



**Friends of
the Earth
Cymru**

**Cyfeillion
y Ddaear
Cymru**

**Response to the National Assembly for Wales
Economic Development Committee Report on
the review of energy policy in Wales Part 2:**

Energy Efficiency

**Response by
Friends of the Earth Cymru
March 2003**

Friends of the Earth Cymru

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.

Executive Summary

Friends of the Earth Cymru fully support the National Assembly in their commitment to a sustainable energy policy. We look to the Welsh Assembly Government to take forward a programme which significantly reduces fossil fuel consumption and greenhouse gas emissions

Friends of the Earth Cymru stress that, as part of this, the Assembly should develop a specific energy efficiency policy that will lead to the implementation of **practical projects** that contribute directly to a **reduction in fossil fuel consumption** and greenhouse gases.

We recommend the Downing Street Policy and Innovation Unit's domestic energy efficiency target of **20% by 2010** and a further 20% by 2020 and propose a similar target for the commercial and industrial sectors.

FOE Cymru recommend that as part of their policy, the Assembly should:

- **Implement targets** for actual installations and infrastructure,
- provide more training and funds for **basic household efficiency improvements** and assessments,
- develop **distributed heating networks (grids)** for major urban areas across Wales, from developing heat maps through to pipe installation and encouragement of community participation in CHP,
- develop a strategy for **implementing solar technology** in buildings, in particular solar water heating for domestic housing.
- implement a **public awareness raising programme** on the urgency of climate change, the potential scale of human suffering and the need for policies to significantly increase energy efficiency measures, renewable sources of energy generation and sustainable lifestyle choices,
- set up a **simple loan scheme** in conjunction with existing high street banks, or an Assembly administered fund, for homeowners who would like to install efficiency measures in their home, including solar water heating panels,
- develop a strategy for **coordinating** utility installation and building development/redevelopment/upgrade. An integrated approach, working alongside commercial developers, can make energy efficiency implementation cost effective,
- formulate and oversee **transparent local national planning policies** which promote energy efficiency,
- encourage **innovative sustainable building**, for example through encouragement of self-build, provision for simpler and cheaper grid-connection of renewable/CHP systems and other grants and tax incentives for building that showcase sustainable living/working conditions,
- implement policies to improve vehicle fuel efficiency and **reduce the need to travel** especially by the more energy-intensive modes,

Response to the Economic Development Committee Report on the review of energy policy in Wales Part 2: Energy Efficiency

The aim of this response is:

- to address the specific recommendations listed in the consultation document,
- to clarify the key issues involved in energy efficiency,
- to offer recommendations and targets to assist the committee in creating a framework for effective energy efficiency policy,

Introduction

In our response to this consultation we understand the term Energy Efficiency to mean the reduction in energy consumption achieved through technological development and through changes in lifestyle.

Friends of the Earth Cymru welcome the Assembly Economic Development Committee's energy efficiency consultation. We believe that energy efficiency measures along with renewable energy generation and less energy intensive lifestyle changes are an integral part of moving to a sustainable, low carbon economy.

The vast array of current and emerging technologies, measures and lifestyle choices can be confusing and care must be taken to develop policies that neither lacks focus nor discredits technologies and solutions merely in an attempt to promote specific technologies. The Assembly must develop policies based strongly on underlying principles.

Key concerns

Of the 14 recommendations proposed by the Assembly committee, points 7,9,11 and 14 are strongest as they propose practical training, support and project implementation. The remainder need re-addressing to ensure that they are effectively implemented. The two chief concerns are that:

- **a large proportion of the allocated funds/assistance by the Assembly will be allocated to academic studies** (both feasibility and monitoring) as these provide a low-resistance path through 'accountable' established networks and appease sceptics of change (Points 4,5,6 and 12 are assessment/monitoring studies and point 8 does not indicate how additional resources will be employed)
- **promotion of energy efficiency is not a new Assembly policy** and consequently points 3,5,10 and 13 in their current form offer no significant addition to existing practice.

Opportunities arising

Within a European context, Wales trails in its energy efficiency practice. Fortunately, this puts Wales in the position of being able to **employ the experience of other countries that have already implemented energy efficiency strategies** (eg Denmark).

Funding can be specifically allocated to developing the infrastructure (policy and planning, educational and technological) to ease the development and progress of energy efficiency schemes. Part of this will include feasibility and monitoring studies, but they must form part of a longer term strategy with clear practical objectives. Hence the need for **targets**.

