

Wood Fuel heating Systems ^{v1.2}

This info sheet discusses the principles of wood fuel heating systems often referred to as 'biomass heating' which simply use the process of burning wood as well as agricultural waste or other vegetative matter to produce heat. This heat can then be used for domestic hot water supply and / or provision of space heating. Wood-fuel heating systems can replace conventional central heating systems which burn fossil fuel. There are many advantages to burning natural or waste vegetative material to produce heat, principal amongst them is that the process can be low-carbon or even carbon neutral if locally sourced and processed wood or waste matter can be used. Carbon dioxide (CO₂) is absorbed by the growth of trees or other vegetable matter and then released during combustion with no net increase in atmospheric CO₂. This is known as a closed loop system.

Wood-fuel heating appliances

This info sheet focuses on systems that use some form of wood as fuel, as these are the most common and appropriate to a domestic setting. Despite its low energy concentration (especially when compared to gas or oil), wood is an attractive green fuel. As a primary heat source it produces the least amount of CO₂ per kWh (kilowatt hour) energy output, when compared to fossil fuels.

A wood burner is a closed freestanding stove designed for intermittent use which provides space heating by radiation and convection. This type of system, like a log fire, will require regular manual fuelling and de-ashing, and cannot respond quickly to increased heat needs. But it has the advantage of being relatively low-cost to install and works as a stand-alone heat source that does not require an electricity supply. Wood burners are more energy efficient than open fires, which lose as much as 80% of the heat produced up the chimney.

It is essential that good quality well dried wood is used for the best efficiency. It is possible to run this type of burner in conjunction with a conventional water cylinder and header tank to provide central heating to radiators and hot water.



Wood burner



Wood pellet burner

A wood pellet burner provides the same functionality as the **wood burner** but with more efficient combustion. It is fuelled by pellets which are made from compacted sawdust, manufactured as a by-product in sawmills. Because they are a processed fuel, moisture levels can be easily controlled during manufacture, giving moisture levels as low as 8% providing very efficient combustion. As with the **wood burner** it is possible to use a **pellet burner** to heat water in a conventional water cylinder to heat conventional radiators. **Pellet burners** have the lowest particulate emissions of all types of wood-fuel heating system. Excess heat produced by both **wood and pellet burners** can be stored for considerable periods using a 'thermal store' system, using either a large secondary water tank or the 'thermal mass' of the house. A house with greater 'thermal mass' (the ability of the house to store heat) and better insulation will help retain any heat created in the house.

A wood pellet boiler is the closest in terms of function to a conventional fossil fuel system, the most practical in use and can readily replace such a system. The wood pellet boiler can be fully mechanised, igniting on a timer system as required and using a hopper to feed the combustion chamber automatically, so that the system is very responsive to changes in heating needs. **Pellet boilers** can be set up to supply 90% of their heat to water, with the remainder used for room heating. This type of system should only need fuelling every few days, and because it burns efficiently, ash needs removing only every few weeks. To give sufficient heat output for a domestic central heating and hot water system, a pellet (or log) boiler producing between 9 and 15kW would be required dependent on property size.

There are disadvantages: **pellet boilers** are the most expensive of all the domestic wood-fuel heating options; they require annual servicing as there are moving parts; the system needs an electric supply to feed the hopper and ignition; it is essential that they are fuelled with good quality, correctly sized pellets, and you may have difficulty sourcing the pellets.

Efficiency of various wood fuelled boilers and room heaters:

Type	Maximum efficiency (%)
Open fire in grate	32
Open fire with backboiler	55
Log burning room heater	30-60
Log burning heater with backboiler	40-60
Wood pellet room heater	85-90
Wood pellet boiler	85-90
Log batch boiler	85-90
Wood chip boiler	85-90

Source: "The Whole House Book", Harris and Borer, 2005.

Costs

The basic wood burner will cost between £1,000-3,000 installed, and a pellet burner around £2,000-3,000 installed. A full heating system comprising log burner, boiler, water tank and flue, plus connections to the existing central heating equipment would cost around £10,000 installed. A more complex automated pellet boiler system could cost up to £15,000.

Logs and woodchips are likely to be cheaper than any conventional fossil fuel, while pellets, if purchased a tonne or more at a time, should be close or equal to the equivalent price for conventional fossil fuel.

The Energy Saving Trust estimates that a large household could reduce their CO₂ emissions by up to 7 tonnes annually if wood fuel burners replace solid fossil fuel burners or electric heaters, and could save between £170 and £390 per year. If you replace a gas heating system with a wood burning system you may end up paying more for your fuel.

