Economic Development Committee **EDC 14-02(p6)**

Date: **17 October 2002**
Time: **9.00 – 12.30**
Venue: **Committee Room 1, National Assembly for Wales, Cardiff Bay**
Title: **Draft Report on Energy Efficiency (including CHP)**

Purpose of paper

1. To discuss and agree Members' amendments to the Committee's draft report.

Background

2. The attached paper is a first draft of the Committee's Report on Energy Efficiency. It summarises the evidence put to the Committee and proposes recommendations which the Committee might wish to adopt. It has been prepared by the Secretariat and the Expert Adviser and at this stage excludes the Chair's opening remarks, list of Committee Members etc.

3. A draft of the paper was considered by the Reference Group at its meeting on 24 September and the attached incorporates the views expressed by them.

4. Members are now invited to consider this and to propose, and discuss, any amendments.

5. The intention is that, following the discussion at EDC, a revised draft will be prepared for consideration at the next meeting. A final report, to be published for consultation, will be prepared as soon as possible thereafter.

Chris Gwyther
October 2002

REVIEW OF ENERGY POLICY IN WALES

PART 2: ENERGY EFFICIENCY: INCLUDING COMBINED HEAT AND POWER

1. Introduction

1.1 This is the second Report of the Economic Development Committee's Energy Review. The first report was concerned with Renewable Energy and made policy recommendations to the National Assembly that would enable renewable sources to contribute to Welsh energy supplies and foster the growth of local renewable based industries.

1.2 The first report also established the context within which the Review is being undertaken. The most significant context was that of global warming and the significance of carbon dioxide emissions. It was noted that the widespread agreement among climatologists and other scientists represented at the Intergovernmental Panel on Climate Change, meant that carbon dioxide emissions had to be stabilised at a level less than half that prevailing today by the middle of this century. Even with such large reductions there would be significant changes in climate and rises in sea level.

1.3 In order to achieve the substantial reductions in carbon dioxide emissions it would be necessary to reduce energy demand (by improvements in efficiency) and obtain most electricity and some other fuels from zero-carbon sources, such as renewables and nuclear power by about the middle of the century. These were recognised as ambitious targets that required consistent action starting now and continuing over the next decades. It should be noted that energy efficiency and low carbon sources of energy are not alternatives, <u>both</u> are essential to achieving the required reductions in carbon emissions.

1.4 Of all the areas of energy policy energy efficiency is unique in providing a positive contribution to all the objectives of sustainable development. By using less fuel to achieve the same end result:

a. the use of natural resources is diminished
b. emissions of greenhouse gases are reduced
c. the end users are better off economically, this is particularly important for households in fuel poverty
d. the economy is using resources more efficiently, thereby fostering economic growth
e. security of supply is increased since less fuel has to be provided

1.5 One of the particular economic benefits of energy efficiency is that it can foster a virtuous cycle of local development. This comes about because the majority of the savings made through energy efficiency investments will be spent locally. The increase in local expenditure will have a beneficial effect on local business, and hence employment and general economic prosperity.

1.6 Energy efficiency is particularly important because it is only by improving the efficiency with which fuels are used that the historic relationship between economic growth and fuel use can be changed. Historically economic growth has lead to increases in fuel use due to increases in industrial activity, increases in transport and personal mobility and increased standards of comfort at home and at work. Increasing wealth has also lead to substantial increases in the number of households, largely through reductions in the average household size. Many of these trends are expected to continue, though the impact of industrial energy use is declining. In order that economic growth, increased standards and personal mobility do not threaten climate change it is necessary for the rate of improvement in efficiency to exceed the rate of increase in energy demand.

1.7 This Report on energy efficiency includes Combined Heat and Power (CHP) as an energy efficiency technology. This is consistent with its inclusion in the Energy Efficiency Commitments imposed on fuel suppliers, where CHP is one way in which they can meet their obligations. As explained in Annex [C], CHP improves the efficiency with which fuels are used and also leads to reductions in emissions of carbon dioxide.

2. Potential and Historical Trends

2.1 There is broad agreement across a range of studies in many different industrial economies, that the potential for improving energy efficiency is substantial. However before discussing the various estimates of potential improvements it is important to differentiate between different categories of potential.

2.2 The *ultimate technical potential* for improving efficiency of fuel use is determined by thermodynamics. Most current energy uses achieve only a few percent, often a lot less, of the theoretical efficiency.

2.3 The current *technical potential* consists of all commercially available energy efficiency technologies. This category therefore includes improvements that may not be economic but for which the technical means are available.

2.4 The *economic potential* is a subset of the technical potential that passes some cost-effectiveness condition. In what follows we will use a simple payback condition for assessing cost-effectiveness. In the domestic sector the required payback is 5 years or less, in the commercial sector 4 years or less. These paybacks correspond to rates of return in excess of 20%.