Public awareness raising about the threat of climate change, and energy efficiency as one of the solutions would be timely. Indeed, we support the proposals by the Our World Foundation on a climate change communications programme for Wales (see Annex 7).

A description of energy usage and energy saving within buildings

The vast majority of buildings use energy for: space heating, water heating, lighting, cooking, cleaning, refrigeration, office equipment and other electrical appliances. Energy can be saved by preventing heat loss, encouraging solar heat gain (when and where it is required), improving electrical efficiency of appliances, using more efficient boiler systems or re-distributing waste heat. That is, demand for energy can be reduced and the fuel supply can be used more efficiently.

Whilst there is rarely only one solution to a problem, paths of least resistance should be identified. Some least resistance paths are identified below:

- projects at **individual** office/household/shop level should be kept as **simple** as possible with little or no requirement for additional annual specialist maintenance /service and with minimal disruption to daily activity whilst being installed. This category includes measures such as loft insulation, cavity wall insulation, double glazing, shutters, draught-proofing, lagging of hot water cylinders, new boiler installations, solar water heating;
- **community** based projects often demonstrate **economies of scale**. More complex small projects on an individual level may require duplication of resources and significant specialist time and cost to comply to any regulations. See also Annex 1;
- lifestyle changes can be more difficult to introduce than technological solutions.

Energy Efficiency Technologies, Measures and Programmes

The consultation document made specific reference to CHP, though it is not clear as to why this technology has been prominently selected. Friends of the Earth Cymru support the case for CHP, but is **concerned that the Assembly may focus primarily on micro-CHP detracting from the proven community CHP technologies**.

A. CHP - Combined Heat and Power (further explanation is given in Annex 2).

CHP is a generic term for technologies that fully utilise the waste 'heat' energy of combustion. The simplest CHP example would be an idling car engine that is charging up the alternator, but simultaneously the waste energy released as heat is not lost to the atmosphere but can be used to warm up the car interior.

CHP is a solution that the Assembly can focus on because:

- it provides energy-efficiency independent of having to upgrade the building fabric and structure,
- it has been successfully implemented on a wide scale in community heating schemes across Europe.
- there is considerable industry in Wales that produces waste heat nearby to other development that are net consumers of heat

Some CHP projects utilise the waste heat, others purposely burn fuel to generate a mixture of electricity and heat. Ideally, whether both electricity and heat or just heat, it requires a demand

that is neither intermittent nor fluctuating. For instance, community projects that include CHP for supply of a leisure centre, houses and offices would be more suitable than for an individual house.

CHP can be effectively implemented in high energy consumption industries where there is often considerable waste heat. Cooling towers and reservoirs (such as is used in the steel industry in south Wales) are evidence of waste heat and demonstrate the potential for community heat distribution. Other processing and refining industries are also potential sources of waste heat.

There is an opportunity for the Assembly to play a key role on the planning side where developments and redevelopments are to take place to ensure that CHP or more specifically, distributed community heating, is applied where appropriate. Installing **distributed heating grids** allows for the retrofit of other environmentally benign technologies, such as biomass and geothermal plants.

B. Micro CHP versus High Efficiency Condensation Boilers

The consultation paper highlights the potential for micro-CHP schemes which generate both electricity and hot water on-site be it home, office or other location. On site electricity generation avoids the losses associated with the production and transport of electricity from centralised power stations (typically 15% of electricity generated).

Micro-CHP may become widely available in the next few years but as yet such boilers are not available for purchase and there are only a handful of demonstration units installed. Micro-CHP will probably prove to be an excellent technology for suburban and rural housing but such installations should not undermine the potential for community heating where a nearby heat source exists. Refer to Annex 3.

There are other high efficiency supply side technologies suitable for individual dwellings, such as condensation boilers that are 90% or more efficient (eg Greenstar).

C. Solar Technologies, Natural Ventilation and Insulation

Solar technology extends beyond the concept of solar panels for water heating (solar collectors) and electricity generation (photovoltaic). **All buildings are solar buildings** to a greater or lesser degree as they employ the sun's energy- as natural lighting or to encourage solar gain (warming) by having south elevated windows. Careful design of buildings can significantly reduce the need for fossil fuel consuming heating (or cooling) and lighting.