Fuel	Price per unit (approx)	kWh per unit	Cost (pence/kWh)	Kg CO ₂ per kWh (gross)
Firewood (hardwood)	£100 per m ³		3.5	<0.1
Woodchip (assuming 30% moisture)	£60 per tonne	3500 kWh/t	2.3-3.0	<0.1
Wood pellets (loose, assuming 8% moisture)	£185 per tonne	4800 kWh/t	4.66	<0.1
North sea gas	3.9p/kWh	1 kWh	1.51-2.17	0.19
Oil	63p per litre	10 kWh/litre	1.77	0.27
Bulk LP gas	52p per litre	6.6 kWh/litre	2.93	0.25
Coal	£330 per tonne	6150 kWh/t	1.80	0.29
Electricity (std)	10p per kWh	1 kWh	7.12-8.27	0.41

Figures for wood- fuel do not take into account transport of the fuel or the CO₂ absorbed during growth. These figures vary according to source.

All log and pellet burners require a flue and any boiler system will require a vent to prevent the build-up of carbon monoxide. It is possible to use an existing chimney for use with a wood-fuel system, but it is likely to need additional lining. There is generally no requirement to obtain planning permission unless the flue will extend more than 1 metre above the height of the roof, or if it is visible on the main elevation of the property in a conservation area.

Physics corner!

Methods of heat-transfer

Heat is thermal energy. It can be transferred from one place to another by conduction, convection and radiation.

Conduction is the movement of heat energy through a solid material, and flows naturally from areas of high energy (hot) to low energy (cold).

Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Heat energy is transferred from hot places to cooler places by convection. Hot gases and fluids are less dense than cold fluids creating upward flow, or convection currents.

Radiation is the transfer of heat energy to or from a body by the transfer of infrared radiation.

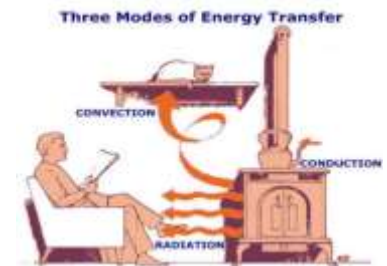


Image source: <http://bigboyyy.glogster.com/>

Financial support

The **Renewable Heat Incentive** (RHI) is a financial incentive to encourage the uptake of renewable heat technologies in your home. Plans have been announced by the Government for a payback scheme for renewable heat sources under the Government (RHI) and for a one-off 'premium payment' to help cover the cost of installation.

Phase 1 is an offering of the Renewable Heat Premium. From the end of November 2011 you could be eligible for a financial contribution towards installing a new technology. To qualify the home must be well insulated (based on the existing Energy Performance Certificate or EPC) and the owner must agree to give feedback on the performance of the system. It is expected that properties which are off the conventional gas grid will be given priority for these "premium payments".

Phase 2 would be the start of Renewable Heat Incentive payments for existing and new eligible installations. Householders would be paid a tariff for each kWh of renewable heat generated over the lifetime of the technology. The tariffs and lifetime of tariff payments will be confirmed towards the end of 2011.

According to the EST, 'Any installations you had completed or commissioned on, or after, the **15th July 2009** will be eligible for the Renewable Heat Incentive **tariffs** (phase 2) when it becomes available... providing they meet the final eligibility criteria.' [1]. You are advised to check the [Energy Saving Trust](#) and [DECC website](#) for updated information.

As with the established "Feed-In Tariff" (FIT) scheme, to qualify for the RHI scheme payments it is essential that the biomass heating system is MCS (Micro-generation Certification Scheme) approved, and is installed by an MCS approved contractor.

Questions for you

- Do you have a local biomass supplier? To minimize CO2 from transport, you should source your fuel locally.
- If you're considering a biomass boiler, do you have enough space for the boiler itself, enough room around it to load the fuel, and dry storage space for the fuel?
- Do you have a chimney, and if so, is it lined with vent material that's designed for wood-fuel appliances? If not, chimneys can be fitted with a lined flue to carry smoke from appliance to chimney, and there must also be sufficient ventilation for the stove or boiler to operate properly.
- Is your home in a Smokeless Zone? If so, under the Clean Air Act, you'll need to buy an 'exempted' appliance to burn wood. To find out if you live in a Smokeless Zone speak to your local council's environmental health department.
- Are you planning on installing other renewable sources of heat or heating systems, and if so have you sought advice as to how a wood fuel system can best be integrated into this?

Next steps: consents and quotes for the work

- You should be clear as to who is seeking planning approval (if required), or any other permissions or consents required (eg under specific covenants or restrictions contained in the title documents to your property). It should be made clear to you if you are required or obliged to carry out any duties, (such as providing feedback information, or operating or maintaining equipment.)
- Aspects such as payment dates and methods, guarantees of workmanship and equipment installed, and the timescale for the work should all be made clear to you by the company you select.

