you aren't considering a complex Combined Heat and Power option. You just want to replace the existing heating system with a biomass system.

This toolkit provides simple solutions for your first steps on a journey to install an increasing amount of biomass heating. Reference to other options and further information is given, but save this for a later date when you are confident with biomass at a number of less complex sites.

Once you have got a few installations under your belt you'll wonder why you hadn't done it earlier.

Nigel Blandford
Timber and Bioenergy
The Mersey Forest

Contents

LEADER+ Mersey Rural Leader defra Department for Environment Food and Rural Affairs

In association with Northwest Regional Development Agency

The European Agricultural Fund for Rural Development: Europe investing in rural areas

Executive Summary

This toolkit has been arranged in several simple steps.

Step 1
A rapid appraisal of all your existing boiler stock. You'll need to know size, ages, fuel usage, fuel prices and something of the physical constraints at the location. You will then need to feed this information through the easy to use online RHI Calculator. From this you will generate a list which will highlight the technically easy and most economic boilers for replacement.

Step 2
From the list of easy hits you then need to draw up some outline specifications for the boiler type and size, accumulator tank size and fuel store type and size. This process has been simplified and made as easy as possible.

Step 3
This outlines the procurement options. The firm recommendation is to offset as much risk as you can and procure via an ESCO or Back to Back contract. This isn't because biomass is inherently risky. The main advantage is it allows you and your staff to observe and become used to the running of this new technology and avoid any teething problems.

Step 4
You may wish to then gradually take more control of the running of the system. You will probably still need some kind of O&M contract. While this is in essence similar to your existing contracts it will need companies with a different skill set. If you want to purchase your fuel as well there is an outline and links to fuel supply contract pro-formas.

While it is not recommended, if you do want to maintain control of the whole project from start to finish, then the further reading section of this document directs you to plenty of information you will need to know, including detailed designs of fuel stores.

Introduction
Why Biomass Heating and Why Now?

There are a variety of push and pull factors moving us away from fossil fuel heating to renewable/low carbon heating forms.

Most public bodies have carbon reduction policies and targets in place and many have signed up to the Nottingham Declaration on Climate Change.

There are regulatory penalties like the Climate Change Levy[1] which will rise by around 5% this year and the CRC Energy Efficiency Scheme[2] which currently charges £12/tonne CO2 emitted.

Fuel costs are also increasing and are subject to a large degree of fluctuation[3] and fuel security and it's relation to price is also a growing concern.

There is also a unique encouragement to switch to low carbon heating in the UK by way of the Renewable Heat Incentive (RHI)[4]. This offers 20 year index linked payments for the amount of renewable heat used. This in particular is likely to increase the move towards renewable heating.

If we are looking at a complete heating package the technology options that are open to us are limited. Biogas is not fully mature as a standalone heat package, heat pumps are not truly renewable unless the electricity source is low carbon and 100% biodiesel heating while an easy conversion from fossil fuel, congeals at low temperatures[5].

That leaves us with biomass and in the context of this report we are concerned principally with woody biomass for space and hot water heating of public buildings.

To date, biomass heating deployment has been patchy and experience varied. New build locations, particularly schools, have seen the greatest penetration of the technology. Some have experienced issues which can be put into three main areas;

1. Badly specified/designed boilers and integration heating system or Building Management System (BMS).
2. Badly specified/designed fuel delivery/storage and handling equipment coupled with poor quality fuel.
3. Poor understanding of operational and maintenance requirements of biomass.

A good biomass heating supply chain is developing rapidly particularly fuel supply[6]. There is still, however, lack of confidence with energy and facilities managers to bite the bullet and commit to biomass heating, even where it is the obvious and economic choice.

With the help of funding from CLASP and RDPE Merseyside this toolkit looks to remove some of these hurdles.

1 Climate Change Levy Rates, HMRC
2 www.decc.gov.uk/en/content/cms/emissions/crc_efficiency/crc_efficiency.aspx
3 Quarterly energy Prices December 2011, DECC
4 www.decc.gov.uk/rhi
5 Technical Paper No.7 (Biodiesel Heating Oil), Chartered Institute of Plumbing and Heating Engineers
6 Woody biomass Fuel Supply in England's North West Directory 2010. Envirolink Northwest

Step 1
Where to Install Biomass?

The RHI makes installing biomass very cost effective in a wide range of situations. New builds and premises not connected to mains gas can be exceptionally attractive.

For a good idea of income, paybacks and carbon savings The Mersey Forest has built a simple online calculator at www.merseyforest.org.uk /rhicalculator

By inputting your annual fuel use and the size of the boiler you are looking to install you will get the amount of RHI income you are likely to receive, the amount and volume of biomass fuel you are going to need and your CO_2 savings.

With the addition of the price you currently pay for your fuel, the delivery price you are likely to pay for your woodfuel[7] , the price to install a new biomass boiler[8] and a replacement fossil fuel equivalent you get a straight payback figure in years.

These aren't the only considerations however. The current boiler age and replacement cycles may be an issue as could be "Asset Rationalisation and disposal" in the current climate.

There are also some technical issues that need to be considered early on and these are principally to do with space and accessibility. Few sites are technically impossible but the ease and cost of a specific engineered solution aren't what you want to undertake particularly early on in the biomass journey.

Where is the current boiler room/house?
For ease you want your biomass boiler located here or as near to here as possible. It just makes connecting into the existing heating circuit a whole lot easier.

Technical issues could be where the existing boiler plant is;

- Located on the roof of a multi story building
- Located in a basement with no easy external access
- In a very cramped space and wouldn't accommodate a larger dimensioned biomass boiler
- Located with inadequate adjacent external space to place a containerised biomass boiler unit
- Isn't located immediately adjacent to the potential fuel store

Or;

- Where the fuel has to be transported more than a few metres from the delivery vehicle to the fuel store (including pellets)
- There is inadequate space for a fuel store on site
- There is inadequate space for a delivery vehicle to enter, discharge and exit

[7] At the rear of this document
[8] At the rear of this document

Where to Install Biomass?

