Briefing

Friends of the Earth Cymru

Cyfeillion y Ddaear Cymru

Stop Global Warming

Why You Should Say Yes to 6TWhrs/year of Renewable Energy in Wales by 2010

Friends of the Earth Cymru inspires solutions to environmental problems, which make life better for people

Friends of the Earth Cymru:

- is dedicated to protecting the environment and promoting a sustainable future for Wales
- is part of the UK's most influential environmental campaigning organisation
- is part of the most extensive environmental network in the world, with over 60 national organisations across five continents
- supports a unique network of campaigning local groups, working in communities across Wales
- is dependent upon individuals for over 90 per cent of its income.

To join or make a donation call us on 0800 581 051

Friends of the Earth Cymru
33 Castle Arcade Balcony Cardiff CF10 1BY
Tel 029 2022 9577 Fax 029 2022 8775 Email cymru@foe.co.uk Website www.foecymru.co.uk

Friends of the Earth Limited Registered in London No 1012357
Registered office 26-28 Underwood Street London N1 7JQ

Printed on paper made from 100% post-consumer waste

July 2002

Introduction

Countries worldwide including Wales are experiencing more floods, storms, droughts and other damaging changes in weather patterns directly as a result of burning coal, oil and gas in power stations, homes, industry, vehicles, aircraft, etc around the world.

This is because the exhaust gases from chimneys and vehicles, known as greenhouse gases, are causing the world's atmosphere to warm up. This warming in turn is causing global weather patterns to change and sea levels to rise. This heating is called global warming and is causing climate change. Worryingly, these adverse weather changes and sea level rises are predicted to get worse, much worse, in the coming decades if all countries do not minimise their coal, oil and gas use.

Millions of people around the world have already been affected to some degree by global warming including in Wales. But by 2050 there may be well as many as one hundred and fifty million refugees on the move from flooding coastal regions or spreading deserts. Regional wars could easily be sparked from such enforced migrations. The Chartered Institute of Insurers estimate that weather related insurance claims may rival global GDP by 2065.

Most Governments around the world are becoming concerned about climate change and are signing up to a global commitment to reduce their greenhouse gas emissions, with the notable exception of the USA. This agreement is called the Kyoto Protocol, named after a city in Japan where international talks were held. Wales as part of the UK has signed up to the agreement.

So how does a country minimise its use of oil, coal and gas ?

Firstly its people should use energy efficiently. Secondly, the energy that is needed should be generated from so called renewable energy technologies. All the energy needed globally can be generated from harnessing the natural energy within or from the sun, wind, crops, tides and waves. The world's vast natural energy resources can be converted by renewable energy schemes to electricity, heat or hydrogen fuel. Numerous renewable technologies are quickly being developed and are likely to generate clean and safe energy at similar or less cost than fossil fuels very soon. Indeed, some technologies such as wind turbines can generate electricity more cheaply than coal and even gas now, and even more so in the coming years.

Some people say nuclear power is needed but Friends of the Earth and many other organisations, governments, and people oppose any new construction of nuclear power stations due to concerns about financial costs, terrorist threats, accidents and long-term storage of radioactive waste.

Developing renewable energy technologies would create more jobs in new innovative industries and would help to make Wales more self sufficient in clean and safe energy in an uncertain world. To minimise dangerous global warming we must minimise our use of oil, coal and gas and switch to energy efficiency and renewable energy generation.

The Benefits of Renewable Energy for Wales

Wales has abundant natural energy resources that can be harnessed by renewable energy technologies to generate electricity, hot water and hydrogen fuel. Indeed, Wales has some of the highest tidal ranges in the world and the UK has about a third of Europe's wind energy resource.

Much if not most of this green or renewable energy resource can be harnessed and delivered to consumers at prices that are competitive with if not, significantly less than, the costs of oil, coal and gas fuels. Other advantages of renewable energy are numerous and important. Renewable technologies generate energy cleanly and safely, emitting only small emissions of greenhouse and acid rain gases or other air pollutants.

Renewable energy schemes pose minimal opportunities for terrorists, in total contrast to nuclear power facilities. Renewable energy costs are stable whereas fossil fuel prices can vary due to world events, particularly in the Middle East. Much of Wales(s energy needs can be generated indigenously forever, improving self sufficiency and security of supply. Most renewables create more jobs per unit energy than fossil fuel or nuclear power, and in a more flexible and widely distributed pattern across urban and rural areas.