2.5 The PIU Energy Review[1] estimates that the current economic potential in the UK is in excess of 30% of total energy use and that the savings to end users (net of taxes) are £12 billion annually. The breakdown between sectors is shown in Table 1.

Table 1. Summary of current economic potential for energy saving[1]

	Energy (Mtoe/year)	**Per cent**	**Savings (£m)**
Domestic	17.4	37.2	5,000
Service sector	3.8	21.0	1,190
Industry	8.6	23.8	1,380
Transport	19.3	35.0	4,700
Totals	**49.1**	**31.4**	**12,300**

2.6 The technical potential is considerably larger. In its working papers the PIU study estimates that for the domestic sector the technical potential is about 60%, for the commercial sector about 40% and for the industrial sector in excess of 30%[2]. As the technologies involved mature they will become more cost effective, a process that will be accelerated if fuel prices increase. Furthermore there are new technical developments that will increase the technical potential, for example the micro-CHP systems currently undergoing commercial pilot trials.

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[1] "The Energy Review", Performance and Innovation Unit, Cabinet Office, February 2002
[2] "Energy productivity to 2010 – Potential and key issues" PIU working paper available from http://www.piu.gov.uk

2.7 These estimates of technical and economic potentials are in line with those reported in a wide range of studies. For example the International Panel on Climate Change Working Group III Third Assessment report[3] estimates that the technical potential for savings in buildings, including appliances used therein, is between 60% and 66%. The International Energy Agency summarises a range of studies as indicating that "energy savings of 20% to 30% could be obtained cost-effectively"[4].

2.8 The economic potential for energy efficiency in the domestic sector in the UK has been around 30% for the last few decades. Similarly the economic potential for improvement in the industrial sector has remained in the region of 20% for at least 30 years. Over the last 30 years there have been substantial improvements in energy efficiency in these sectors, at around 1% per year in the domestic sector and in excess of 3% in the industrial sector. Some of these improvements have been deliberately to reduce energy use, others have arisen through the adoption of new technology which has a higher energy efficiency. As these improvements have been adopted so others have become economic and new technologies have become commercially available. Thus the potential for energy efficiency is a dynamic process and the existence of an unused potential is in part due to the lags between an improvement becoming cost-effective and being widely adopted. This also indicates that if the rate of energy efficiency adoption is to be accelerated, then so too must the rate of technical progress and innovation in order to ensure a continuing supply of cost-effective options. In order to take these ideas further it is necessary to examine the historical trends in further detail.

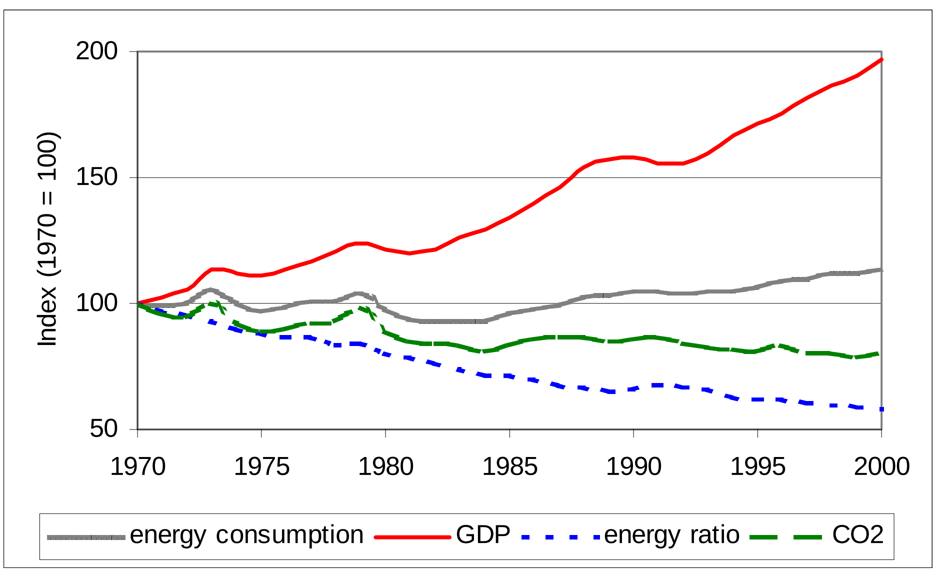


Figure 1. UK GDP, energy consumption and CO_2 emissions 1970-2000

[3] Available at http://www.ipcc.ch

[4] "Energy Efficiency Initiative", IEA available at http://www.iea.org/pubs/studies/files/danish/dan1.htm

Historical Trends

2.9 Since 1970 GDP has almost doubled whilst energy use has increased by only 15%. Thus the energy required per unit of GDP (the energy ratio) has fallen by almost 50% in the period 1970 to 2000. The main reasons for this decline are:

a. improvements in energy efficiency
b. changes in industrial structure, particularly the increasing contribution to GDP from the service sector
c. saturation in demand for some important energy needs

2.10 Over the same period, 1970 to 2000, carbon dioxide emissions have decreased by about 20%, largely due to the reduction in the use of coal and increase in use of gas. This fuel switch is now virtually complete and so will not deliver significant carbon savings in the future. Indeed some of these savings may be reversed by the recent rise in gas prices and reduction in electricity prices, causing more electricity to be generated from coal. For further reductions in carbon emissions there must be a growing use of zero carbon sources, such as nuclear and renewables.

