



Centre for  
Alternative  
Technology

## THE WOOD-FUELLED HOME

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The vast majority of scientists and politicians now agree that climate change is happening, and is due mainly to the release of carbon dioxide from fossil fuels. The need to both reduce our energy use and switch to renewable sources of energy is clear, but most renewables are best used for electricity generation, and it's very unlikely that this electricity could also meet our heating needs. A big contender for a renewably-heated future is wood fuel - already a sustainable and cost-effective way to both provide heat and reduce our use of coal, oil and gas.

### **Why Burn Wood?**

Biomass fuels include wood, energy crops such as oilseed rape or miscanthus ('elephant grass'), animal wastes, and other agricultural by-products such as straw and grain husks. When burned, these fuels release only the amount of carbon dioxide (CO<sub>2</sub>) that they absorbed whilst growing. Wood fuels from a sustainable sources (where replanting matches harvesting) will not cause a net increase of CO<sub>2</sub> in the atmosphere, so won't contribute to climate change - unlike the carbon in coal, oil and gas, which was absorbed over millions of years but is being released over the space of a few decades.

Carbon 'sinks' (such as planting trees to absorb carbon dioxide) may provide temporary mitigation from the threat of climate change, but they do not address the fundamental problem. To both meet our energy needs and be truly carbon-neutral we need to make sustainable use of trees as fuel, and replant them as we harvest them - so that the carbon is reabsorbed in a continuous cycle. Growing our own fuel also creates jobs and is an ideal foundation for strong, local economies.

### **No fire without smoke?**

Emissions from wood fuel contain virtually no sulphur dioxide and very low levels of nitrous oxides, so won't cause acid rain. Burning wood cleanly gives off very low amounts of smoke particulates, and many wood-fired appliances are certified for smokeless zones (for details see [www.uksmokecontrolareas.co.uk](http://www.uksmokecontrolareas.co.uk)). It's important to burn efficiently, by having properly seasoned wood (with low moisture content) and making sure that equipment is used properly. Manually fed stoves can produce lots of pollutants if operated badly.

Logs should be burned fiercely with lots of air input

until they are almost charcoal, after which the stove can be 'damped down'. Reducing the air supply too early creates lots of smoke and tar. The key is to have plenty of 'secondary combustion' of the high-energy volatile gases given off by burning wood. Larger stoves are often fitted with a 'Lamda' sensor, which regulates the amount of oxygen added, and so optimises combustion efficiency. Avoid burning treated, painted or glued wood, or non-wood waste, as these will give off toxic and polluting gases.

Building regulations require that all fuel burners have a dedicated vent to avoid producing carbon monoxide. The chimney need an insulated flue to prevent fumes condensing as tar. With complete combustion, wood burns to a small amount of ash, which (unlike coal ash) is an excellent fertiliser.

### **What equipment is available?**

There are many ways to heat with wood, from a small wood stove up to a huge boiler heating an entire community. Before switching to any new heating system it is vital to maximise the efficiency of the building. Measures such as increasing insulation, lagging pipes and draught-proofing will save money on fuel, and also on equipment - as they'll allow you to specify a smaller boiler. A combination of wood fuel and solar water heating (for hot water through the summer), can give renewably-generated heat all year round.

An open fire is not financially or environmentally beneficial - most of the heat goes up the chimney, and the rate at which the fuel burns (drawing in oxygen) will create draughts across the room that at worst can cancel out any benefit from the fire. A simple wood stove is a great improvement; it should need only one-third as much fuel, as the efficiency will be about 70%. Automated pellet stoves are more convenient than a manually-fed stove, and can even have an automatic de-ashing function. A stove with a back-boiler to heat water and perhaps supply radiators could be all you need in a small home.

Advanced wood heating systems for larger houses have been common for many years in mainland Europe and the USA, and are as efficient as modern gas boilers - converting well over 80% of the fuel into useful heat.

A 'batch' log boiler can be fired up once a day (or less often), and the heat stored in a large water

cylinder. Automated pellet boilers make wood fuel almost as convenient as gas. They are more costly, but ease of use is a big plus - in Sweden, annual pellet use has risen in ten years from almost zero to over 800,000 tonnes.

For those keen on range cooking there are specially designed wood-fired ranges, with a bigger firebox to accommodate logs. Doing everything from one appliance is not ideal, so the efficiency of these is less than dedicated boilers or stoves, but they would give the satisfaction of a wood-fired Sunday roast!