Modern construction has tended to employ fossil fuels as a replacement for good design. Large house builders will offer the same house design in many orientations, therefore paying little consideration to solar gain. In fact, building regulations often dissuade developers from providing creative designs as they can use pre-approved building reg. designs. There are a dozen pre-approved designs that are used repeatedly by the large developers for domestic housing, just changing the brick/stonework adding a gable, porch or garage to create an appearance of a variety of designs. New ideas and innovative sustainable design are not feeding into the mainstream architecture. This is a planning issue (Building Regulations and TAN8- Technical Advice Notes on Renewable Energy) that should be considered in the Assembly's energy efficiency policy.

Solar thermal technology (Annex 8) combines cost effectiveness with ease of installation for most house types and maximises summer sunshine by providing water heating as opposed to general space heating. This technology should be seen as one of the priority solar technologies

for new build and retrofit of individual dwellings, but its suitability must be considered in relation to plans for community CHP.

Natural lighting and ventilation can be used to enhance the working environment and reduce the consumption of fossil fuels. Natural ventilation should be considered as preferable to poorly used forced air-conditioning systems especially where forced air-conditioning is used as a retrofit to solve an issue of poor air circulation or overheating. It must not be assumed that natural ventilation cannot allow a degree of control of air movement. i.e. these can be as simple as a window or considerably more sophisticated.

Insulation of buildings is a basic but highly cost-effective and often overlooked energy efficiency measure. Insulation measures and schemes have substantial potential especially where little or no attempt has been made to upgrade existing and particularly older dwellings. Simple technologies of draft proofing, loft and cavity insulation are cheap and should be applied to all dwellings.

D. Heat Pumps and Air Conditioning

Heat pumps are the basis of what is commonly known as 'air conditioning'. They use fossil fuels to pump heat against a gradient. In an efficient system the energy used to pump the heat is considerably less than the energy value of the heat. Space heating using air conditioning systems can use less energy than a conventional boiler system. However, air conditioning systems are a mixed blessing. They are usually required to regulate air temperature and thus will be used to cool as well as heat. They require control over the inflow and outflow of air, which may prevent users from regulating the airflow and temperature in a more natural way- through opening windows, opening and closing blinds etc. User behaviour and poor maintenance often leads to a higher consumption of energy and, specifically, high-grade energy (electricity). See also Annex 4.

Intelligent air conditioning systems can prevent such losses whilst giving users some degree of freedom. Further benefits can be obtained if the extract air it used to heat the incoming air (heat reclamation) either using heat pumps or other heat transfer methods.

Heat pump technology for space heating is inappropriate where there is considerable use of traditional ventilation methods (windows and chimneys), particularly in older building stock, as the air inflow and outflow needs some degree of control. It can be combined with traditional hot water radiator systems, but becomes considerably less efficient at these high temperatures. It can, however, be appropriate technology and bring other secondary benefits if used for low temperature background heating (either air or water heating) in addition to a conventional heating system. See also Annex 5.

Possible Policy Measures

Numerous policy measures could be introduced to improve energy efficiency.

Broad categories:

1. Housing
2. Offices
3. Commercial/retail
4. Industrial
5. Transport
6. Lifestyle

1. Housing - barriers and opportunities

There is significant scope for increasing the energy efficiency of the Welsh housing stock, 40% of which are solid wall construction and have low levels of roof insulation. Devolution of building regulations may help in addressing the specific circumstances in Wales.

Old housing stock that already has basic energy efficiency features such as loft insulation, is best tackled with supply side technologies such as community heating and high efficiency boilers. Here are specific targets proposals:

- **Loan scheme** for energy efficiency measures.

There is a need for access to reliable tradesman, products and finance and continuing impartial support. Poor regulation led to a backlash in the 1970s when solar water heating systems were installed that didn't function properly or failed within a year. A repeat must be prevented. As well as approved suppliers and fitters there must be a clampdown on 'cowboy' installers. An integrated approach should allow users to pick up an energy saving loan from their high-street bank, supported with free advice and consultation on where the best energy savings can be made and who can supply the service.

- **1000 zero carbon homes scheme**

An initiative to demonstrate the potential of energy savings/micro renewable energy schemes. These should demonstrate as many technologies as possible and include a multitude of new designs and innovations. As well as the major developers, small builders/developers should be represented, local designers and individuals. A significant proportion should be grant assisted self-build one-off dwellings.