Questions to ask potential suppliers/ installers

- Are they Microgeneration Certification Scheme (MCS) accredited: this is essential if you are claiming Renewable Heat Incentive (RHI).
- Can they give you information about RHI payments, and guide you through the process?
- Do they belong to the Renewable Energy Assurance Limited (REAL) scheme?
- Can they give you information about local planning permissions needed?
- Does the system and related equipment meet the requirements of the relevant BSI British Standard?
- Are they HETAS registered? HETAS is the official body recognised by Government to approve biomass and solid fuel domestic heating appliances, fuels and services including the registration of competent installers: <http://www.hetas.co.uk>

Other questions to help you choose between installers

- Ask several potential installers to assess your home and give you a clear picture of what they are proposing, the breakdown of costs, and what the cost includes or excludes (e.g. chimney lining if needed, connection to heating systems etc) and if there are any implications for combining with other heating or renewable energy systems.
- Do they have any testimonials or references (including contact details) for previous customers?
- What are the straightforward parts of the job in your home, and are there any difficulties posed by the installations?
- What's the timescale, and what might get in the way of the timescale?
- A company belonging to the REAL scheme could provide you with written estimates of the anticipated performance of your system in an accepted format, and indicate clearly if this is based on estimates or is referenced to your actual energy use www.realassurance.org.uk/real-assurance-consumer-code.
- What 'cooling off' period is there after signing a contract with the installer, and what are your rights and obligations under the contract?

FIND OUT MORE

See case studies of householders with wood and wood pellet stoves:

- <http://ecovation.org.uk/html/designs/egerton.html> Wood burning stove in house.
- <http://ecovation.org.uk/html/designs/churchcottage.html> Wood pellet boiler and wall heating system
- <http://ecovation.org.uk/html/designs/andrewhunt.html> Victorian terraced house, existing gas central heating system was converted to run on wood fuel and solar power.
- <http://ecovation.org.uk/html/designs/17thcenturycottage.html> Integrated heating system which includes a twin-coil hot water cylinder heated by solar thermal panels, a highly efficient wood burning stove and under-floor heating.
- <http://climatex.org/articles/eco-renovation/case-study-minster-road/> Wood burning stove in semi detached Edwardian property.

Further information:

- **The Energy Saving Trust:** Always a good starting point. See their website for general Home Energy Generation information, 'Beginners Guide to the Renewable Heat Incentive' and 'A Buyer's guide to renewable and low carbon energy'; and 'A buyers guide to Wood Fuelled heating'. You can also telephone to ask questions or for ongoing guidance and support on 0800 512012 www.energysavingtrust.org.uk
- **Department for Energy and Climate Change:** Updates and information about the Renewable heat Incentive. www.decc.gov.uk
- **TV Energy:** aims to provide education about renewable energy for communities, businesses, organisations and individuals within the Thames Valley and beyond. It has useful local case studies. www.tvenergy.org / 01635 817 420.
- **United Sustainable Energy Agency:** a not for profit organization providing services to the Public Sector, Business, and individuals to help them reduce carbon, adapt to climate change and tackle fuel poverty. <http://www.usea.org.uk/>
- **TZERO:** helps identify optimal low carbon solutions suitable for your specific house type. www.tzero.org.uk/ also has details of local suppliers and installers www.tzero.org.uk/MarketPlaceExplorer.aspx, together with technical questions to ask: and you can request a quote through the TZERO site: www.tzero.org.uk/information.aspx?ID=26
- **Yougen:** a good blog and online information resource on renewable energy generation: www.yougen.co.uk/
- **Renewable Energy Assurance Limited - REAL:** this site has a list of suppliers who are members of the scheme www.realassurance.org.uk/search together with a consumer guide: www.realassurance.org.uk/consumer-guide
- **Centre for Alternative Technology (CAT):** information about Biomass heating systems and much more <http://info.cat.org.uk/biomass>
- **Log Pile:** information, suppliers of wood, pellets and chips, and examples of systems www.logpile.co.uk
- **Microgeneration Certification Scheme:** lists installers accredited for the Renewable Heat Incentive and Feed in Tariff. Tel: 020 7090 1082 www.microgenerationcertification.org
- **Biomass Energy Centre:** owned and managed by the Forestry Commission, the Biomass Energy Centre aims to be a "one-stop-shop" for information, advice and guidance on all biomass technologies. www.biomassenergycentre.org.uk
- **My Forest Service:** An innovative web-based suite of tools developed to support sustainable woodland management and local wood marketing, aiming to reconnect the wood-chain across Britain. Wood users can search for local wood products. <http://www.sylva.org.uk/myforest/index.php>

Notes: [1] Source: http://www.energysavingtrust.org.uk/Resources/Features/Features-archive/A-beginner-s-guide-to-the-Renewable-Heat-Incentive?utm_source=dyn&utm_medium=email&utm_campaign=RHI

Last revised: 2nd November 2011

This work is part of the Low Carbon Living Toolkit and is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. If you have any questions or tips to suggest please email them to us at lowcarbon@hotmail.co.uk. Whilst we have made every attempt to ensure the accuracy of this leaflet, this information should not be relied upon as a substitute for formal advice. ClimateXchange will not be responsible for any loss, however arising, from the use of, or reliance on this information. Written by Olly Downward and Jo Hamilton.



The power to make it possible

www.lowcarbonliving.org.uk