

INTRODUCTION

As part of the UK's commitment to the Kyoto Climate Change Protocol, we are aiming to reduce greenhouse gases by 12.5% and CO₂ by 20% relative to 1990 levels by the year 2010. To do this our use of renewable energy, currently only 3% of capacity, will increase to 10% i.e. 4000MW electrical energy. Long-term aspirations are for a 60% CO₂ reduction by 2050 with 40% of our energy coming from renewable sources. Biomass energy is expected to provide a significant proportion of this, not only contributing to power generation but also to the generation of heat.

Biomass fuel can be defined as fuel that is derived from any organic, renewable material that can be used in either raw or processed form. Examples of biomass fuel sources include:

- Fast growing shrubs, trees and grasses. Collectively these are known as energy crops when they are grown specifically for the production of biomass energy
- Wood from off-cuts of the sawmilling industry, tree prunings, sawdust, wood chips, etc.
- Municipal wastes.

BIOMASS FROM ENERGY CROPS

The energy crops currently in use are:

Short rotation coppice (SRC): This is a perennial crop of high-yielding shrub willows, planted at high density and harvested every two to four years using specialist machinery to produce chips, billets or whole stems. An SRC coppice plantation should be viable for up to 30 years.

Poplars: The poplar varieties currently available are not well suited for coppicing, but they can be grown as single stem trees and harvested at 7 years.

Miscanthus: This is a high-yielding perennial grass. It is propagated by rhizomes and harvested annually, usually in baled form, using standard agricultural machinery. A Miscanthus plantation should be viable for at least 15 years.

Other energy grasses being developed include Reed Canary grass, Switchgrass and the Giant Reed.

Using energy crops as a source of biomass energy is advantageous for a number of reasons:

- They can provide a long-term, sustainable and secure local fuel source.
- The energy supply is not intermittent (unlike wind or solar power).
- Some energy crops, particularly Miscanthus and short rotation coppice (SRC), can provide increased biodiversity within the agricultural landscape.
- Energy crops can be grown on set-aside land without affecting the Single Payment Scheme.
- When compared to conventional agricultural crops, energy crops require significantly reduced quantities of pesticides and less cultivation.
- The production of energy crops offer opportunities for diversification, developing specialist contracting skills and improving the local economy

However they can be expensive to establish and fir Miscanthus and SRC require a long term commitment by the farmer due to the high establishment costs.

BIOMASS FROM FORESTRY

Producing biomass energy from forests provides a market for forest residues including branches, tops, small trees and low quality stems. In this way, it may help to revive the forestry industry. It can also encourage and improve the management of broad-leaved and farm woodlands by providing a market for otherwise low value timber or "waste".



Fig 1: Loading forest residues

BIOMASS TECHNOLOGY

Modern biomass technology is clean, efficient, fully automated and exempt from the Climate Change Levy. Biomass systems are available for a wide range of situations and can produce either solely heat, or a combination of heat and power.



Fig 2: Dol Llys 60kW KWB boiler

Domestic and community heating:

Biomass boilers can provide heat and hot water for single houses, farms, schools, village halls, community centres, glasshouses, etc. It is of particular use where there is a high heat demand or no mains gas supply. To heat a single house requires appx. 15kW of thermal energy and would need 5 oven dry tonnes of fuel per year. To heat a medium sized school might require 350kW of thermal energy and would need 100 oven dry tonnes of fuel per year.

Combined Heat and Power plants:

Small-scale combined heat and power (CHP) systems of 0.5MWe and above are still in the development and demonstration stage in the UK. They typically convert about 30% of the fuel into electricity and 50% into heat. They can be highly fuel efficient, with primary savings of 25% to 35% compared to conventional heating and electricity generation. They offer a low-cost heat source for industry, district heating schemes, etc combined with electricity production either for use on site or for sale to the grid. To fuel a CHP plant for a housing development or industrial estate might require 1MW of electrical energy and need up to 8,500 oven dry tonnes of fuel per year

Electricity power plants:

Purpose built power plants generating electricity on a large scale that may be used to reinforce the national grid where it is overloaded. The technology can range from direct combustion, where the steam produced turns turbines and drives generators to produce electricity, to the newer, more energy efficient methods such as gasification. Here the fuel is converted into a combustible gas used directly in a gas turbine, which then drives a generator. Gasifying biomass can be up to twice as efficient as burning it and produces fewer greenhouse gas emissions. A dedicated or purpose built biomass power plant, generating up to 40 MW of electrical energy (such as the Elean plant in Cambridgeshire fuelled by straw and Miscanthus) would need appx. 340,000 tonnes of oven dry fuel per year.

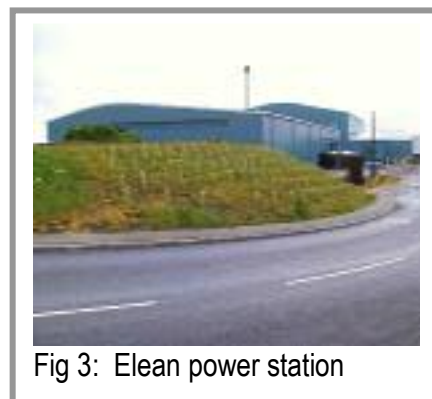


Fig 3: Elean power station

Co-firing, the process of blending and burning up to 10% biomass fuel with coal at large coal-fired power stations, is now being considered by electricity generators. For example, Aberthaw power plant near Barry is currently trialling co-firing and is actively sourcing fuel. Under the Government's Renewables Obligation, 75% of this biomass fuel must come from energy crops by 2011.

HOW MUCH DOES BIOMASS ENERGY COST?

Biomass boilers are at present more expensive than equivalent fossil fuel boilers due, in part, to the currently small market. However, in new-build schemes where grant aid is available, a biomass system can prove competitive with oil, LPG and electricity. Where mains gas is unavailable, biomass may be the most cost-effective heat source.