2.11 Against the background of these trends for the whole of the UK economy there have been specific changes in each of the major sectors that influence energy demand and the potential for energy efficiency improvements.

Domestic

2.12 The basic unit of energy use in the domestic sector is the household. Although the population has grown by only 5.5% in the period 1970-1995, the number of households has increased by 30.5%. This reflects the decrease in the number of people per household, from about 3.0 in 1970 to less than 2.4 by 2000. Thus although the energy use per household has hardly changed since 1970, total energy use in the domestic sector has increased by about 30%[5].

2.13 Although the total energy use per household has remained remarkably constant there has been a significant growth in the use of electricity in lights and appliances; it has more than doubled since 1970. There has been a decline in the energy used for cooking and the use of energy for space and water heating has increased in step with the number of households.

2.14 BRE have analysed the use of energy in the domestic sector with a view to establishing the savings that can be attributed to changes in insulation and improvements in heating system efficiency. The results are shown in Figure 2 below. The lowest line shows the actual energy delivered to the domestic sector. The middle

[5] All data on household numbers and energy use per household from "Domestic Energy fact File", BRE. The data are for GB (not UK). Note that the energy use per household varies significantly with weather, as does the total energy use in the domestic sector.

line shows the estimated delivered energy had there been no improvements in home insulation and the upper line adds in the effect of no improvement in heating system.

2.15 The analysis, summarised in Figure 2 (below), indicates that between 1970 and 1996 there was a 38% saving attributable to improvements in insulation and heating efficiency. This is equivalent to an annual improvement in energy efficiency of 1.25%. The PIU Energy review has proposed a target for increasing domestic energy efficiency by 2% per year for the next 20 years. This represents a significant acceleration from the historical trend.

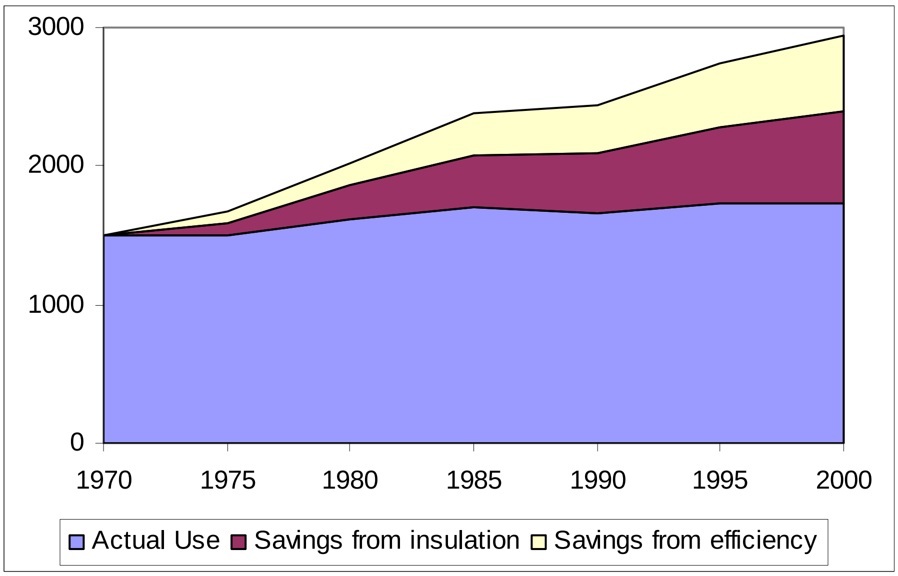


Figure 2. The effect of energy efficiency improvements in the domestic sector.

Commercial

2.16 Energy use in non-domestic buildings, which includes public sector, commercial and retailing, is about 60% of the energy used in the domestic sector i.e. delivered energy of about 1000PJ. However there are fewer statistics available on this sector, largely because it has historically been lumped into an "other category". Recently BRE have published detailed statistics for non-domestic buildings for which the service sector accounts for about 80% of the total.

2.17 The BRE statistical analyses are based upon national surveys of non-domestic buildings. One of the remarkable results from these surveys is the very wide variation in energy use per unit floor area for apparently similar use buildings. For offices the mean energy use is about 0.7 GJ/m^2 /year. However there are some offices which use 1.7 GJ/m^2 /year and others which use less than 0.2 GJ/m^2 /year. There is a similar range for shops, with the average being about 0.5 GJ/m^2 /year. These results indicate that there is a substantial potential for improvements in energy efficiency if the high-energy users can be improved to figures around the average or even less.

