

# EUBIONET European Bioenergy Networks

## UK Country Report



This report was prepared by Wycombe District Council in consultation with TV Energy Ltd., the local regional energy agency for the Thames Valley and Surrey.

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## 1. Introduction

Trends in energy markets have been comparatively benign over the past 10–15 years: the UK has been self-sufficient in energy; commercial decisions have resulted in changes in the fuel mix that have reduced UK emissions of greenhouse gases; and trends in world markets and domestic liberalisation have reduced most fuel prices.

The future context for energy policy will be different. The UK will be increasingly dependent on imported oil and gas.

The introduction of liberalised and competitive energy markets in the UK has been a success, and this provides a cornerstone of future policy.

The UK's future energy strategy as addressed in the Energy Review Report ([www.piu.gov.uk/2002/energy/report/](http://www.piu.gov.uk/2002/energy/report/)) has the following elements:

- (i) energy security should be addressed by a variety of means, including enhanced international activity and continued monitoring. However, there appear to be no pressing problems connected with increased dependence on gas, including gas imported from overseas. The liberalisation of European gas markets will make an important contribution to security;
- (ii) continued attention to long-term incentives is needed, though recent levels of investment in the energy industries have been healthy;
- (iii) there is a strong likelihood that the UK will need to make very large carbon emission reductions over the next century. However, it would make no sense for the UK to incur large abatement costs, harming its international competitiveness, if other countries were not doing the same;
- (iv) keeping options open will require support and encouragement for innovation in a broad range of energy technologies. The focus of UK policy should be to establish new sources of energy which are, or can be, low cost and low carbon;
- (v) the immediate priorities of energy policy are likely to be most cost-effectively served by promoting energy efficiency and expanding the role of renewables. However, the options of new investment in nuclear power and in clean coal (through carbon sequestration) need to be kept open, and practical measures taken to do this;
- (vi) the Government should use economic instruments to bring home the cost of carbon emissions to all energy users and enable UK firms to participate in international carbon trading. Achieving deep cuts in carbon would require action well beyond the electricity sector where cuts have been concentrated in recent years;
- (vii) step changes in energy efficiency and vehicle efficiency are needed, with new targets for both. In the domestic sector, the Government should target a 20% improvement in energy efficiency by 2010 and a further 20% in the following decade;
- (viii) the target for the proportion of electricity generated from renewable sources should be increased to 20% by 2020;

- (ix) institutional barriers to renewable and combined heat and power investments should be addressed urgently; and
- (x) the Government should create a new cross-cutting Sustainable Energy Policy Unit to draw together all dimensions of energy policy in the UK.

## **2. National RES policy and role of bioenergy**

In 1990 biofuels accounted for 61% of UK renewable supply. By 1995 this had risen to 78% and by 2001 it had grown to 86% of UK supply. By contrast in 1995 wind power accounted for 1.6% of supply and this has now grown to 2.7%. The key finding is that as the market grows, both biofuels and wind increase their market share. In the period 1995-2001 biofuels have put on 8% points market share and wind has put on 1%. A more vigorous approach to the creation of heat and transport fuels markets for biofuels would of course increase the pace of growth further ([www.britishbiogen.co.uk](http://www.britishbiogen.co.uk)).

### UK policy on renewables and support mechanisms for bioenergy

The central aims underlying the Government's policy are to:

- Help the UK meet national/international targets for reducing greenhouse gas and other emissions.
- Help provide secure, diverse, sustainable and competitive energy supplies.
- Stimulate the development of new technologies.
- Help the UK renewables industry become competitive in home and exports markets
- Contribute to rural development.

The Government is proposing an initial 10-year strategy, in collaboration with industry, to help meet its aims. Specifically, it is proposing that 5% of UK electricity needs should be met from renewables by the end of 2003 and 10% by 2010, as long as the cost to consumers is acceptable. These targets are intended to act as a stimulus to industry and provide milestones for progress monitoring.

### Regional Planning and Targets

The Government aims to provide a positive strategic approach to planning for renewable energy from the regional level downwards. This will include regional assessments of renewable energy and setting regional targets for renewables. The assessments are currently being completed.

### Renewables Obligation (RO)

The new Renewables Obligation and associated Renewables (Scotland) Obligation represent a vital instrument in the Government's strategy. Introduced through the Utilities Act which received Royal Assent in Summer 2000, they will require power suppliers to derive from renewables a specified proportion of the electricity they supply to their

customers. The cost to consumers will be limited by a price cap. The Utilities Act also introduced transitional arrangements for NFFO-3, 4 and 5 and SRO-1, 2 and 3 projects.