As this is an initial appraisal these technical issues should not be dwelled on in any great detail but assessed as following; no issues, some issues or there are some real deal breakers. These can then be given a simple traffic light system of Red, Amber, Green. The same can be done for the other main issues noted below

How to carry out an audit of existing installations and draw up a traffic light scheme based on;

Physical access for fuel deliveries is vital

Premises Name	Boiler age Years	Payback Years	Technical issues	Overall
Rural Care Home	15	3	No	
Central Council HQ	25	10	Yes	
Rural Leisure Centre	15	5	No	
Rural Primary School	10	10	Some	
Central Secondary School	1	15	Yes	
Rural Highways Depot	20	8	No	
Central Swim Centre	5	15	Yes	
Central Library	10	15	Some	
Rural Secondary School	5	10	Some	
Central Primary School	10	5	Yes	
Rural Library	20	4	No	

The above table has been replicated with some additional fields on a spreadsheet for easy sorting of information and can be filtered on any particular criteria.

While we have a look at this, there is also the possibility of looking at replacing electric heating with biomass.

Here you are going to have to factor in the additional costs of a new wet system.

There may also be issue in pinning down the precise energy use attributed to heating.

Even where there is a separate night rate meter there may be some heating during the day via a different meter.

Saying that, the carbon savings are likely to be considerable as current electric grid generation is still heavily dependant on coal.

With the above information you are now ready to take the best options to the next stage.

Step 2
Initially Specify the boiler and Associated Equipment

You are now armed with a list of sites that look like good options. You can now start to draw up the specifications.

Boiler Type

As for boiler type we suggest you keep things simple and run in line with the current RHI bands.

- <200kW Pellet (with potential use of woodchip over 100kW)
- 200kW – 400kW Pellet and Woodchip
- >400kW Woodchip

We have not chosen to consider batch log systems because of the daily manual loading requirement. They only instance where they may be appropriate for early biomass deployment is with the Fire and Rescue Service where they might be considered at manned stations and loading could fit in with shift patterns.

The boiler should include;

- Automatic ignition is essential otherwise it will require a staff member to manually ignite the fuel. Often a supplier will note that the boiler has a 'kindle' or 'slumber' mode to reduce the number of times a woodfuel boiler has to be ignited but this is not an alternative to automatic ignition.

- Automatic heat exchanger cleaning systems, otherwise boilers require manual cleaning to prevent fouling the heat exchanger over time. If the tubes are not cleaned on a regular basis, the efficiency of the heat exchanger in the boiler system is reduced. The numerous 'fire tubes' in a typical woodfuel boiler heat exchanger make manual cleaning a time consuming and dirty task. Also, take into account the orientation of heat exchangers. You may be able to install a boiler with vertical heat exchanger tubes into a low roofed boiler room but could you replace these tubes after a number of years with little height access?

- Automatic ash cleaning mechanisms to collect ash from beneath the combustion grate and the fly ash that has been cleared from the heat exchanger tubes. This is then extracted into a bin external to the boiler. Some systems claim to have automatic ash removal, but require the boiler to be shut down and monitored during the cleaning process. This is not considered to be automatic ash removal.

- Lambda sensor linked to air controls.

- A safety heat exchanger. If a power shortage should occur whilst the boiler is running and a safety heat exchanger is not fitted or not commissioned properly, there is a risk the boiler will overheat. The safety heat exchanger is usually a mechanically operated device that indirectly cools the boiler water if the main boiler pump stops.

Initially Specify the Boiler and Associated Equipment

- A back end protection system which prevents condensation of acid gases in the boiler. This occurs because the return water is too cool, which causes flue gases to condense in the boiler heat exchanger and flue. Condensed acid gases will increase the rate of corrosion of the boiler tubes, and condensed tars and soot will increase the rate of fouling within the boiler. This is a more common problem when using woodfuels with higher moisture content.

- Easily accessed flues. They are essential, as no access for flue cleaning or drainage provision for flue condensate can lead to the inside of the flue and the boiler becoming corroded, which reduces combustion efficiency. Additionally, flue gases can leak into the boiler house, causing a severe health and safety risk.

- Remote diagnostics which allow for a data line access to the boiler controls by the supplier or service engineer. This can allow for quick diagnostics if problems do occur.

You will also need to bear in mind Air Quality. The exhausted combustion products from biomass are different from fossil fuels. In general, there are decreases in oxides of sulphur (SO_X), negligible increases in the oxides of nitrogen (NO_X) but increases in small particulate matter (PMs)[9].

There are no boiler restrictions on the first phase of the RHI but the second phase will bring in emission limits. These are likely to be set at 30 grams/Gigajoules net for total particulate matter and 150 grams/Gigajoules net for nitrogen oxides.

The location of the proposed installation is an important consideration. If it falls within a Smoke Control Area[10] then you will need an Exempt Appliance[11] or demonstrate to your Environmental Health team that the emissions limits are within acceptable limits. They will want to know this as well if it falls within an Air Quality Management Area[12]. These are generally located adjacent to the busiest roads in each authority area.

If a fuel is being used that comprises of waste wood and the boiler is in excess of 350-400kW then further emission limits and monitoring equipment will be required.

9 www.biomassenergycentre.org.uk/portal/page?_pageid=77,109191&_dad=portal&_schema=PORTAL

10 http://smokecontrol.defra.gov.uk/background.php#smoke

11 http://smokecontrol.defra.gov.uk/appliances.php?country=e

12 http://aqma.defra.gov.uk/

Initially Specify the Boiler and Associated Equipment

Boiler Sizing

We are assuming here that in replacing the existing boiler you now want to meet the entire load from biomass. There are strong merits in having a secondary fossil fuel boiler to pick up peaks and troughs and allow for more optimal biomass boiler sizing. However, for simplicity we are not considering this and so boiler sizing is on peak demand.

Woodfuel boilers have certain characteristics you need to be aware of from the start. They are best run at close to full load, they don't modulate like gas boilers and are not suited to continuous low level outputs. This isn't really an issue as they are generally run in conjunction with an insulated accumulator tank or thermal store.