2.18 There are two striking trends for the service sector. The first is the growth in use of electricity, which now accounts for more than 60% of the carbon emissions from the sector. The second is the growth in the use of air conditioning. Figure 3 shows the percentage of non-domestic floor space with full air-conditioning by the age of the building.

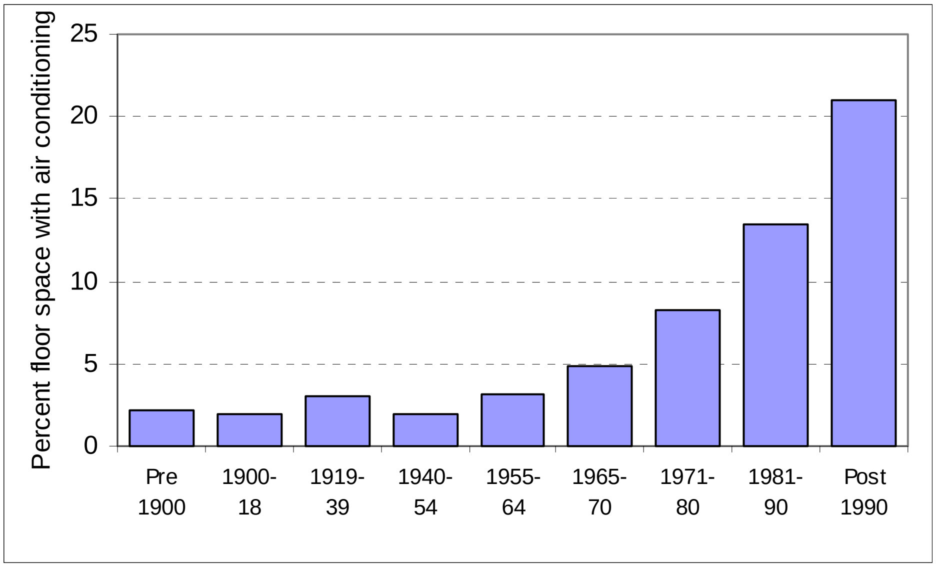
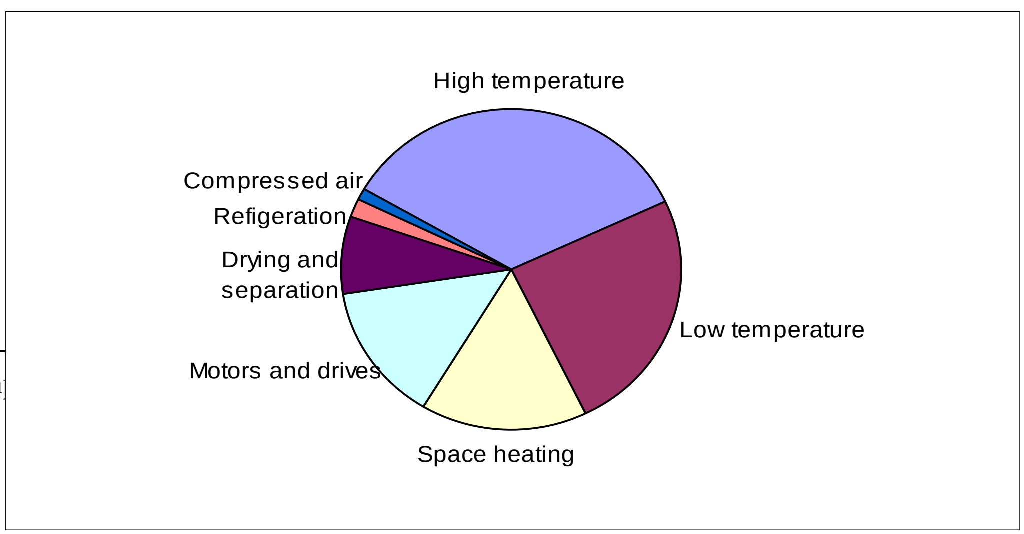


Figure 3. Percentage of non-domestic floor space with full air conditioning by age of building

2.19 The trends in increased use of electricity and air-conditioning are mutually reinforcing since a major driver for air-conditioning is the over-heating caused by increased use of IT and other office equipment. Office equipment and lighting are the major drivers for increased electricity use and both can be substantially reduced by using higher efficiency devices.