The aim of the Renewables Obligation (RO) is to increase the contribution of electricity from renewables in the UK so that by 2010, 10% of licensed UK electricity sales will be from renewable sources eligible for the RO, subject to the costs to consumers being acceptable.

It is proposed that the obligation on each supplier will rise from 3% of sales in the first obligation period (ending 31<sup>st</sup> March 2003) to 10.4% of sales in the year ending 31<sup>st</sup> March 2011. It is also proposed that the Obligation will then remain at least constant at 10.4% of sales until March 2027, but may well be increased to meet more ambitious targets for renewables beyond 2010.

### Climate Change Levy Exemptions

Having come into effect in April 2001 under the provisions of the Finance Act 2000, the Climate Change Levy applies to energy used in industry, commerce and the public sector. With the exception of large-scale hydro power, electricity and heat produced from renewables are exempt. The aim is to provide an incentive for business to opt for "green" electricity. Revenue from the levy will be recycled to business via a cut in employers' National Insurance Contributions and extra support for energy efficiency measures.

The Levy is charged at the rate of 0.43p/kWh on electricity supplied to non-domestic customers in the United Kingdom, except where negotiated agreements have been made. Electricity from qualifying renewable sources is exempt from the Levy.

### **Grants for bioenergy**

The schemes that are available for bio-energy are as follows:

- Bio-energy Capital Grants Scheme
- Community and Household Capital Grants Scheme- Community Renewables Initiative
- Bio-energy Infrastructure Scheme

### Bio-energy Capital Grants Scheme

The purpose of the Bio-energy Capital Grants Scheme is to promote the efficient use of biomass for energy, and in particular the use of energy crops by stimulating the early deployment of biomass fuelled heat and electricity generation projects. It will do this by awarding capital grants towards the cost of equipment in complete installations.

The scheme is a joint initiative funded by the Department of Trade and Industry (DTI), and the National Lottery New Opportunities Fund (The Fund) with input from the Department for the Environment, Food and Rural Affairs (DEFRA). The Scheme will provide a common focus and entry point into the capital grant funding available from the DTI and The Fund.

The aim of the scheme is to deliver the following capacity on the ground in the next five years;

- A small number, around 3 – 5 of substantially sized, greater than 20 MW<sub>e</sub> installations that will convert energy crops and other biomass feedstocks to electricity with high efficiency, using state of the art technology.
- At least 10 MW<sub>e</sub> capacity with a preference for CHP at outputs greater than 1 MW<sub>e</sub>.
- One or more commercially scaled demonstrations of advanced technology e.g. gasification or pyrolysis, that will significantly improve the efficiency of conversion of energy crops to electricity and can look towards commercial deployment in the short to medium term.
- Several examples of biomass heating/CHP projects or clusters that will create an initial market for equipment and services and stimulate rural economies.
- A range of projects that will deliver learning benefits that will accelerate deployment in the future.

The total funding available for this round is at least £66 million, subject to sufficient quality and quantity of proposals being received under all priority areas. This comprises up to £30 million from the DTI and at least £36 million from the National Lottery New Opportunities Fund ‘Transforming Communities’ programme.

#### Community and Household Renewables Scheme

In November 2001 the Prime Minister announced the allocation of an additional £100 million of funding for renewable energy. This allocation was based on recommendations contained in a report by the Cabinet Office’s Performance and Innovation Unit (PIU). In its report the PIU recognised that “...(initiatives) will not get renewable energy off the ground unless the public extends its general support for renewable energy to support for renewable energy in local situations. This makes community engagement crucial, so that more people are either individually involved in renewable energy schemes or able to see them”. As such the PIU report recommended that up to £10 million of support be provided as capital grants specifically for renewable energy schemes that engage local communities or individual households.

The key criterion for this support were that schemes must be able to demonstrate a strong community or household interest, and that no restrictions will be placed on the types of technology employed. However, eligibility will be restricted to renewables deployed at the level of households, or buildings/ land owned by non profit making organisations.

The scheme will be administered by DTI, working closely with the devolved administrations.

In making its recommendations the PIU recognised that capital grants for community and household schemes could duplicate existing programmes and DTI are currently designing an approach that avoids such wasteful duplication.

### Community Renewables Initiative

The Community Renewables initiative is being led by the Countryside Agency, with support from the DTI, Forestry Commission, DEFRA, and the Energy Savings Trust. It will be a means of:

- supporting local community groups and organisations establish renewable energy developments which suit their circumstances, and which they can benefit from;
- integrating renewable energy developments with other activities in the countryside, to provide livelihoods, skills, income, and community development benefits;
- providing a framework for public, private, and community level bodies to collaborate in order to deliver renewable energy developments;
- establishing renewable energy developments in ways which are environmentally sensitive and which allow all relevant people and groups to shape and influence them.