These accumulator tanks can allow for some under sizing of a boiler. A modern Building Management System (BMS) can easily draw heat from the accumulator tank(s) and the boiler recharges this hot water store by running at high output.

However to size a boiler accurately and optimally is a dark art. Suppliers may try to sell you a unit they want to sell rather than the correct sized unit or you may be tempted to oversize to gain a larger RHI income. These are false economies. You need to be doing it right from the start or you'll end up with a bad experience which may put you off further biomass deployment.

To aid you in getting the correct size to specify to a supplier, follow the following;

1. Perform a full heat loss calculation[13] on the building including hot water demand.
2. Estimate from existing fuel consumption
   - Take the highest monthly fuel consumption (equates to the coldest month)
   - Convert the fuel consumption to kWh[14]
   - Use 80% of this figure to allow for boiler efficiency losses.
   - Divide this by the core operating hours that month.
3. Use the simple online tool at Asgard Biomass[15].
4. Take down the size of the current fossil fuel boiler if it adequately heats the premises.
5. Use the figures from 1, 2, 3 & 4 as a range for specifying, noting you should never exceed (or get close to) the value in 4.

If you have some patience, The Carbon Trust has produced a full Biomass Boiler System Sizing Tool[16] although it is fairly complex.

[13] Commercial Heat loss calculators are available from Hevacomp, IES and others are available online.

[14] www.merseyforest.org.uk/RHI/rhi_calculator_assumptions.asp

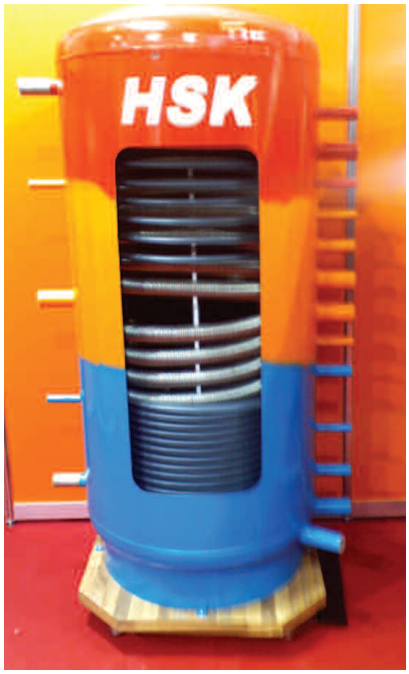
[15] www.asgard-biomass.co.uk/biomass_boilers_sizing.aspx

Initially Specify the Boiler and Associated Equipment

Accumulator Tank Sizing and Specification

Accumulator tanks can also be called heat batteries or buffer tanks. These insulated thermal stores are extremely useful in ironing out the modulation /cycling issues with biomass boilers and meeting some peak load requirements. Accurate accumulator tank sizing[17] can be vital if you are intending to use just a single biomass boiler to provide all the heating requirements.

Initially, a useful rule of thumb is to allow for 10 litres/kW plant capacity where loads do not fall below zero and 20 litres/kW where they do[18]. However as we are looking at boiler sizing without a smaller secondary fossil fuel, boiler sizing is critical.



The hot water in the tank is designed to stratify and not mix. Temperature sensors should be set at different levels in the tank and feedback to the boiler/heating controls.

[16] www.carbontrust.co.uk/emerging-technologies/current-focus-areas/biomass/pages/biomass-tool.aspx

[17] Section 4.3.1 Biomass for London: Wood Fuel Guide www.lep.org.uk/uploads/LEP Biomass for London Wood Fuel Guide Jan 09 FINAL.pdf

[18] Section 2.2.5 Biomass Heating: A practical guide for potential users. www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=CTG012

Initially Specify the Boiler and Associated Equipment

Back Up Boilers

Many early biomass installations often had back-up fossil fuel boilers. If you want this added security of heat supply, then request it as part of the specification and ensure it is RHI compliant. It will require a more complex installation and you will need to make sure that the biomass boiler always takes the lead, unless you bring the fossil fuel boiler into play manually.

An alternative is to allow for a back up boiler to be "plugged in" to the system. Plug in boilers are commonly used in industry when an existing boiler is taken off line for routine maintenance but heat of steam is still required. These can be hired in a container or truck[19]. You will need to design in easy access to the relevant services to plug–in to the boiler. However this will be cheaper than installing a back up boiler that may not be used.

While not instantaneous you could hire in a truck mounted boiler when you need to.

[19] www.byworth.co.uk/truck_mounted.aspx

Initially Specify the Boiler and Associated Equipment

Fuel Store Sizing

There will be a range of influences to determine this[20] including;

- Physical space available
- Fuel density and flow properties (pellet/chip)
- Fuel degradation time
- Delivery vehicles able to supply the site
- Guaranteed restock time from putting a call in to fuel supplier
- Days/weeks fuel buffer required
- Dead space in store

You probably want to allow yourself a minimum buffer of 2 weeks peak fuel demand or twice the usual delivery volume if that is larger. Add on an additional 30% to allow for dead space due to coning when tipping and areas in the corners of chip stores. Under this scenario you will be looking at a maximum of weekly delivery at peak times.

Large stores are good but because fuels can degrade and the occasion bad batch of fuel needs to be used up quickly, so over sizing stores isn't always the best option. Also, space is often tight.

Thus;

The existing boiler running on LPG has a maximum monthly delivery of 5000 litres

- Less 50% = 2500 litres
  2500 x 7.1 = 17,750 kWh
- 17,750 kWh in Woodchip volume (@1m^3 =700kWh = 5 m^3/tonne) = 25m^3
- + 30%
- = 32.5m^3

Based on fuel being delivered in a 4 axle tipper holding 15m3

- 15 x 2 = 30m^3
- + 30%
- = 39m^3

A 40m^3 store is therefore desirable.

[20] Section 4.6.2 Biomass for London: Wood Fuel Guide
http://www.lep.org.uk/uploads/LEP%20Biomass%20for%20London%20Wood%20Fuel%20Guide%20Jan%2009%20FINAL.pdf

Initially Specify the Boiler and Associated Equipment

Containerised Systems

For ease of installation and operation, a containerised system should be the first choice if space and specifications allow. Particularly, pellet systems that can accept blown deliveries.