- **100% of housing with basic insulation standards .**

FOE Cymru fully support any initiative to ensure basic minimum energy efficiency at the point of house transfer - eg loft insulation, lagged pipes and hot water tanks. Reference should be made to the proposed European Energy Efficiency policy which includes an energy performance certificate (for 5years) required when properties are built, rented or sold.

2. Offices – barriers and opportunities

As previously discussed, there is a lack of innovation in this sector and examples of poor design. FOE Cymru would like to focus on issues of sick office syndrome, which results from poor ventilation, volatile organic compounds and a lack of day-lighting. Ventilation issues are often tackled by introducing poorly considered air conditioning systems that increase energy consumption. FOE Cymru propose all new office build be constructed with consideration to natural ventilation (including solar air pre-heating) and day-lighting.

3. Retail – barriers and opportunities

There are specific issues related to the increasing number of out of town stores that heat large air volumes per capita. They also encourage car use and cause the loss of local businesses. There is also an emphasis on customer comfort and convenience that can be detrimental to energy efficiency. For instance, large superstores typically have heated aisles with open fridges either side and change the air up to 7 times an hour, with no heat reclamation.

- Ban the construction of new very large warehouse style retail complexes (as has been done in Denmark).
- Ensure that all new build incorporates skylighting or other forms of natural lighting.
- Install heat reclamation systems for buildings that have disproportionately large volume air changes per customer.

4. Industrial Energy Efficiency

Many industries have realised the benefits of energy efficiency in the last decade or so and have reduced their energy use and energy bills. Further progress is being made with the Climate Change Levy providing incentive and further fiscally neutral 'green' levies should be implemented.

5. Transport

The transport sector accounts for about 25% of UK greenhouse gas emissions and air travel is the fastest rising source of emissions. Transport policies to encourage transport activity to less energy-intensive modes and reducing the need to travel to essential, routine and leisure activities requires more concerted political effort. Recent Government policies such as the Ten Year Transport Plan have failed to reduce or even moderate traffic growth in most areas even though there are a variety of reasons and possible solutions to do so.

Modal shift from vehicles to public transport, cycling and walking, from lorry freight to rail and sea freight and from air travel to train (to UK and near Europe destinations) and holidays nearer home require more concerted policy and political commitment. Within the transport sector the rapid delivery of world-class public transport system incorporating emerging technological improvements and aware lifestyle choices could significantly reduce GHG emissions resulting from UK residents travel activity. Determination to invest in a sustainable world-class UK transport system requires serious commitment and a globally aware public may well desire sustainable lifestyle choices. A programme of awareness raising about the urgency of responding to global warming, especially since the Iraq crisis has brought global politics to the front of the public's mind, would now be even more timely.

Policies to encourage fuel efficiency of the vehicle fleet, including the fuel duty and motoring cost rises should be supported (see Annex 6). Financial breaks to encourage the purchase of more efficient vehicles need to be further developed to achieve significant and sustainable results.

Schemes to produce alternative fuels such as bio-diesel and hydrogen (for fuel-cell vehicles) should be supported. A strategy for increasing the availability of greener fuels at fuel-stations needs to be developed so that the switch to greener vehicles is not hindered by weak fuel infrastructure. This strategy should be formed within the wider aim of developing a hydrogen economy and infrastructure across Wales. Ways to move towards a hydrogen economy are being researched by a programme based at the University of Glamorgan and there are some interesting developments abroad.

The Welsh Assembly should publicly champion the idea of an aviation tax which accounts for the greenhouse gas effects of the flight undertaken. The tax could be levied at UK, European or international level. This would encourage shorter distance destination choices and revenues would provide the latest public transport technologies. The tax could be calculated as passport and flight details are comprehensively available and the global warming effect can be calculated with a good degree of accuracy (even to the aircraft type and fuel consumption).

Consideration should also be given to the global warming consequences outside the UK and a fair portion of the aviation tax revenue collected (possibly administered by the UN) could be used

to fund mitigation measures and solutions in climate vulnerable countries and emergency relief when weather-related disasters strike (at least part of the current starvation problems affecting millions of people in southern Africa).

6. Financing

There is little reason to suppose that Wales's energy efficiency will improve without significant funds to support some or most of the feasible measures and programmes. One key area that requires review is the funding of distributed heating grids.