Further information is available on <http://www2.dti.gov.uk/renewable/renew.htm>

### Bio-energy Infrastructure Scheme

This is a new scheme which is being drawn up by the Department for Environment, Food and Rural Affairs, National Assembly for Wales, Scottish Executive Environment and Rural Affairs Department, Department for Agriculture and Rural Development Northern Ireland and the Forestry Commission.

The scheme will help the development of the infrastructure required to harvest, store and supply biomass to energy end-users.

The exact details of the scheme, including the percentage grant, are subject to State Aid approval by the European Commission. More detailed guidance will be available once State Aid approval has been granted. The scheme is expected to be in operation in early 2003. £

The scheme is likely to include provision of grants to assist:

- the setting up of producer groups to supply biomass to energy end- users. Grants are likely to be available towards administrative set-up costs and the purchase of specialist capital equipment;
- new businesses or existing businesses to diversify into supplying biomass to energy end-users. Grants are likely to be available towards the purchase of specialist capital equipment.

3.5million is available for the UK as a whole. This money must be contractually committed within 3 years of the announcement of the scheme and spent by 2006.

### **3. Energy market and the role of biomass fuels**

#### **Energy Production**

Primary fuel production in the United Kingdom in 1999, at 298 million tonnes of oil equivalent, was 4 % higher than in 1998.

Crude oil production increased by 4 % compared to 1998, reaching a new record.

Production of natural gas rose by 10 % to reach record levels for the tenth year in succession. Gas demand was higher because of the continuing increase in demand for gas for electricity generation (an increase of 18 % between 1999 and 1998); and also because of increased exports of gas (1999 gas exports were almost three times greater than those in 1998 and in 1999, 7 % of UK production of gas was exported).

Production by the coal companies in 1999 was 10 % lower than in 1998. Deep mined production was down by 17.5 %.

Production of nuclear electricity in 1999 was 4 % lower than in 1998.

#### **Energy Consumption**

Consumption of primary fuels for energy use in the United Kingdom fell by 0.5 % in 1999 compared to 1998.

Energy consumption by final users (i.e. after conversion to secondary fuels) at 170 million tonnes of oil equivalent, was 1 % higher than in 1998. There were increases in consumption in the industrial and transport sectors, with the largest increase being in the industrial sector, an increase of 4 % on 1998. However, there were decreases in the domestic, public administration, commercial and agriculture sectors.

Deliveries of DERV fuel rose by 0.5 % in 1999 whilst deliveries of petrol fell by 1.5 %, continuing the decline in deliveries seen since 1990, reflecting in part the continuing switch to diesel-engined cars. In total, deliveries of road transport fuels fell by 1 % in 1999 reflecting the decline in petrol deliveries and the slow down in the rate of increase in deliveries of DERV fuel. Deliveries of aviation turbine fuel rose by 10 % in 1999.

The amount of electricity supplied from gas increased by 20 % in 1999 and gas now produces 39 % of all electricity supplied. This is above both coal's and nuclear's shares of 28 % and 25 % respectively. Imports of electricity (which are predominantly from France) increased by 15 %, but were still lower than the average annual volume of imports recorded in the mid 1990s.

The installed electrical capacity of combined heat and power (CHP) plants in the UK has continued to grow steadily, with an increase of 9 % in 1999 to 4,239 MW<sub>e</sub>. Just under 6 per cent of all electricity generated in 1999 was from CHP.

There was a 9.5 % increase in the amount of electricity generated from renewables in 1999. Generation from wind increased by 2.5 %; generation from hydro sources by 2 % and generation from biofuels by 23 %. Renewables provided 2.8 % of the electricity generated in the United Kingdom in 1999, up from 2.6 % in 1998 and 1.8 % six years ago in 1993. Renewables funded by the Non Fossil Fuels Obligations (NFFO)(including those whose NFFO contracts have now come to an end) accounted for 1 % of UK electricity generation in 1999.

The gross thermal efficiency of combined cycle gas turbine stations was 46 % in 1999 compared to an efficiency of 37 % for conventional steam stations. Use of combined cycle gas turbines combined with fuel switching and increasing use of renewables are contributing towards the reduction in carbon dioxide emissions. Provisional figures show a decrease in CO<sub>2</sub> emissions of 0.5 % in 1999.