Industrial

2.20 Since 1970 fuel use by industry has decreased from over 60 Mtoe to less than 40 Mtoe by 2000. During this period there has been a steady improvement in energy productivity with a rate of increase of 3.4% per year[6]



[6]. Energy pa

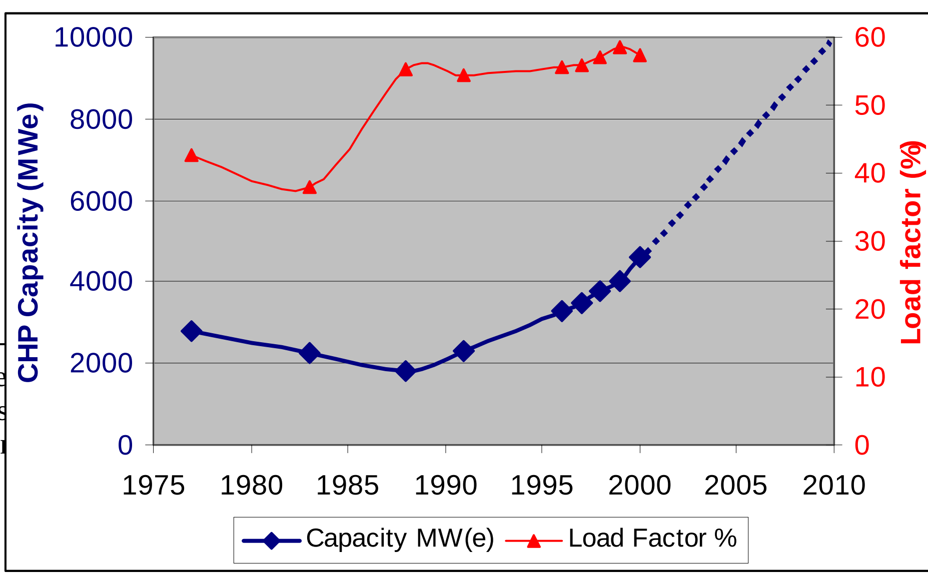
Figure 4. The breakdown of energy use in the industrial sector.

Transport

2.21 Transport is the fastest growing sector of energy demand. The current transport system is also highly dependent on oil based fuels. World oil production from conventional sources is expected to peak in the next 10-40 years and thereafter become progressively more expensive. This, coupled with the drive to reduce greenhouse gas emissions, has lead many manufacturers to seek radical improvements to the current road transport vehicles. Over the period 1970 to 2000 the fuel consumption of petrol vehicles decreased from 9.5 litres/100km to about 7.5 litres/100km. This trend is expected to accelerate as a result of current research and voluntary agreements to reduce fuel use in the sector. For example hybrid vehicles are expected to produce savings of 20% to 30% quite quickly and up to 50% in the longer term. However the anticipated increase in the number of vehicles is likely to outweigh efficiency improvements in terms of overall energy consumption.

Combined Heat and Power

2.22 The main trends in CHP deployment in the UK show two distinct periods[7]. From the 1970s until about 1990 CHP capacity was declining. This was due to the restructuring of industry, the decline in industrial heat demand and changes in industrial processes so that less steam was required. The second period from 1990 to 2000 is one in which CHP capacity steadily grew, roughly doubling in the period. This growth was largely due to the low price of gas and the increased use of combined cycle gas turbines (CCGT). In 1991 more than half of all CHP capacity was back pressure steam turbines using coal, oil and gas in roughly equal amounts. By 2000 CCGT accounted for more than half of all CHP capacity and almost 70% of all fuel used in CHP was gas.



[7] Caution is re… in the official CHP s… which has to meet certai…

Figure 5. The trends in CHP capacity and load factor. The dashed line shows the growth required to meet the Government's 2010 target.

2.23 Table 2 below sets out the division of CHP schemes, capacity and output between the various scales of CHP plant. Although the micro-CHP capacity is currently zero, field trials of the technology is underway and it is expected to show rapid growth over the next few decades. The strongest feature of Table 2 is that whilst most schemes are under 500kW(e) the majority of the output is produced in the relatively few schemes with capacity in excess of 50MW(e). Growth at this large scale end of the market tends to be restricted by the availability of suitable heat loads.

Table 2. Breakdown of CHP schemes by size (end 2000)

	Number of schemes	*Number (%)*	Output Capacity MW(e)	*Capacity (%)*
Micro-CHP (<5kW)	0	*0*	0	*0*
Mini-CHP (5 – 500kW)	1,228	*79*	139	*3*
Small scale CHP (500kW- 5MW)	186	*12*	400	*9*
Medium scale (5 – 50MW)	113	*7*	1,432	*31*
Large scale (> 50MW)	29	*2*	2,661	*57*
Total	1,556	*100*	4,632	*100*

2.24 The growth in use of gas also explains the significant slowdown in CHP growth and output since 2000 coupled with a significant reduction of CHP electrical exports to the networks. The recent downturn has three causes, all of which work together adversely on the economics of CHP. These are:

a. a significant increase in the price of gas. During the 1990's gas prices were around 0.5p/kWh, they have risen to 0.75 – 1.0 p/kWh. They are unlikely to fall below 0.7p/kWh in the immediate future.

b. the wholesale price of electricity has decreased significantly as a result of the introduction of the New Electricity Trading Arrangements (NETA). The price differential between gas and electricity wholesale prices, referred to as the spark gap, has therefore decreased dramatically – and is unlikely to return to the levels seen in the 1990s.

c. NETA has had another effect, namely increased the penalties associated with small and intermittent generators. Most CHP falls into both categories. As a result CHP exports to networks have declined by 61% since the introduction of NETA.