In addition capital must be readily available for loans for small schemes (it is often difficult to borrow sums under £10,000).

Public sector accounting policy must be reviewed to ensure that the effects of fiscal incentives are not lost because of the way in which budgets are allocated. For instance, schools should be able to re-direct savings from carbon tax/NI contributions into energy saving schemes.

It should be realised that energy efficiency reduces the external costs of fossil fuel use, such as weather-related impacts (flooding, storm damage, drought), health damaging air pollution, acid rain damage to buildings, crops and sensitive ecologies, fossil fuel transport problems (oil tanker coastal disasters), opencast coal extraction, and military costs to ensure energy security. These costs have been variously estimated, they are a real cost to the nation and so should be included in the overall financial accounting of any Assembly energy efficiency policies.

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March 2003

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Annex 1

Issues concerning the individual versus community projects.

The choice between whether to focus at an individual level or community level will depend on the complexity of the issues such as technology, installation, maintenance and finance. There is a general reluctance in the UK towards collective schemes, and it is tempting for policy makers to look for solutions that can be implemented on an individual basis. However, there are not always simple solutions and often the complexity of schemes for individual households/ small offices/ shops are underestimated (see Annex 3 on micro CHP). Collective schemes require the involvement of a community, which in itself will provide excellent momentum for a project and can offer good use of resources that are in short supply, such as the technical expertise required to implement a good scheme. The wasted capital plant is also considerably less. For instance, a 1MW demand for heating will require the installation of 5MW of boiler capacity, if boilers are installed in every household. With the trend towards a growth in households (30 % increase since 1970, as compared to a 5.5% increase in population) the case for avoiding duplication of capital equipment, particularly in areas of high population density, becomes stronger. See also Annex 2.

Annex 2.

CHP- the issue of factors preventing further growth of CHP

Government Research referenced in the Assembly consultation document (ref. 8) appears to indicate that the future lies in micro-CHP over community based heating and CHP systems. Only 130MW of community heating schemes are projected for 2010 as compared to 400MW from micro-CHP. This would imply that the National Assembly should place a strong emphasis on micro-CHP. These figures are based on estimates using a discount rate substantially higher than the current Treasury discount rate of 3.5%. Even for a conservative discount rate of 6%, community energy schemes would be economically viable for an estimated 5.5 million households (based on EST publication on the potential for CHP). Friends of the Earth Cymru believe that the Welsh Assembly should focus strongly on community heating schemes, the technology for which has advanced considerably since the 1960s. It is important to generate a demand for waste heat by providing a link between suppliers and users, through the development of distributed heating grids. Distributed heating has been effectively demonstrated in Sweden, Finland and Denmark amongst others.

Annex 3.

The issue of micro CHP and grid-connection

Micro-CHP is appropriate for larger detached houses in more sparsely populated areas with no mainline gas. A threshold heat energy demand level has been calculated below which Micro-CHP is inappropriate (EST publication on the potential of micro-CHP details this). This threshold rules out efficient urban houses, such as flats but is likely to include large detached suburban and rural houses. It is of great concern to Friends of the Earth Cymru that the micro-CHP systems will be installed inappropriately in blocks of flats that should have community heating. The resulting backlash of inappropriate technology could severely limit micro-CHP and even community CHP market penetration, as did the 'cowboy' solar water heating installations of the 1970s.

Micro CHP is currently not a proven option for wide scale deployment. It should be pointed out that the micro-CHP industry has committed significant resources to lobbying and its voice can be heard much louder than that of community CHP. BP Microgen alone has 70 staff whilst it still has no fully commercialised product. Having said that, considerable research has been performed to overcome the barriers, in particular issues relating to grid connection. For

instance, the Microgen system avoids two way metering and thus allows, under the new G83 regulations, simple installation to the grid, though without permitting the unit to supply electricity to the grid. Demonstration of these systems will indicate whether demand issues (for heat and electricity) have been overcome as the manufacturers' claim. Simple and cheap two –way grid connection may be some years away, but such a system allows any excess electricity production to be fed onto the grid, crediting the meter.

