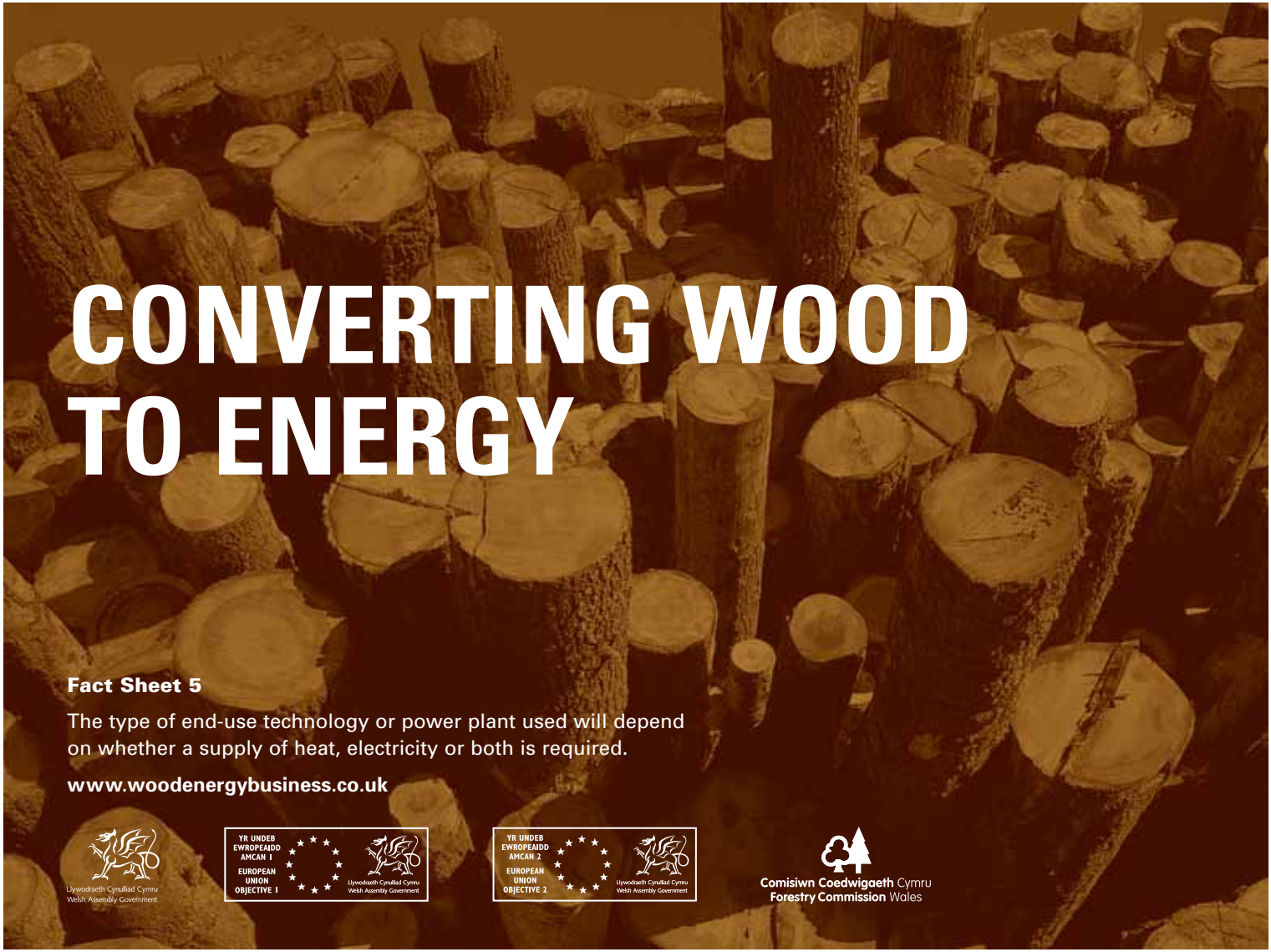
woodENERGY



CONVERTING WOOD TO ENERGY

Fact Sheet 5

The type of end-use technology or power plant used will depend on whether a supply of heat, electricity or both is required.

www.woodenergybusiness.co.uk

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

YR UNDEB EWROPEAIDD AMCAN 1
EUROPEAN UNION OBJECTIVE 1
Llywodraeth Cynulliad Cymru
Welsh Assembly Government