Renewable energy schemes generally:

? are cost competitive if not cheaper than fossil fuels and nuclear power (onshore wind significantly so)

? emit few greenhouse gases unlike fossil fuels

? are relatively very clean and safe, emitting no or few damaging and costly acid rain gases or toxic air pollutants

? are an indigenous or self-sufficient and secure source of energy forever

? leave no toxic and expensive legacy of long-term radioactive waste and future waste management responsibilities

? would be widely distributed and non toxic offering difficult and far less tempting targets for terrorist attack than nuclear facilities

? give price stability, being little affected by world events and oil prices

? create more jobs per unit of energy than fossil fuel or nuclear generation

? would be widely dispersed in rural and urban areas providing wide economic opportunity for community involvement, financing and profit

Public Consultation on Welsh Energy Policy

The Economic Development Committee of the National Assembly for Wales has just conducted a Public Consultation on Renewable Energy in Wales. This Briefing forms part of Friends of the Earth Cymru's response to the Consultation. A more detailed consultation response has been sent to you on email.

Considering the problem of global warming the Committee recommends 'that the National Assembly for Wales recognises that over the next twenty to fifty years it will be necessary to move towards a zero carbon electricity system.' This may mean little use of coal, oil or gas for electricity generation by 2050. The Committee also recommends the NAW seeks to develop Wales's indigenous renewable resources and says that renewable energy is an industry in its own right and one which can create many clean and safe jobs. Friends of the Earth Cymru agree with these analyses and recommendations. We also think that targets and commitments should be set to aid policy implementation.

Targets and Commitments for Production or Demand

Targets can be expressed in different ways and can mean different things to different people. A 'target' can be very different to a 'minimum commitment'. A target can be used to set planning framework and funding policy. A minimum commitment indicates the minimum level to be achieved within that framework and policy.

Friends of the Earth Cymru estimate that somewhere between 3.8 to 10.2 TWhrs/year of electricity could feasibly be generated by renewable energy schemes by 2010 (see table below). Consequently, we think it reasonable that a target of 6 Tera Watt Hours per year by 2010 is set by the Assembly (equivalent to 30% of current Welsh electricity DEMAND or 20% of current PRODUCTION).

THIS TARGET DOES NOT INCLUDE LARGE TIDAL LAGOONS OR A LARGE WINDFARM IN THE CAMDDWR REGION OF MID WALES.

ANY CONTRIBUTIONS FROM SUCH LARGE SCHEMES SHOULD BE ADDITIONAL TO THE 6 TWHR/YEAR TARGET

We also propose that a 2010 MINIMUM COMMITMENT to 1.2 TWhrs/year generation by onshore wind turbines and 0.6 TWhrs/year from biomass technologies is adopted by the Assembly. These commitments would help establish a regional wind energy planning framework and any fiscal support policies for biomass schemes.

We think that 6 TWhrs/year is a realistic possibility which could be encouraged by supportive economic development policies. Indeed, it could actually be exceeded by some margin depending particularly of positive environmental assessments of new offshore generating technologies. The table below details what we regard as the likely range of feasible contributions to electricity demand up to

2010 from the various renewable energy technologies.

Feasible Range of Electricity Generation by 2010

Each 0.2 TWHrs/year is equivalent to 1% of current Welsh demand

Onshore Renewables	Possible TWhrs/year	% of Demand	Existing Schemes
Onshore windfarms	1.2 - 2.2	6-11 %	2.3 %
Biomass schemes	0.6 - 1.0	3-5 %	~
Hydro schemes	0.2 - 0.4	1-2 %	1 %
Solar photovoltaic (PV)	0.2+	1+ %	~
Landfill tips and mines gas	0.2 - 0.4	1-2 %	1 %
Offshore Renewables			
Offshore windfarms	0.8 - 2.2	4-11+%	~
Marine current turbines	0.6 - 1.0	3-5 %	~
Tidal (lagoon) generators	0.2 - 2.8	1-14 %	~

Our overall range estimate is 19-51% or 3.8-10.2 TWHrs/year by 2010. Consequently, we consider that 6 TWHrs/year is a reasonable target comprising 3 TWhrs /year from onshore schemes and 3 TWHrs/year from offshore schemes.

6 TWhrs/year by 2010 is an aspirational target because the Assembly does not currently have all the powers needed to deliver such targets due to limited devolvement of political powers, especially in offshore generation. But the Assembly can put in place supportive policies and funding while calling on the UK government for the necessary powers to be devolved.