2.25 In 2000 there was an additional 2719MW(e) of CHP capacity with planning consent. Given the above changes in market conditions it is regarded as unlikely that this will be built in the near future.

2.26 There is a large potential for CHP in all sectors of the market. In 1997 an assessment carried out by ETSU reported a potential between 10 and 17 GW(e) by 2010 with the base case estimate at 14.72GW(e). A study commissioned for the EU gave a potential of 14GW(e) by 2010. More recently a report from Forum for the Future gave a potential of 6.6GW(e) by 2010 and Energy paper 68 projected a CHP capacity of 7.6GW(e) by 2010. A study by Cambridge Econometrics looked at the likely movements of gas and electricity prices and concluded that by 2010 an installed capacity between 9.3 and 10.3 GW(e) was achievable by 2010. This last projection includes 400MW(e) from micro-CHP, 130 MW(e) from Community Energy programmes and 750MW(e) from the CHP Quality Improvement programme.

2.27 The Strategy for CHP[8] concludes that there is a good chance that the 10GW(e) by 2010 will be achieved. Further information on how the strategy aims to promote and facilitate CHP is described in the next chapter.

[8] The Government's Strategy for Combined Heat and Power to 2010: Public Consultation Draft: 15th May 2002. DEFRA. available from www.defra.gov.uk

3. Energy Efficiency programmes and barriers to adoption

3.1 There are a significant number of UK and European schemes in place to foster, promote or enforce improvements in energy efficiency. These are expected to accelerate the adoption of energy efficiency measures in the targeted markets. The following brief summary describes the main schemes, their target audience and their overall aims.

3.2 The wide range of policies in place in the UK is summarised in "Climate Change; The UK Programme"[9]. The programme is expected to deliver an overall reduction in greenhouse gas emissions of 20% by 2010 compared to 1990 levels.

3.3 Climate Change Levy. This levy is made on all businesses through increased charges for gas, electricity, coal and LPG. The revenue generated is recycled to businesses through a reduction in National Insurance contributions and through capital allowances for efficiency investments. This strategy means that businesses that use more than average fuel are encouraged to improve energy efficiency. Businesses that use less than average fuel, and this includes most of the service sector, find themselves better off because the refund in NI contributions exceeds the increases in fuel costs.

3.4 For the very energy intensive industries an 80% reduction in the CCL is granted in return for a negotiated agreement to reduce energy use over a specified period. These voluntary agreements are expected to produce significant levels of energy and carbon savings over the next decade. Further savings are anticipated from the capital allowances.

3.5 Fuels derived from good quality CHP and renewable sources are excluded from the CCL. This provides an incentive for companies to adopt good quality CHP.

3.6 Building Regulations. New Building Regulations come into force this year and further improvements over the next five years have been pre-announced. The changes apply to all new domestic and commercial buildings and also to major refurbishments.

3.7 Energy efficiency commitment. This is an obligation placed on all suppliers of gas and electricity. The suppliers are required to demonstrate energy savings for their domestic customers (based on a kWh/year figure per customer supplied). The obligation requires that at least 50% of the improvements should be in disadvantaged households, i.e. those in fuel poverty or with elderly or disabled members. CHP is one of the measures that companies may use to fulfil their responsibilities under EEC. The programme budget is about £3.60 per customer per fuel, roughly £144m/year. This is expected to finance measures for vulnerable households and provide a significant incentive for private households to take up improvement measures.

3.8 Home Energy Efficiency Scheme This is a scheme to provide grant assisted improvements to heating and insulation to all the vulnerable (the term used in

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[9] "Climate Change:The UK Programme" DETR November 2000

our scheme and related UK Fuel poverty strategy is vulnerable meaning elderly, sick and disabled and families with young children) households in fuel poverty. The scheme provides loft insulation, cavity wall insulation, hot water cylinder insulation and improvements to heating systems, including the installation of central heating under prescribed conditions. The maximum grant per household is £2,500. Recently it has been announced that the scheme will be extended to include an initial trial of 6000 micro-CHP.