YR UNDEB EWROPEAIDD AMCAN 2
EUROPEAN UNION OBJECTIVE 2
Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Comisiwn Coedwigaeth Cymru
Forestry Commission Wales

Heating

Heating projects involve straight forward burning or combustion. Wood chips or pellets can be burnt. The hot gases emitted during combustion are used directly for heat. They connect to the existing pipework system, heating radiators and providing hot tap water. The benefits of purpose built wood fuelled boilers over conventional log burning is in their ease of use, scale, flexibility and cost. Modern systems involve very few inputs from the operator, with bi-weekly deliveries of fuel directly into a hopper. Many larger systems have fully automated ignition, feed and de-ashing systems. Even smaller systems will only need de-ashing every two to three weeks.

There are many types and makes of boiler available in the UK. Some from UK manufacturers and others are imported from countries with a long tradition of wood fuel heating.

District heating

Many European cities have district heating networks, a network of pipes carrying hot water buried under the pavement with other utilities. Just as you tap in for electricity and gas, so you also tap into the 'Heat Main' for hot water. As the UK does not have the pipework infrastructure in place, district heating is more suited to compact situations such as a small community, providing heat for homes, shops and the village school.

Combined heat and power (CHP)

Electricity can also be generated from wood combustion. CHP ensures the 'waste' heat given off by the electricity generating system is used for adjacent businesses or nearby housing. At a small-scale it can be used for drying wood for fuel, for heating swimming pools, greenhouses, hotels, colleges, etc. For rural industries with a demand for heat and electricity, CHP provides a reliable, low-cost heat source with the potential opportunity to sell any excess electricity to the local grid.

Electricity

Most existing wood and fossil-fuelled electricity generating plants are combustion systems where the heat is used to raise steam to drive a turbine for electricity generation. The technology is reliable, although the conversion efficiencies from primary fuel to electricity are low, ranging from 20% in older systems to over 30% in newer ones.

More advanced technologies are available, with higher conversion efficiencies, such as gasification. When wood is heated with a restricted air supply, combustible gases are produced which can be cleaned and then used to fuel either an internal combustion engine (generally small-scale gasification) or a gas turbine (more than 5MWe in size). The engine or turbine is then used to turn a generator, producing electricity.

Another high efficiency method of generating electricity is through Pyrolysis. In this system, wood is heated in the complete absence of air, and degrades to produce a liquid fuel, solid char and combustible gases. The liquid fuel is used to drive an engine or turbine which then turns a generator for electricity production. The gases can also be burnt to heat the pyrolyser. The charcoal can be burnt or sold for other purposes. This is a new technology, and has not been commercially demonstrated with wood as yet.

Co-firing

Co-firing, a tried and tested system in the USA, is the simultaneous combustion of a supplementary biomass fuel such as wood chip with coal. It is the most cost-effective means of using biomass fuels for power generation. Relatively small quantities of wood chip (up to 10%) are mixed with the coal in existing high-efficiency coal-fired power stations. These require only minor modifications to accommodate the biomass fuel. As these power stations can be up to 2,000MWe in size, the resultant reduction in greenhouse gas emissions, when replacing coal with wood, is significant.

Physical size of Wood Energy schemes

Size or energy generated	Properties served	Annual Fuel requirement	Physical size comparison	End-use technology
Heat				
15 kWth	1 family house	5 odt	Large suitcase	Boiler
1 MWth	200 houses	500 odt	Garden shed	Boiler
350 kWth	School	100 odt	Garage	Boiler
Small scale Electric				
250 kWe	250 houses	1500 odt	Small barn and fuel store	Gasifier/Pyrolyser/Engine (NEW)
1 MWe	1000 houses	5600 odt	Medium barn and fuel store	Gasifier/Pyrolyser/Engine (NEW)
1 MWe	1000 houses	8600 odt	Medium barn and fuel store	Boiler
Large scale Electric				
5 MWe	5000 houses	25000 odt	Medium barn and fuel store	Gasifier/Pyrolyser and engine or turbine
30 MWe	30000 houses	130000 odt	Large factory	Gasifier and turbine or boiler and steam turbine

odt – oven dry tonnes kWth – 1000 watts of thermal power ie. heat MWe – 1000 kW of electrical power

Source: Bio-Renewables Ltd