## Renewable Sources of Energy

### Electricity

Electricity generation within the United Kingdom is dominated by the use of non-renewable fossil fuels: two-thirds of all electricity generated comes from coal and gas. It is the growth of gas-fired generation - from a negligible amount in 1991 to around a third in the late 1990s - which is a major reason for the decline in greenhouse gas emissions. In the EU as a whole, two-fifths of all electricity was generated by coal and gas in 1998, while a third was from nuclear fuel, another non-renewable source.

In the future it is expected that sources such as biomass, wind and solar will play a larger role in more EU countries, including the United Kingdom, as part of the drive to achieve EC targets for the reduction of greenhouse gas emissions. The UK Government has set a target of 10 % of all UK electricity being from renewable sources by 2010, with an interim target of 5 % by 2003. The proportion has already increased from 1.7 % in 1989 to 2.8 % in 1999.

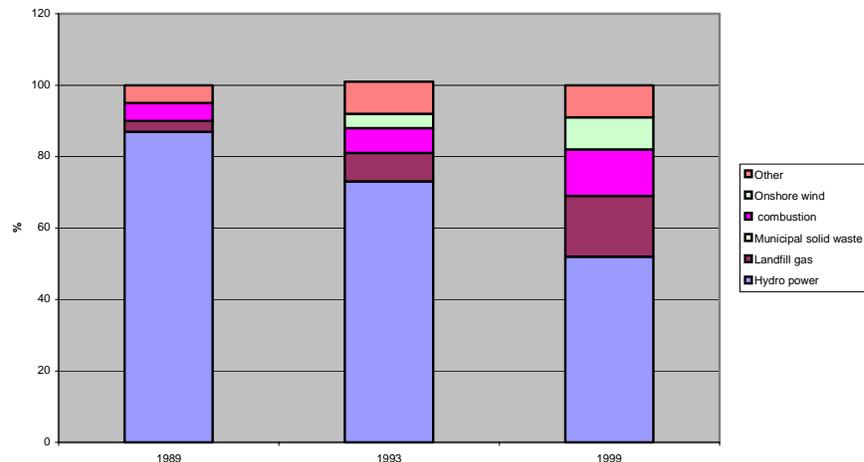


Figure 1. Electricity produced by renewable sources. Source: [www.statistics.gov.uk](http://www.statistics.gov.uk)

### CHP from Renewables

The main renewable sources that are used for CHP in the UK are biofuels particularly sewage gas, other biogases, clinical waste and municipal waste.

The following table presents the types of CHP installation using renewables as well as the electrical and the heat capacity by type of installation.

Table 1. Types of CHP installation using renewables as well as the electrical and the heat capacity by type of installation. Source: Digest of UK Energy Statistics 2001, DTI

	1996			1997			1998			1999			2000		
	GWh	MW <sub>e</sub>	MW <sub>th</sub>												
Back pressure steam turbine	282	16	53	284	16	54	289	16	54	119	13	46	119	18	46
Gas turbine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Combined cycle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Reciprocating engine	1707	88	145	1692	87	149	1651	91	142	1635	92	150	1417	86	138
Pass out condensing steam turbine	202	13	30	202	13	30	301	17	52	466	18	57	466	18	57
<b>Total renewable fuels</b>	<b>2190</b>	<b>117</b>	<b>229</b>	<b>2178</b>	<b>117</b>	<b>233</b>	<b>2241</b>	<b>124</b>	<b>248</b>	<b>2219</b>	<b>123</b>	<b>253</b>	<b>2002</b>	<b>122</b>	<b>241</b>

In the following table, the CHP fuelled with renewables by sector is presented in GWh. It is clearly shown that renewables are highly used in the sewage treatment sector with 1,397 GWh out of a total 1986 GWh in 2000 (70%).

Table 2. CHP renewable fuels: Use by sector (GWh). Source: Digest of UK Energy Statistics 2001, DTI

Sector	1996	1997	1998	1999	2000
Food, beverages and tobacco	2	2	2	2	2
Sewage treatment <sup>1</sup>	1681	1666	1619	1599	1397
Other	507	507	608	603	587
Total	2180	2175	2229	2204	1986

## Resources Potential

### Energy Crop

The NFU and CLA suggest that the land potential for energy cropping will be between 25 and 39% by 2020. If 5 million HA of agricultural land became available, more than 200 TWh could be produced – more than 50% of current consumption. The new emphasis in CAP on rural development and environmental improvement should greatly assist the development of energy crops.

### Forestry and Arboricultural By-products

The UK Timber Industry harvests about 10 million tons of wood each year, leaving about 5 million tons on the forest floor. The processing of this harvest produces around 4 million tons of sawdust and offcuts. By 2010 the harvest will rise to 15 million tonnes.