### **What's the cost?**

A log stove is likely to cost between £500 and £1000, with installation costs probably the same again. Pellet Stoves cost £1500 to £2500 plus installation - but should be eligible for a £600 grant. A log boiler will be roughly £4000. Together with a water storage tank, flue and installation the total will be about £7000. Automated Pellet Boilers are more advanced, and so is the price tag: £6,000 to £8,000 for the boiler; the total perhaps £11,000 to £12,000. Wood-fired central heating boilers should be eligible for a £1500 grant (see below), and as the use of these modern systems spreads in the UK, costs should fall. A cheaper option for larger premises, such as schools, is to retrofit pellet-burning components to an existing (e.g. coal-fired) boiler.

Also, find out about the support structure in place for the equipment you choose, before going for the cheapest. Will it be easy to get the appliance serviced annually? Are there enough plumbers or engineers with the relevant knowledge? Remember to factor in the ongoing purchase of fuel. Bought in bulk, log fuel should be cheaper than gas, oil or coal. A 15kg bag of pellets will cost £3 to £4, but a bulk delivery should be comparable to or less than fossil fuel. The Log Pile service can help you locate fuel suppliers in your area.

### **Storage**

Delivered wood should be stored for at least one year, preferably two. This 'air-dries' the wood, taking moisture content to below 25%. Bringing the logs inside for the last week or so improves them to room dryness. Multi-fuel stoves may be specified to cope with 50% moisture content, but efficiency will suffer. Compressed wood pellet fuel is dryer still, around 8% moisture. Good pellets are vital for reliable operation. Manufacturers specify pellets of a certain size, shape and moisture content. Some pellets are produced for power station co-firing, and are not of high enough quality for domestic appliances.

The space needed will depend on how big and how well-insulated your home is, but a small cottage is likely to need 8 cubic metres (m<sup>3</sup>) of logs each year, a three bedroom house maybe 12m<sup>3</sup>, and a large detached house 16m<sup>3</sup>. Pellets have a higher energy

content and store more densely, taking up less than half the space. Stoves use 0.5 to 1.5kg of pellets per hour, so a 15kg bag should last a few days. Larger systems can use chipped wood - this allows more automation than logs and is cheaper than pellets. A wood chip boiler heats several buildings at CAT; seasoned wood is delivered, chipped, and stored until it reaches about 15% moisture content. We have a supply contract to ensure a reliable supply of wood - a good idea for larger schemes.

### **Large-Scale and Community Schemes**

If a domestic system is not feasible, another way to support wood fuel is to help set up a community project. The Energy Saving Trust's Community Energy programme can help with advice and funding. The Wood Fuel Wales website is another good source of advice: [www.woodfuelwales.org.uk](http://www.woodfuelwales.org.uk)

Wood, animal wastes and energy crops are already used for large-scale electricity generation, either by themselves or via 'co-firing' in coal-fired power plant. Feeding smaller power stations with locally grown fuel is a good strategy. Instead of wasting two-thirds of the energy as discarded heat it can go into district heating networks. During 2007, CAT is installing a combined heat & power (CHP) wood chip boiler, giving 100kW of electricity & 250kW of heat.

### **Further Information**

**Home Heating with Wood** is a new book giving detailed advice on planning a wood-fired heating system. See our publications leaflet or visit [www.cat.org.uk/catpubs](http://www.cat.org.uk/catpubs)

#### **CAT Residential Course: Wood Fuel Heating**

In-depth advice on choosing and installing wood-fired heating. Include site visits.

Tel: 01654 705981; Web: [www.cat.org.uk/courses](http://www.cat.org.uk/courses)

#### **Low Carbon Buildings** Tel: 0800 915 0990;

Web: [www.lowcarbonbuildings.org.uk](http://www.lowcarbonbuildings.org.uk)

Grants for householders, small businesses, community schemes, and larger projects.

#### See also the **Scottish Renewables Initiative**

Tel: 0800 138 8858; web: [www.est.org.uk/schri](http://www.est.org.uk/schri)

#### Or in Northern Ireland, **Action Renewables**

Tel: 0808 141 2020; [www.actionrenewables.org](http://www.actionrenewables.org)

#### **Log Pile** - Information, fuel suppliers, case studies.

Tel: 01908 665555; Web: [www.logpile.co.uk](http://www.logpile.co.uk)

#### **Energy Saving Trust** - energy efficiency advice, and details of any additional local grants.

Tel: 0800 512 012; web: [www.est.org.uk/myhome](http://www.est.org.uk/myhome)

#### **Carbon Trust** - advice and support for businesses.

Tel: 0800 085 2005; [www.thecarbontrust.co.uk](http://www.thecarbontrust.co.uk)

#### **Community Energy** Tel: 0870 850 6085;

web: [www.est.org.uk/communityenergy](http://www.est.org.uk/communityenergy)