They will bring together the fuel store, boiler, accumulator tanks and controls in a single integrated package put together by the manufacturer. With the provision of power, water and control wiring, it can be in effect a plug and play system.

Initially Specify the Boiler and Associated Equipment

Fuel Store Designs

It is advisable to stick to the specific type/brand/design that the boiler installer recommends. An integrated package of a tried and tested design is undoubtedly the best. Going for a mix and match approach can throw more variables into the equation. However, you will need to set some broad specifications.

Initial Three Golden rules;

1 Allow adequate room for the vehicle to arrive, discharge and leave without causing obstruction. Remember most vehicles tip so there will be height restrictions to take into account as well.

2 Even though you can blow wood pellets some distance, allow for a design to get the vehicle as close to the fuel store loading pipe as possible. Pellets can degrade rapidly if forced round corners and over distances. Minimise pipe lengths and bends.

3 Get the fuel store as close to the boiler as possible. By cutting down auger/transfer distances to a minimum, you lessen fuel jamming issues and further fuel degradation.

Initially Specify the Boiler and Associated Equipment

Pellet Stores

Animal Feed Silos >20kW

If there is no issues with aesthetic looks, then a feed silo is likely to be the best option. Why?

They have been used to store and convey animal feed pellets for a good number of years. They come in a wide range of sizes, they are weatherproof therefore can be sited externally fairly easily. They might not look pretty but the work. Be sure you can ascertain the level of pellets in the silo from the outside.

Silos for pellets are easy to install and ideal where only outside storage is available.

Flexible textile stores <50kW

For smaller sized systems you can purchase pre fabricated textile pellet stores up to about 10m^3 in size. These are supported in a metal frame and the pellets feed from the bottom. As they are not weatherproof they need to be located in dry internal space.

Self-supporting textile stores. An easy solution if you have a dry internal space. Until blown deliveries can offer smaller loads, tipping bagged pellets into open topped stores like the one on the right may be necessary.

Initially Specify the Boiler and Associated Equipment

Plastic Underground Stores <50kW

These basically look like heating oil tanks sunken below ground. One of these has been installed by Cosmopolitan Housing at Balliol Road in Bootle. These are a new development and at the current time not been fully evaluated in the UK.

Custom Built Pellet Stores >50kW

If you can't use an external animal feed silo or a prefab flexible textile store is too small then you could build a custom pellet store.

There are some golden rules to be followed here as well:

- It must be completely dry as pellets absorb moisture rapidly and degrade
- The sides should be at least 45% to allow free pellet flow
- There needs to be an inlet pipe and exhaust pipe
- There needs to be an impact mat.
- You need access by way of a sealed door to inspect and maintain the store
- Any lighting/electrics used in the store needs to be "safety" and not be the cause of an ignition point for dust.

Custom built stores increase the risk over the above options.

Good design guides and checklists based on German experience can be obtained via an Irish website[21]. CO2sense have produced a document which highlights actual issues from UK fuel stores[22].

[21] www.woodenergy.ie/media/coford/content/publications/projectreports/cofordconnects/pp12_pelletstoragefacility.pdf

[22] www.co2sense.co.uk/uploads/public/Installing%20and%20Operating%20WoodfuelHeating%20Systems.pdf

Initially Specify the Boiler and Associated Equipment

Wood Chip Stores

Fuel Stores >200kW

Woodchip stores are more complex than pellet stores as chip is not free flowing, is bulkier and has in general, to be tipped, meaning they have to be on or underground unless you use specialist lifting delivery vehicles. We have discounted the latter as to simplify the operation and allow the option of using a greater range of fuel suppliers with standard tipper trucks or trailers.

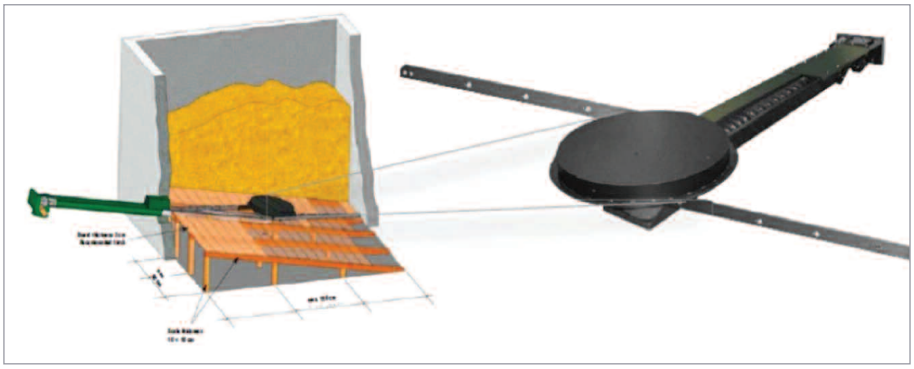
If you do want to look at all the options available then most are described in Econergy's guide on Fuel Reception and Storage[23].

We recommend you concentrated on two options.

Rotary arms 200-400kW

This uses a pair of spring steel rotary arms that move round the base of the fuel store. These act as an agitator to prevent the wood chip bridging and to move the fuel into the auger that leads to the boiler. It is common for stores to be designed for chip but used with pellets at some time.

While this will work you need to ensure that both the raised floor and the fuel agitator can cope with the increased weight of a denser pellet fuel. Also, try to ensure that there is access to the auger feed and central drive for the arms. If there is an issue it will be easier to deal with rather than emptying the fuel store and pulling up the floor.