### Farming By-products

Production of 30 million tons of food consumed in the UK results in an equivalent amount of surplus biomass such as straw, waste vegetables and by-products such as starch and fibre. If only a proportion of this became available for energy use, for example

<sup>1</sup> It is worthwhile to mention that in CHP plants for the sewage sector renewable fuels account for more than 85%, the other fuels being fuel oil and natural gas.

6 million tons, this could replace 10% of UK's petrol consumption, reducing greenhouse gas emissions in the transport sector by 8%.

### Organic Waste

Households are prodigious biomass producers producing 20-30 million tons of surplus biomass each year from gardening and wastage from daily food preparation.

Segregatable organic waste from municipal sources could amount to another 20 million tons.

Animal slurry can be turned into useful energy in AD plants. A major fertiliser manufacturer estimate that total EU slurry arisings would be sufficient to replace over 60% of current European fertiliser sales.

There is urgent need for a full inventory of these resources and the appropriate paths to market.

Recognition of the role of household, municipal and industrial organic wastes in the biofuels economy is essential. They can contribute to the carbon-recycling strategy, and, crucially reduce the average cost of biomass feedstock, which is one of the main barriers to the rollout of a biomass energy programme, all at no cost to Government and huge benefit to the community.

Modern separation technology is clean and efficient and deserves promotion by Government.

## **Bioenergy Success Stories**

### World's largest straw-fired power station opened

A £60 million electricity generating station that uses new techniques to burn surplus straw was officially opened at the end of January. Developed by EPR Ely and located in Sutton near Ely, the 36MW plant will generate, and feed directly into the National Grid, over 270GWh/year of electricity - enough power to heat and light 80,000 homes. The power station will burn around 200,000 tonnes/year of straw collected from farms within a fifty-mile radius. The plant comprises two 18m-high straw barns flanking a 25m-high central boiler. To blend in with the surrounding business park, the design resembles existing warehouse buildings.

At the opening, Brian Wilson, Minister for Energy, said "This power station represents a milestone in the Government's drive for renewable energy. It is the UK's first power station to use any agricultural crop as its fuel. The power station's fuel supply, logistics, project development and financing are all UK based.

"The DTI is providing substantial support for energy crops. The Renewables Obligation will provide support to power stations using biomass. Also, the Government is providing planting grants for farmers and capital grants for new power stations to convert these crops into electricity. Over a three-year period, the DTI will give a boost to bio-energy worth almost £85 million pounds."

### Biomass-fuelled technology receives a boost

The Government has announced a £2.9 million grant to develop the next generation of biomass-fuelled technology. The grant, which is the largest awarded by the DTI Renewable Energy Programme for a biomass project, will support a £7.3 million

development programme involving Alstom Power UK Ltd and First Renewables Ltd. The DTI-sponsored project will push forward the development of technology to generate electricity from energy crops and other fuels from farming and forestry.

The project consortium will work on extending the technology and techniques that will lead to commercially viable, grid-connected power stations that will help the UK reach its renewable energy and greenhouse gas targets. The industry estimates that around 1000MW of new biomass projects will be required to contribute to the achievement of the 10% renewables target by 2010 and it is hoped that the use of biomass fuels in the form of traditional forestry, energy crops and crop residues will provide a much needed boost for the agricultural sector.

The project will build upon the successes of the ARBRE project, the first commercial wood-fired power station in Europe to utilise high-efficiency gasification technology.

The ARBRE project team, including Alstom Power UK Ltd, is led by First Renewables Ltd and this investment is the ideal platform on which to build the second-generation programme. It will scale-up the design by a factor of five, improve the performance of the concept and develop a gas turbine adapted specifically for the application.

#### *UK's first large-scale anaerobic digestion plant*

Farmatic UK has successfully commissioned the UK's first large-scale anaerobic digestion plant at Holsworthy in Devon. The plant, a first in the UK, will process 146,000 tonnes of slurry from 28 local farms and food waste from processors in the South West. Methane gas from the digested slurry & food waste will fuel two generators and the power generated will in turn be sold to the National Grid.

The excess heat from the generators will be sold to a new district heating system planned to start next year.

The anaerobic digestion plant will provide a boost to local farmers and benefit the local environment - processed material which has been pasteurised will be safe for farmers to spread on their fields as a valuable bio-fertiliser.

This design of plant which is the first of its kind in the UK, has already been successful in Germany and Denmark.

#### **4. References**

1. [www.britishbiogen.co.uk](http://www.britishbiogen.co.uk)
2. [www.dti.gov.uk/NewReview](http://www.dti.gov.uk/NewReview)
3. [www.piu.gov.uk](http://www.piu.gov.uk)
4. [www.statistics.gov.uk](http://www.statistics.gov.uk)