3.9 Appliance Standards and Labelling. The EU has introduced a range of appliance labelling schemes and standards based upon these labels. The Boiler Efficiency Directive had a dramatic effect on the efficiency of domestic and commercial gas boilers. More recently the removal of white goods with labels of E or less has eliminated the most inefficient appliances from the market. It is expected that this trend will continue with a combination of voluntary agreements and enforced standards. An EU Buildings Directive, currently in the final stages of deliberation, will require all buildings to have statements of energy performance (effectively energy ratings) available to prospective buyers or tenants at the time of rental or sale.

3.10 EU Agreements on vehicle efficiency. These are voluntary agreements that aim to improve the average vehicle efficiency by 25% by 2010. They are supported by changes in UK vehicle excise duty and the taxation of company cars.

3.11 Home Energy Conservation Act (HECA). This places an obligation on all Local Authorities to devise schemes to improve the energy efficiency of all housing within their domain by 30%. Although Authorities have a statutory obligation to report on such schemes the lack of any significant resources to implement them means that as currently formulated the programme is unlikely to succeed.

3.12 Community Energy programme. Community heating schemes are being promoted to reduce fuel poverty as well as reduce environmental emissions. In a 1997 survey of 265 community heating schemes only 10 (4%) had CHP[10]. The EST estimates that the cost-effective potential for CHP in this sector is over 4GW(e) by 2010. The current programme aims to contribute 130MW(e) by 2010 and thereby help 100,000 people on low incomes heat their homes.

3.13 There are a range of other programmes, including the Energy Efficiency Best Practice programme (recently relaunched as Action energy by the Carbon Trust), the UK Emissions Trading scheme, the suite of programmes organised and promoted through the EST, the Enhanced Capital Allowances scheme and so on, all of which will contribute to the dissemination of information about, and promotion of, energy efficiency.

3.14 Taken together it is clear that the above schemes provide adequate levels of action for

[10] The survey found that community heating supplied 41,000GWh of heat in 1997, of this 4,000GWH was used for housing.

a. fuel poverty for those on the gas network and in cavity walled dwellings (not sure it is clear from the above without expanding on what is presently covered by EEC/HEES
b. new buildings, both domestic and commercial
c. domestic appliances
d. energy intensive industries
e. road transport vehicles

It should be noted that although action to alleviate fuel poverty is an important social objective it does not lead to significant reductions in energy use or greenhouse gas emissions. This is because this group does not heat their homes to a reasonable standard, so there is much less energy and emissions available for savings.

3.15 It is also clear that the existing schemes do not adequately address issues concerning the:

a. fuel poor who are off the gas network and occupy solid walled dwellings, domestic
b. households not in fuel poverty, or non-benefit households, particularly owner occupiers and tenants of private landlords
c. commercial sector, both existing buildings and equipment
d. public services sector, both buildings and equipment

Taken together items b, c and d represent close to half of the total UK energy use. There is a reluctance to initiate anything other than advisory programmes in these sectors since it is held that making cost-effective improvements is in the interests of the agents involved i.e. they only need to be appraised of the possibility for action to be undertaken. However such information campaigns have been remarkably unsuccessful in the past and it is in these sectors that some of the greatest, and cheapest, potentials for improvement exist. For example some 75% of domestic properties in the UK with cavity walls remain uninsulated and fewer than half of all houses have adequate loft insulation.

3.16 The range of support for CHP has been summarised in the government's strategy paper. The measures identified for good quality CHP are:

a. Exemption from the Climate Change Levy
b. Climate Change Agreements (under CCL) to reduce emissions
c. Emissions trading scheme
d. eligibility for Enhanced Capital Allowances
e. Business Rates exemption for CHP equipment
f. £50m Community Energy Programme
g. Reduction of VAT on micro-CHP schemes used in HEES/Warm Front
h. Promotion and support by EST and Carbon Trust

3.18 Although the government is optimistic that these support measures will enable the 2010 target to be met there is widespread scepticism that they will not be enough to offset the effects of low electricity prices, high gas prices and the penalties associated with NETA.

Barriers to adoption of energy efficiency

3.19 The notion that there are barriers inhibiting the adoption of energy efficiency[11] improvements presumes that such improvements are otherwise desirable purchases. Engineers and scientists are taught to value high efficiency and presume it is "a good thing". Economists are taught that consumers and businesses act in their own economic interests, so anything that is cost-effective will be adopted by all 'rational' agents. However these assumptions do not reflect the ways in which householders and business people actually operate.