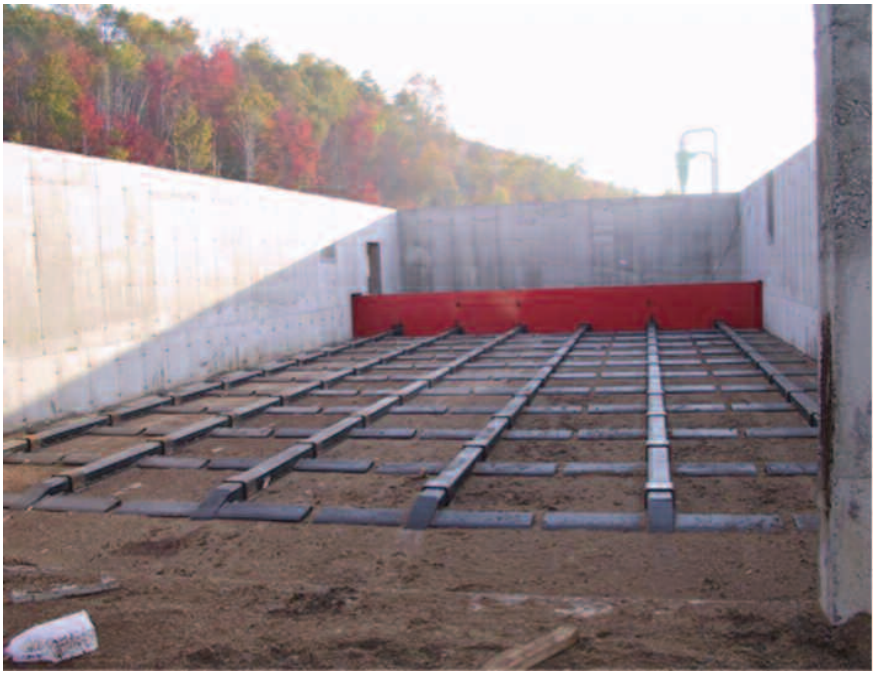


[23] www.econergy.ltd.uk/design/fuel_reception_and_storage

Initially Specify the Boiler and Associated Equipment

Walking Floors >400kW
These are more robust systems that are in effect a set of reciprocating metal ladders set into the floor. They are powered by hydraulic rams and slowly move the chip to an end where an auger then feeds to chip towards the boiler.

Walking floors can be designed to allow delivery vehicles to drive over them during deliveries and are thus suitable for ground level storage. Walking floors are good for large dedicated woodchip stores for boilers of several hundred kilowatts.



Step 3
Procurement Options

Armed with the list of facilities and outline specification you can now start to consider different approaches to procurement.

A limited number of companies have already been approved via the public purchasing group Pro5[24]. However, you will probably want to tender to a broader selection that may include local suppliers. A list of suppliers can be found at the rear of this document.

Energy Service Companies (ESCOs)
Several companies offer this kind of package where they take on the fuel supply arrangements, maintenance, and repair and then bill the user for metered heat. However, there is often the option to finance the capital through a higher heat purchase rate. In some cases where you are replacing a high use boiler running on oil or LPG you may not have to pay the capital, and will eventually begin to receive some of the RHI payments.

You will need to sign up to a long term heat purchase agreement and you may or may not actually own the boiler and equipment. This option offers the least risk and should be considered. The Carbon Trust have made available a pro-forma Heat Supply Contract[25] and Guidance Notes[26].

Back-to-Back: Installation, O&M and fuel supply
Similar to an ESCO but you front the capital expenditure and the equipment is yours. However, the supplier not only installs the system but looks after the operations, maintenance and fuel supply. You may be involved in the day-to-day running of the system such as ash emptying and accepting fuel deliveries, although the contractor provides full support and guidance.

If you are new to biomass systems you should be looking at this or an ESCO as the starting point although you may wish to switch to have greater involvement after a couple of years.

Installation and Service
As well as installation you set up a regular services contract with the installer. You will be responsible for fuel procurement and daily maintenance.

Installation Only
Contractors install the fully functional heating system however all subsequent maintenance and management tasks are down to the user. The benefit of this contract is that the system purchaser will directly benefit financially from the running cost savings however they will need to source all fuel and servicing independently. In reality, this type of agreement is quite rare.

It is strongly recommended that you look at the ESCO or Back-to-Back option. With the latter you may wish to go this way for a couple of years and then switch to a regular service contract once site staff have gained experience.

[24] www.pro5.org

[25] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/REVISED%20CONTRACT%20FOR%20SUPPLY%20OF%20HEAT%20ENERGY%20(2).doc

[26] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/Guidance%20note%20for%20supply%20of%20heat%20contract%20CT%20Template.pdf

Step 4
Running Your Boiler

Service, Operation & Maintenance Contracts and Site Staff Training

In some instances installations may already be installed, and the site manager looking for a regular service or O&M contractor.

This is a problematic area as this is a relatively new field. The installer may be able to offer you this service although you may find the installer's engineer is located too far away. They may only be experienced in installation and not full servicing and maintenance.

What you need to be looking for in a contractor;

- Brand specific training /experience on your existing boiler model or the one you intend to install. Experience on other brands is an advantage
- General boiler experience, integration with multiple heat sources and Building Management Systems
- Solid fuel heating training /experience – Wet systems and modern biomass systems via HETAS[27]
- Having a remote dial–in diagnostics facility on your boiler is advantageous as the supplier/installer/contractor can check the boiler quickly

You will be lucky to fulfill all these requirements but as the supply chain matures it will become possible.

While the installer will give your site operator initial instruction in routine maintenance it is worth obtaining some more detailed training for your site staff. Find out if it is possible for them to go on a manufacturers training course.

A standard Servicing Contract[28] is available from The Carbon Trust along with accompanying Guidance Notes[29].

A standard Operation and Maintenance Contract[30] is also available from The Carbon Trust along with a Guidance Note[31].

[27] www.hetas.co.uk/nearest_member
[28] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/SERVICESAGREEMENTv2.doc
[29] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/GuidancenoteforServicesAgreement.pdf
[30] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/OPERATIONANDMAINTENANCEAGREEMENT.doc
[31] www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/GuidancenoteforOperationandMaintenanceAgreement.pdf

Running Your Boiler

Fuel Supply

Fuel supply is readily available and a full list of suppliers in the region can be found in "Woody Biomass fuel supply in England's Northwest 2010"[32].

Wood pellets should be produced to ENplus[33] A1 Quality Assurance Standard.