Whilst micro-CHP manufacturers have attempted to overcome the need for two –way metering, this has resulted in the units delivering a smaller percentage of electricity, so that supply rarely exceeds demand. It is the electricity production at a considerably higher thermal efficiency than power stations that is the benefit of such systems and thus without the two –way grid connection some of the advantages of the system are lost. Two-way metering is likely to prove essential for market penetration of micro CHP and, significantly, other micro generating technologies such as solar photovoltaics, biomass and wind. As such, Friends of the Earth Cymru would encourage the Assembly to **actively follow and act upon issues related to embedded generation and two-way metering.**

Annex 4.

Air-conditioning and poor design

The consultation document mentions the link between increased office appliance electricity use and air conditioning, as more heat is generated from the equipment. This is just one example of poor design, where air-conditioning becomes a retrofit solution and a highly energy inefficient solution. Similar problems occur due to the large areas of glazing used in modern offices, which increase the need for cooling. Often there is no possibility to provide natural passive ventilation through vents, shafts, stair wells and windows. Conversely, where windows can still be opened/fire doors propped open etc. the air conditioning has to work harder to cool the warm incoming air and once again the system becomes highly energy inefficient.

Annex 5.

Heat pumps as an option for domestic housing

Air-to –air heat pumps that introduce air at relatively low temperatures can supply more heat for the fossil fuel consumed than by the direct combustion of gas. Conversely, higher temperature systems have a lower COP (coefficient of performance) unless water or ground borehole systems are used (the Assembly is investigating borehole systems – contact: Francois Samuel). However, these add to the complexity and cost. A simple air based system can provide steady background heat and at the same time remove problems associated with intermittent heat such as condensation. Such systems are a possible technology for older building stock.

Annex 6.

Transport and road traffic

The fuel protests of September 2000 received so much support because highly pertinent counter-arguments based on widely available information was not introduced into the debate by most politicians. Environmental groups supporting the fuel duty escalator received little attention from the media so politicians could have made a difference. The result is little change to the overall fuel efficiency of the Welsh vehicle fleet and relative reductions in motoring costs compared to disposable income and most public transport fares which can only have encouraged the continued rise in road traffic.

Annex 7.

Our World Foundation

The Foundation's objective is, quote:

'The objective is to undertake a Welsh Climate Change Communications Programme utilising key media to raise awareness amongst the general public, as well as the private and public sectors, about the cause, impacts and solutions to climate change. The role of such a programme is to stimulate support for renewable energy and its more rapid expansion as well as encouraging energy efficiency measures and life style changes to mitigate global warming.'

'It is proposed that the programme be instigated under Art 6 of the United Nations Framework Convention on Climate Change (UNFCCC) and be run by a Welsh Art 6 Climate Change Steering Group comprising parties drawn from non-governmental organisations, the public and private sector as is recommended under the COP 8 Art 6 work programme. It is further proposed that the programme may serve as a model for a European and long term Global Climate Change Communications Programme, which could form part of the Welsh Assembly's Pan European Regional Network on Sustainable Development.'

Annex 8.

Solar thermal notes

An individual who wishes to install solar water heating at the moment would come up numerous obstacles from which system would be most appropriate to finding reliable suppliers and installers. Individuals may be approached by companies charging excessively with no guarantee that the system will work. This is why there is a need for both regulation and assistance.

Typical domestic solar thermal system cost savings may be £70 compared to the equivalent water heating by mains gas (£60 in gas plus £10 less per year boiler maintenance) or about £100 per year if electricity were used (figures obtained from Solartwin website). The pay-back period for a £2000-4000 system could be 20 - 30 years in the absence of other fiscal incentives. Such a long payback would mean that the original purchaser would typically be paying for the system long after they had left the house and ceased to benefit from the savings.

It should be noted that building and area-housing renovation schemes could significantly reduce the installation costs of solar thermal systems (eg scaffolding costs of roof mounting the panels may be £500) by doing the various jobs all at one time (eg replace roof slates/tiles, chimney renovation, loft insulation installation, panel location).

A typical domestic solar thermal system may collect 1,000 - 1,500 kWhrs per year of energy. If a large scale programme were adopted across Wales to fit significant numbers of systems then the amount of energy collected annually could become significant. For example, for every 100,000 households fitted with a panel the energy collected would be over 0.1 TWhr per year (100,000 x 1,000 kWhrs). There are also non-domestic roof areas that would be available too. With a highly concerted effort perhaps the energy collected could approach 1 TWhr per year. This amount of energy would be roughly equivalent to 1/15th of current Welsh electricity consumption.