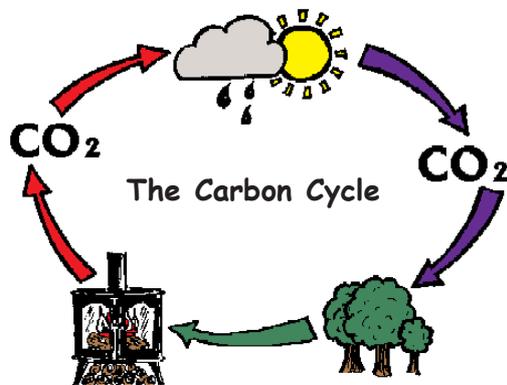


BIOMASS

Biomass is a collective term for all plant and animal material. A number of different forms of biomass can be burned or digested to produce energy. Examples include wood, straw, poultry litter and energy crops such as willow and poplar grown on short rotation coppice and miscanthus. Biomass is a very versatile material and can be used to produce heat (for space and water heating), electricity and a combination of heat and power (electricity). The UK has some of the largest examples of the use of Biomass to generate electricity in Europe.

Biomass

Plants produce biomass by a process called photosynthesis in which the energy from the sun converts carbon dioxide and water to carbohydrates and oxygen. Various types of biomass can be burned to produce energy. Examples include wood (from trees), straw, poultry litter, food wastes and a special grass called *Miscanthus*. When plant biomass is burned, carbon dioxide (a greenhouse gas partly responsible for climate change) is released into the atmosphere. However, the amount of carbon dioxide released is not more than the amount absorbed by the plant when it is growing. This is known as the carbon cycle and a simple illustration of how it works is shown below.

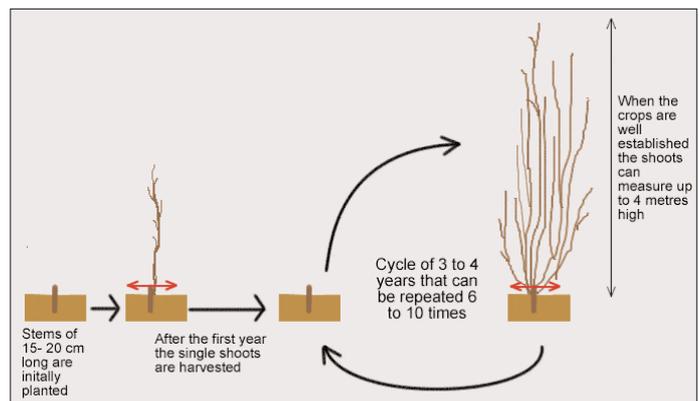


Energy from Wood

In order not to increase the amount of carbon dioxide in the atmosphere it is important that the total number of trees being grown never decreases. Wood that is to be burned as a fuel should therefore be derived from a sustainable source. Examples of sustainable sources of wood include forest residues (what is left over after timber has been extracted - provided new trees are planted to replace those that are felled), tree surgery waste and wood extracted from trees grown on a coppice system. Coppicing involves cutting the tree back down to near ground level.

The wood, which is harvested, can then be used as a fuel and the tree grows back until it is ready for harvesting again.

Traditionally, hazel and chestnut trees have been grown on this system. Today fast growing trees like willow and poplar are being grown on a Short Rotation Coppice (SRC) system. Because they are fast growing they can be coppiced every 3-4 years.



The Cycle of Short Rotation Coppice (SRC) - Willow and Poplar

In the home wood can be burned to provide both space and water heating. It can also be used to provide the water and space heating needs of larger buildings. Examples include Weobley Primary School in Herefordshire and Shenstone Lodge School in Staffordshire. Wood can also be used to heat a group of buildings via a district heating scheme. An example of this can be found at the Centre for Alternative Technology (CAT) in Wales.

Did you know?...

The new ARBRE electricity generating plant at Eggborough, North Yorkshire will shortly start producing 10MW of electricity through the gasification of wood chips derived from SRC and forestry wastes. That's enough electricity for 33,500 homes.

On a larger scale wood can also be used for the production of electricity. The main method of producing electricity from wood is a combustion plant (where the material is burned to produce steam), although there are two other possibilities, namely, gasification (where the material is heated in such a way that gases are given off) and pyrolysis (where the wood is heated in the absence of oxygen to produce a bio-oil liquid with some charcoal and gas).

Energy Crops

Some agricultural crops are grown specifically with energy use in mind. Crops such as wheat and oil seed rape are being processed to produce liquid transport fuels such as ethanol and biodiesel. Studies have shown how easy it is to substitute biodiesel for conventional diesel in existing vehicles. As the UK government is keen to promote the use of biodiesel, it recently reduced the amount of tax to be paid on biodiesel to make it more competitive with other fuels. As biodiesel gradually becomes more widely available, it is anticipated that its use in the UK will spread.

The perennial grasses *Miscanthus* and *Switchgrass* are other examples of energy crops as they produce high yield of dry matter. In theory *Miscanthus* should perform better than native plants as it has a more efficient photosynthetic process. The UK Government is currently giving grants to farmers to encourage them to grow *Miscanthus* and willow and poplar on a Short Rotation Coppice system.



Harvest of one year old *Switchgrass* at The National Energy Centre

Energy from Waste

Agricultural Waste

Other forms of biomass produced by farmers are by-products of conventional agricultural activity. They include 'dry' agricultural wastes such as straw that can be combusted (burned) to produce energy.

Did you know?...

That the World's largest straw fired power station is at Ely in Cambridgeshire. It burns 202,500 tonnes of surplus straw annually, which produces 36MW of electricity, enough for over 80,000 homes.

'Wet' wastes such as green matter or slurry can be 'digested' to produce methane in a process known as anaerobic digestion. This can then be used to fuel a gas engine to produce electricity and heat.

Did you know?...

That poultry litter, which consists of a mixture of wood shavings, straw and poultry droppings is used to generate 38.5MW of electricity at Thetford in Norfolk. It is Europe's largest generator of electricity from biomass.

Municipal and Industrial Waste

Municipal waste products need to be minimised or recycled wherever possible. However there will always be some requirement for disposal. Some forms of municipal and industrial waste can be described as biomass - such as waste food and waste wood (from the construction industry, for example). Whether the burning of other types of municipal waste to produce energy can be described as renewable is a matter of some debate. There can be environmental benefits if these wastes are used to generate electricity and/or heat such as the reduction of the demand for landfill space. However care has to be taken with emissions and residues as they can cause environmental problems.

Sponsors: The National Energy Foundation, The Department of the Environment Transport and the Regions, Student Force, PowerGen

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