The supplier of the bulk delivered fuels should ideally meet ENplus Quality Assurance Standard, but this is only just emerging.

For woodchip, some quality assurance schemes are emerging like the HETAS Quality Assured Fuel[34] or Woodsure[35].

However they have yet to gain a firm foothold but are an indication that the supplier is taking Quality Assurance seriously. Austrian Onörm[36] fuel standards are still commonly used for specifying boiler fuel.

Dalkia produce a waste wood pellet[37] that makes an interesting cost effective alternative for woodchip. Until Dalkia achieve "End of Waste"[38] for their pellets, there are still some regulatory hoops to jump through if the boiler is larger than 400kW.

While fuels are generally sold by the tonne it is the calorific value that you are actually interested in.

If you are going to buy fuel directly then use the Carbon Trust's Fuel Supply Contract[39].

Indicative Delivered Fuel Costs in North West England[40]

Virgin Wood Pellets to ENplus A1 Standard

- > 3 Tonne bulk blown delivery c£190/tonne (4p/kWh)
- Bagged Pellets c£250/tonne (5.3p/kWh)
- Virgin Woodchip @ <30% moisture c£90/tonne (2.4p/kWh)
- Recycled wood pellets from Dalkia via YPO* c£120/tonne (2.5p/kWh)

32 www.merseyforest.org.uk/library/timber-and-bioenergy/
33 www.pelletprocess.de/?p=301&lang=en
34 http://hetas.co.uk/fuel-quality/quality-assured-fuel
35 www.woodsure.co.uk/consumer_intro.htm
36 www.biomassenergycentre.org.uk/portal/page?_pageid=77,317197&_dad=portal&_schema=PORTAL
37 www.dalkia.co.uk/wood-pellet-fuel
38 www.environment-agency.gov.uk/business/sectors/124299.aspx
39 www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/REVISED%20CONTRACT%20FOR%20SUPPLY%20OF%20BIOMASS%20FUEL%20(2).doc
40 www.merseyforest.org.uk/library/timber-and-bioenergy/

Appendixes
Further Information

Boiler Sizing
- Commercial Heat loss calculators
  Hevacomp **www.**bentley.com/en-GB/Products/Bentley+Hevacomp+Mechanical+CAD/
  IES **www.**iesve.com/content/mediaassets/pdf/ApacheCalc2pager.PDF
- Boiler efficiency comparisons
  www.merseyforest.org.uk/RHI/rhi_calculator_assumptions.asp
- Online boiler sizing
  www.asgard-biomass.co.uk/biomass_boilers_sizing.aspx
- Carbon Trust boiler sizing tool (complex)
  www.carbontrust.co.uk/emerging-technologies/current-focus-areas/biomass/pages/biomass-tool.aspx

Accumulator Tank Sizing and Specification
- Biomass for London: Wood Fuel Guide - Section 4.3.1
  http://**www.**lep.org.uk/uploads/LEP%20Biomass%20for%20London%20Wood%20Fuel%20Guide%20Jan%2009%20FINAL.pdf
- Biomass Heating: A practical guide for potential users. Section 2.2.5
  www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=CTG012

Back Up Boilers
- Truck mounted back up boilers
  www.byworth.co.uk/truck_mounted.aspx

Fuel Store Sizing
- Biomass for London: Wood Fuel Guide - Section 4.6.2
  http://**www.**lep.org.uk/uploads/LEP%20Biomass%20for%20London%20Wood%20Fuel%20Guide%20Jan%2009%20FINAL.pdf

Fuel Store Designs
- Design guidelines
  www.woodenergy.ie/media/coford/content/publications/projectreports/cofordconnects/pp12_pelletstoragefacility.pdf
- CO2Sense Installation and Operational guide
  www.co2sense.co.uk/uploads/public/Installing%20and%20Operating%20WoodfuelHeating%20Systems.pdf
- Econergy Design Sheets and Drawings
  www.econergy.ltd.uk/design/?PHPSESSID=1460acca0a935acfdb432627f19ed0a1

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Procurement Options

- Public Sector pre screened companies
  www.pro5.org
- Heat Supply Contract
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/REVISED%20CONTRACT%20FOR%20SUPPLY%20OF%20HEAT%20ENERGY%20(2).doc
- Guidance on Heat Supply Contract
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/Guidance%20note%20for%20supply%20of%20heat%20contract%20CT%20Template.pdf

Operations and Maintenance

- Solid Fuel accredited heating engineers
  www.hetas.co.uk/nearest_member
- Service Agreement
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/SERVICESAGREEMENTv2.doc
- Guidance for Service Agreement
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/GuidancenoteforServicesAgreement.pdf
- Operation and Maintenance Agreement
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/OPERATIONANDMAINTENANCEAGREEMENT.doc
- Guidance for Operations and Maintenance Agreement
  www.carbontrust.co.uk/SiteCollectionDocuments/Various/Emerging%20technologies/Current%20Focus%20Areas/Biomass%20Heat/GuidancenoteforOperationandMaintenanceAgreement.pdf

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Air Quality
- Biomass Air quality Guidance for Local Authorities
  www.environmental-protection.org.uk/biomass/
- Summary of biomass combustion emissions
  www.biomassenergycentre.org.uk/portal/page?_pageid=77,109191&_dad=portal&_schema=PORTAL
- Smoke Control Areas
  www.smokecontrol.defra.gov.uk/background.php#smoke
- Exempt appliance in Smoke Control Areas
  www.smokecontrol.defra.gov.uk/appliances.php?country=e
- Air Quality Management Areas
  www.aqma.defra.gov.uk/
- Exempt Waste Wood Regulations and air quality
  www.archive.defra.gov.uk/environment/quality/pollution/ppc/localauth/pubs/guidance/notes/pgnotes/documents/pg1-12.pdf
- Proposed changes to above
  www.archive.defra.gov.uk/environment/quality/pollution/ppc/consultations/pgn-1-12-11.pdf
- Scottish Biomass Air Quality Study
  www.scotland.gov.uk/Publications/2008/11/05160512/0