Friends of the Earth Cymru agrees with the Committee that a target should be expressed in tera watt hours per year (TWhrs/year). For explanatory purposes it would also be useful to express any target in percentage terms. However, we think that any percentage target should be set in the context of current Welsh electricity demand rather than overall electricity production in 2010 Wales. This is because a 2010 forecast has to make predictions about ageing large power stations like Wylfa, and future electricity exports to England. Also, the National Assembly has a legal duty for sustainable development and Wales should clearly express and address its own ecological footprints.

If Wales achieves 30% electricity generation by renewables in eight to nine years time then it will, alongside Denmark, create a strong lead by example in the switch to green electricity. And in the process the renewable energy industry will support a healthy fabric of employment in rural hills, Valley towns, historic ports and seaside resorts.

What Does A 6 TWHr/year Renewables Target Mean On the Ground and in the Water?

Friends of the Earth Cymru estimate that by 2010 over 30% of electricity demand in Wales (6 TW

hours/year out of 19.5 TWhrs/yr) could feasibly be supplied by renewable energy schemes. This estimate may sound a lot but as it happens, the switch from coal to gas power generation in the 1990s represented a shift of 33% of UK generation capacity (25 Giga Watts or GW). And over the next 20 years almost half of all the power stations in England and Wales (38 GW of capacity) are expected to be retired. In comparison, overall demand in Wales requires an average of 2.2 GW of generating capacity producing 19.5 TW hours/year.

The successful deployment of the various different renewable technologies will depend to some degree on Assembly policies and funding. Assembly support would be demonstrated if it sets a high target for renewable energy generation by 2010.

Below we describe the various technologies and the basis for our estimates of their contribution to current Welsh electricity demand by 2010. Energy efficiency improvements can reduce current demand in which case the percentage contribution from renewable schemes would be higher than stated below. For example, electrical efficiency improvements of 33% by 2010 would mean that the 6 TWhrs of renewables would supply 45% of Welsh demand. Either way our proposed target is for 6 TW hours/year by 2010.

How 6 TWHrs per year of Welsh Electricity Demand Could Be Generated by Renewables By 2010 (15% onshore and 15%+ offshore)

Onshore Renewables

Onshore Windfarms: Our estimate 6-11% of current Welsh demand by 2010 (1.2-2.2 TWhrs/yr)

Currently, there are about 340 medium sized wind turbines in 15 windfarms in Wales (mostly in the 330kW to 600kW size totalling 153 MW of Installed Capacity). They supply an average of 46 MW or about 2.3% of Welsh demand.

More schemes are currently being drawn up or are within the planning system which could feasibly supply an additional 4-8% of demand by 2010. The Cefn Croes scheme alone (39x1.5 MW turbines) in mid Wales could supply nearly 1%.

Based on DTi projections, the British Wind Energy Association estimates that an additional 290 MW of installed capacity (440 MW IC overall) is needed in Wales to meet the UK Government's Kyoto commitments. This would probably require somewhere between 290 – 390 additional turbines (eg 340 turbines of 850kW capacity) onshore in Wales. The large Cefn Croes turbines in mid Wales and the Tir Mostyn scheme awaiting approval in Denbighshire would account for about 80 MW of the additional 290 MW of capacity, or nearly 100 turbines in the example above.

The 440 MW of windfarms would supply 6% of Welsh demand excluding the benefit of locally generated electricity (termed embedded generation*). This benefit occurs because locally generated electricity from windfarms and other renewables avoid some of the transmission losses incurred along the National Grid.

If this embedded generation benefit is included, and also a contribution from smaller and domestic

wind generators (1kW-50kW), the total contribution from onshore windfarms and turbines in Wales could reach about 7% of current Welsh demand.

* The DTi are considering ways in which embedded generation can be fiscally credited.

To enable regional and Local Authority planning decisions to be taken in a national context Friends of the Earth Cymru think that a MINIMUM COMMITMENT should be made by the Assembly.

Friends of the Earth Cymru support an onshore wind target of 440 MW Installed Capacity or a MINIMUM COMMITMENT to 1.2 TWHrs/year by 2010. We would also welcome further schemes that are publicly supported and have a satisfactory Environmental Impact Assessment.

This could include a very large 330 MW windfarm which may be proposed by the Camddwr Trust if it is supported by a majority of the public in the region. The largest Camddwr scheme would itself supply nearly 5% of current Welsh consumption. When turning at full speed, such a 330 MW windfarm would generate more electricity than the Trawsfynydd nuclear power station averaged.