System Considerations and Design
- Biomass Heating: A practical guide for potential users.
  www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=CTG012
- Biomass for London: Wood Fuel Guide
  http://**www.**lep.org.uk/uploads/LEP%20Biomass%20for%20London%20Wood%20Fuel%20Guide%20Jan%2009%20FINAL.pdf

Renewable Heat Incentive (RHI)
- Scheme details from Department of Energy and Climate Change
  www.decc.gov.uk/rhi
- Administrative and application details from OfGEM
  www.ofgem.gov.uk/e-serve/RHI/Pages/RHI.aspx
- Online RHI Calculator
  www.merseyforest.co.uk/rhicalculator

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Suppliers of Heating Systems and Fuels

Local Fuel Suppliers

Supplier	Contact	Woodchip	Pellet	Quality Assurance
Beacon Deliveries (St Helens)	07770 777727	Yes		
Billington Biofuels (Liverpool)	0151 243 9047		Yes	Can supply ENplus pellets
Bowland Bioenergy (Clitheroe)	07766 757997	Yes	Yes	HETAS
Dalkia Bioenergy (Manchester)	0800 9808110		(Recycled)	ISO 9001
Euro Tree Woodfuel (Frodsham)	01928 740289	Yes		
Foxhill Timber (Halewood)	07753 859952	Yes		
Liverpool Wood Pellets (Liverpool)	0151 236 9181		Yes	
Midland Woodfuel (Culcheth)	01952 510001	Yes	Yes	Woodsure

Heating System Suppliers

Supplier	Location	Website
Bowland Bioenergy	Lancashire	www.bowlandbioenergy.co.uk
Dalkia Bioenergy	Gt. Manchester	www.dalkia.co.uk/biomass-solutions
Eco Energy Depot	Merseyside	www.ecoenergydepot.co.uk
Econergy	Bedfordshire	www.econergy.ltd.uk
Evergreen Ecosystems	Lancashire	www.evergreenecosystems.co.uk
Imperative Energy	Cheshire	www.imperativeenergy.co.uk
MGL Biomass	Lancashire	www.mgl-biomass.co.uk
Myriad	Leicestershire	www.myriadceg.com/biomass
Remeha	Berkshire	www.uk.remeha.com/index.php?id=269
Real Renewable Energy	Cumbria	www.realrenewableenergy.co.uk
SustaBurn	Cumbria	www.sustaburn.co.uk
Tomkinson Heating	Cheshire	www.tomkinsonheating.co.uk
Windhager	Wiltshire	www.windhager.co.uk
Wood Energy	Bristol	www.woodenergy.com

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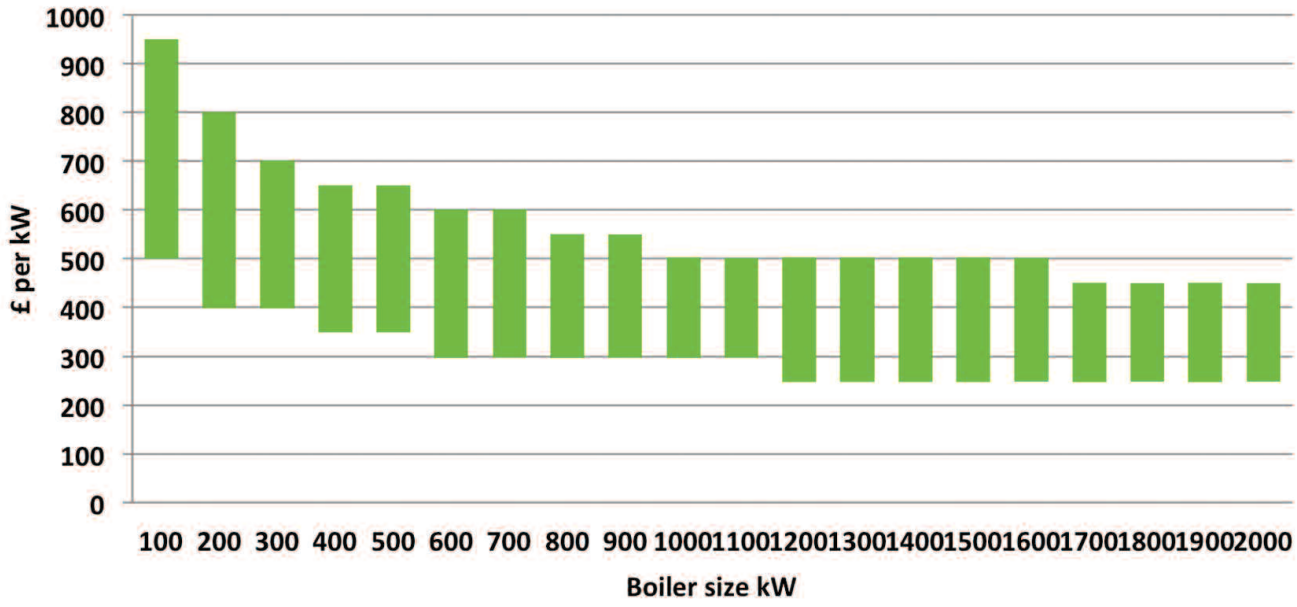
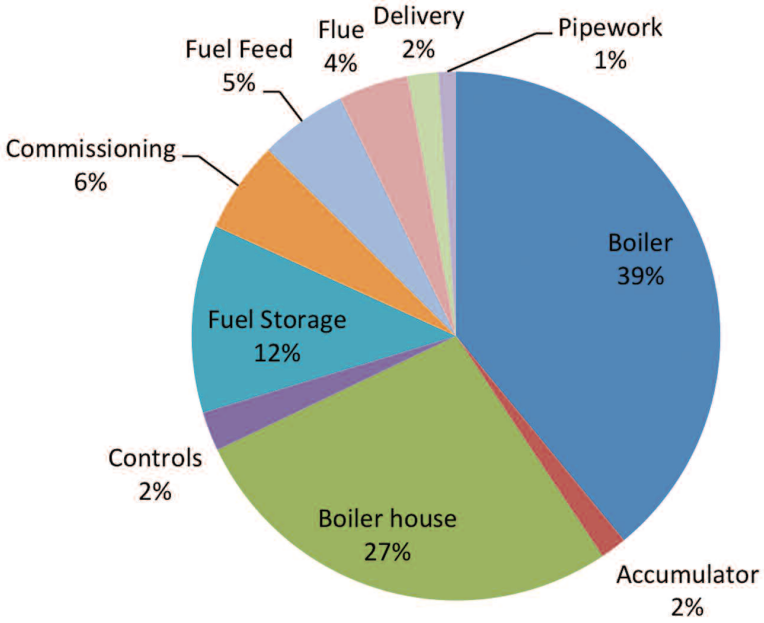
Indicative Biomass Heating Systems Costs



Capital Cost Breakdown for an Example Biomass Heating Project



From – Biomass Heating - A Practical Guide for Potential Users – The Carbon Trust
www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=CTG012

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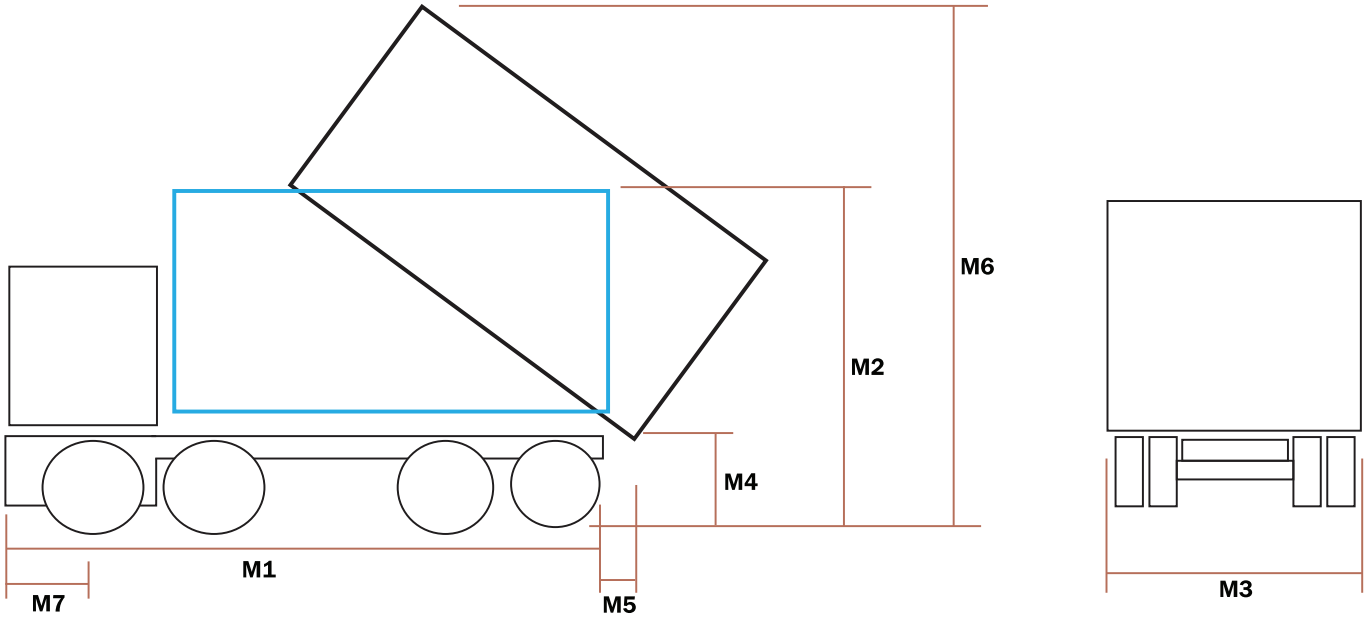
Indicative Dimension for a Range of Common Woodchip Delivery Vehicles



Delivery Vehicle	Mechanism	Capacity m^3	M1 (mm)	M2 (mm)	M3 (mm)	M4 (mm)	M5 (mm)	M6 (mm)	M7 (mm)
4 Axel Tipper	Tipping	15	9000	3300	2500	700	700	8000	700
4 axel hook lift	Tipping	30	8600	4900	2500	1200	500	8200	700
Tractor trailer	Tipping	15-24	10000	3000	2800	700	600	7000	0-1000
Articulated lorry	Walking Floor	90-110	16500	4100	2500	n/a	n/a	8200	700

From – Biomass for London: Wood Fuel Guide – London Energy Partnership
http://**www.**lep.org.uk/uploads/LEP%20Biomass%20for%20London%20Wood%20Fuel%20Guide%20Jan%2009%20FINAL.pdf

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Sample Letter to Supplier

We are undertaking a pre tender analysis for a biomass heating system by <procurement type> at our premises at ..... which is/is not in a Smoke Control Area.

We estimate that the boiler is likely to be in the range of ..... and we would expect this to run in conjunction with accumulator tank(s) in the region of ..... which would need temperature sensors to feed back to the heating controls. The system needs to have a class 2 Heat Meter and be RHI Compliant.

The system would need to be integrated with a full back up oil/gas boiler that you would need to supply.

As standard we would expect the system to include automatic ignition, automatic heat exchanger cleaning, automatic ash removal, lambda sensoring, safety heat exchanger, back end protection and an option for remote monitoring/diagnostics and weather compensated controls.

We want the system to run on <fuel type>

We anticipate the fuel store would need to be XXX cubic metres in size.

We think there is adequate space for a containerised system and are prepared to consider this option.

Can you confirm you are able;

- Able to supply and install such a heating system
- Provide references of a broadly similar plant in the UK you have installed
- Visit the site to make an assessment
- Provide a fully inclusive initial quote
- Provide outline system specifications
- Provide outline heating circuit design
- Proposed fuel store design
- Provide your calculations for on boiler and accumulator tank sizing

We can make available current fuel usage and access to the premises.

Toolkit for easy deployment of biomass heating systems in the public sector

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Reviewed by: Max Bishop
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