Biomass Schemes: Our estimate 3-5% by 2010 (0.6-1.0 TWhrs/yr)

Biomass is the name given to schemes which burn or convert forestry wastes, wood wastes and energy crops to produce electricity, hot water, biofuels or hydrogen. New techniques are being developed which could result in many farms diversifying to growing energy crops and providing much needed rural income.

The NAW commissioned SEL resource study has estimated significant potential which could greatly benefit rural Wales. However, existing technologies can have traffic and other drawbacks, and can be relatively costly. Even so, Assembly supported and innovative schemes could account for more than 5% of Welsh demand by 2010.

To stimulate biomass technology and deployment Friends of the Earth Cymru propose that the Assembly should make a MINIMUM COMMITMENT of 0.6 TWhrs/year by 2010 (3% of current electricity demand) to be generated by biomass schemes.

Hot water production of upto 1 TWhr/year is not included in this assessment. The commitment would ensure that biomass development is not undermined by deployments of other well developed and or less expensive renewables.

Hydro Schemes: Our estimate 1-2% by 2010 (0.2-0.4 TWhrs/yr)

There are a number of medium and small scale hydro schemes in Wales. Significantly increasing the overall output from hydro schemes would be limited by ecological damage caused by over abstraction from sensitive watercourses. Resource studies have estimated that upto about 2% of current demand would be achievable.

Solar Photovoltaic: Our estimate 1+% by 2010 (0.2+ TWhrs/yr)

Solar photovoltaic (PV) systems generate electricity from the sun's light. Solar PV systems be it panels or tiles are still relatively expensive. Systems are best deployed in new building construction to keep costs down. Demonstration and grant aided schemes may drive up the overall capacity. Unless there are significant cost breakthroughs the total output by 2010 could remain quite small. However, the Assembly could support indigenous development work and specify PV on new public and private

sector building.

Other Technologies: Our estimate 1-2% by 2010 (0.2-0.4 TWhrs/yr)
Landfill tips and mines produce and leak methane, a powerful greenhouse gas. The methane can be collected and burnt to provide useful energy. Existing schemes supply about 1% of demand and further schemes are estimated to increase this to about 2%. There may also be other demonstration technologies by 2010 such as geothermal and offshore wave power schemes.

Offshore Renewables
The Assembly has little direct planning power over offshore schemes which are the province of the DTi and Crown Estates. However, further devolution of planning powers and investment in shore side employment opportunities could encourage deployments of several types of offshore devices and schemes. Our overall estimate for offshore generation is at least 15% of current Welsh demand by 2010, though 25% may be possible.

Offshore Windfarms: Our estimate 10+% of current Welsh demand by 2010 (2 TWhrs/yr)
There are currently three proposals for offshore windfarms around the Welsh coast, each of 30 turbines, two in Liverpool Bay and one off Porthcawl. The turbine sizes have not been decided yet but 5MW turbines are under discussion by at least one developer. So, the output from the three farms could average over 4% of Welsh demand. A second round of offshore licences are likely before 2010 which could result in the total output exceeding 10% of Welsh demand. There is a large wind energy resource offshore though electricity generated by offshore windfarms of about twice the price of that from onshore windfarms.

Marine Current Turbines: Our estimate 4-5% by 2010 (0.8-1.0 TWhrs/yr)
Marine Current Turbines: Our estimate 4-5% by 2010_Sea currents, especially around headlands can be very powerful. To extract energy from such currents two different devices are being built and tested off the Devon coast and in Milford Haven. Commercial schemes could be ready by 2005 and generation costs may be quite favourable. Assembly investment could possibly realise manufacturing as well as deployment and maintenance jobs in peripheral ports such as Holyhead and Pembroke Dock. Exploitable currents exist off the north coast of Anglesey, Penllyn and south Wales.

Tidal Lagoon Generators: Possible schemes may generate 1-14% by 2010 (0.2-2.8 TWhrs/yr)
The tidal range of the Severn Estuary is the second highest in the world, and Liverpool Bay also has high ranges. Energy can be extracted from the rising and falling tides by trapping and releasing water in large rock walled lagoons. The generator walls would be very similar to a rock breakwater and would house water turbines within their structure.

The world's first scheme is being planned for Swansea Bay. A larger scheme enclosing about 20 square miles is also being considered for Liverpool Bay. The coast facing wall would typically be about a mile or so offshore and could also provide both habitat and coastal defence.

A small number of large schemes in the Severn Estuary could rival the output of the proposed Severn Barrage but would cover only half the area and would be much cheaper. The developers say that tidal generators are commercially attractive and would not require public funding.

Whether such large schemes are given approval will very much depend on site specific environmental assessments and so are additional to our 30% target. Assembly support in principle to tidal generators

could assist in realising world leading schemes.

Summary

The world-wide generation of electricity and energy by renewable energy technologies is a major part of the solution to global warming, the Earth has abundant natural energy resources. Wales is particularly fortunate to have large wind and tidal resources. Renewables are also cost-competitive, clean, safe, secure and can benefit people, wildlife and planet in numerous important ways.

Renewable energy technologies also present a variety of significant economic opportunities of sufficient potential for Wales to experience a green industrial revolution, similar to the wind industry in Denmark.

For a country with a world-leading remit for sustainable development the social, environmental, economic and political opportunities should not to be missed. Setting energy generation targets and minimum commitments as part of a supportive planning and policy framework would enable the opportunities to be realised.

For all these reasons Friends of the Earth Cymru calls on the Assembly to do all within its powers and influence to seize such opportunities.

Annex A

Wales Electricity Facts and Figures for Comparative Purposes:

To facilitate easier comparison between different technologies the table below lists the AVERAGE annual output of various electricity generating stations, schemes, proposals, and possibilities in Wales (this is not a comprehensive list). Note that some power is exported to England and CF means Capacity Factor which takes account of the intermittency and or down-time of the various technologies:

Generation required to supply current electricity demand Which would comprise a combination of the generators below:	**2,200 MW**
Connahs Quay CCGT (1,400 MW) assuming 90% CF	1,260 MW
Aberthaw Coal (1,500 MW) assuming 30% CF	450 MW
Wylfa nuclear station rated at 1,000 MW (average to date)	660 MW
Trawsfynydd nuclear station, closed (lifetime average)	300 MW
Windfarms Include:	
Llandinam (103 x 300kW turbines)	9.3 MW
Parc Cynog (5 x 600kW turbines)	1.0 MW
Total windfarms constructed (onshore)	46.0 MW
Mynydd Clogau (17 turbines) Approved	3.0 MW
Cefn Croes Approved	17.6 MW
Tir Mostyn Awaiting Decision	6.4 MW
Llandinam Extension (23 turbines) Proposed	6.3 MW
Camddwr Trust (165 x 2MW turbines)Possible Proposal	100 MW
BWEA and current FOE C onshore target by 2010	**135 MW**
Offshore Wind Resource	? Large MW
First Offshore Tranche (3 farms of 30 x 3MW turbines)	84 MW
Subsequent Tranches (each farm of 30 turbines each 5MW rating)	50 MW
Other technologies: (? - Resource Assessments needed)	
Marine Current Resource (various locations)	? 100-1,000 MW
Tidal Lagoon Generators (Severn Estuary resource)	? 100-2,000 MW
Swansea Bay Tidal Lagoon Generator Possible Proposal	20 MW
Rhyl Lagoon (large 20 sq mile scheme) Possible Proposal	265 MW
Severn Barrage proposal	2,170 MW
Dinorwig Pumped Storage (for 5 hours)	288 MW
Note again: these outputs are AVERAGE output not Installed Capacity	

Annex B

Government Energy Review 2002 - Unit Cost Estimates by 2020 (PIU Report)

Below are the Unit (kWhour) electricity generation cost range estimates for 2020 for various electricity generating technologies as forecast by the Government's Cabinet Office Performance and Innovation Unit. Note that a typical household consumes over 4,000 Units per year costing about 7 pence per Unit from the electricity provider.

Onshore wind	1.0 - 2.0	pence per kWhr
Gas	3.0 - 3.5	(inc 1p for sequestration)
Offshore wind	2.0 - 4.0	
Tidal Flow	2.5 - 4.0	
Near Shore Wave	3.0 - 4.0	
Energy crops	4.5 - 6.0	
Offshore wave	4.0 - 6.0	
Solar PV	10.0 - 16.0	
Micro CHP	2.5 - 3.5	
Large CHP	< 2.0	
Nuclear	3.0 - 4.0	
Coal (IGCC)	3.0 - 3.5	
Coal	3.0 - 4.5	

Sequestration means that the carbon dioxide gas not released to the atmosphere (eg pumped into old oil and gas wells) so as not to cause a global warming effect.