3.20 There are two core reasons why energy efficiency improvements are *not even considered* by householders and business people. The first is that they have <u>no motive</u> to consider them. Energy costs are a very small proportion of outgoings, for the average household less than 3% and for all but the energy intensive businesses less than 1%. Saving a fraction of a percentage of expenditure does not provide a motivation. The second reason is that both householders and business people have <u>more important things to pay attention to</u>. For almost all economic agents *attention* is the scarcest resource and it is allocated to issues that have the greatest significance (from the perspective of the agent). This means that people and businesses do not have the time to collect and digest all available information, decisions are made using rules of thumb or when the indications are 'good enough'. In economic theory this is known as 'bounded rationality'. Together bounded rationality and lack of motivation means that for the majority of households and businesses spending money on energy efficiency improvements is *not even considered.*

3.21 It should be noted that when bounded rationality is operating then providing more information does not help, indeed it makes matters worse. In order to ensure that businesses and households do consider energy efficiency improvements it is essential to provide:

a. sufficient motivation to capture the attention of the target audience
b. simple guidance on what to do and how to do it

3.22 Cost savings do not provide sufficient motivation because:

a. fuel costs are a very small proportion of expenditure
b. any savings will be a fraction of an already small outgoing
c. the savings will also fluctuate (with weather or levels of use)

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[11] The discussion of barriers presented here is based upon one of the PIU energy Review working papers: "Energy productivity to 2010 – Potential and Key Issues" available from the PIU website http://www.piu.gov.uk

d. the investment costs are not recoverable other than through an (arguable) enhancement to a property's price – although much of this can often be attributed more to the related benefits of increased floor space, improved security etc.

3.23 For householders there are further barriers that have to be overcome even when sufficient motivation exists. The main factors are:

a. distrust of sales people and fuel companies in providing advice;
b. hassle associated with having installers or plumbers working in one's home;
c. efficiency purchases are not seen as being desirable products in the way that cars, clothes, holidays, cameras etc are.

3.24 For the commercial sector the main secondary barrier is the fact that the costs of improvements will fall on the building owner whereas the benefits accrue to the business occupying the building. This barrier, referred to as split incentives, also occurs in the domestic private rented sector. The same barrier exists between builders and house purchasers, but in the case of new buildings it is overcome by the standards imposed by the Building Regulations.

3.25 In the public sector the main secondary barrier is restricted access to capital. This may take the form of a split incentive if capital acquisitions are determined by one department (e.g. purchasing) and the fuel costs paid by another (e.g. maintenance). The need to demonstrate 'value for money' does not always take into account the balance between capital and running costs.

3.26 This brief discussion of barriers to the take up of energy efficiency improvements has indicated that increasing the rate of take up of improvements will not be straightforward. In particular to achieve the accelerated rate of adoption in the domestic market, as proposed by the PIU Review, will require a new approach.

3.27 The financial barriers to the adoption of CHP have already been itemised (see para 2.24 above). The current level of government support does not address these financial issues and whilst they remain in place then it is unlikely that there will be much large-scale development of CHP. Indeed several of the large concerns responsible for supplying CHP to industrial and commercial users have withdrawn from the market.

3.28 For large commercial and public sector clients another barrier identified was that of lack of expertise by estate managers and senior executives. In the case of large leisure centres, prisons, hospitals and universities the main focus of the senior managers was rightly on their core business, not on evaluating a complex technology such as CHP. This barrier has been made larger by the withdrawal of the large suppliers of CHP services who often undertook all the necessary design work as part of an energy services or lease contract.

3.29 There are different barriers facing the adoption of micro-CHP in domestic and small businesses. Here the main barriers are associated with type approval and connection to the network. If exports of electricity have to be metered to be credited[12] then the introduction of two way meters would be a further barrier. At present it is unlikely that micro-CHP units will be sold to the heating trade as boiler replacements. This is because special training is required for their installation and maintenance. It is more likely that the suppliers will lease the units to the users with the lease charge including annual maintenance. Nonetheless, it is important to continue to work for the take-up of CHP units because, as explained in Annex [C], CHP improves the efficiency with which fuels are used and also leads to reductions in emissions of carbon dioxide.

[12] An alternative, especially relevant for domestic customers, is for suppliers to adopt standard credits for a particular size family in a given sized property. Such credits would be based on detailed profiles of actual electricity use and generation patterns.

4. Energy Efficiency in Wales

4.1 The fundamental issues associated with energy efficiency are very similar in all industrialised countries, including the UK as a whole and Wales in particular. In this respect the situation is different from that pertaining to Renewable Energy where there were a particular set of resources, opportunities and issues that had to be dealt with in Wales. In the case of energy efficiency the issues are the same as those elsewhere, it is just the particular mix that is different in Wales.

4.2 One of the difficulties in establishing the specific issues of most importance in Wales is the lack of separate statistics on Welsh energy use. From what is known the following differences from the rest of the UK stand out.

a. Wales has a higher proportion of heavy industry than the rest of the UK. This means that there is proportionally more energy used in industry. Most energy intensive industries are energy efficient, though there is variation from one company to another, and the incentives produced by the Climate Change Levy should promote further improvements.

b. However Wales has less than its proportionate share of CHP. Table 3 below indicates that Wales has only 3% of the installed capacity, compared to 5% of the population and more than average heavy industry.

Table 3. CHP schemes by UK Region (2000)

	Number of schemes	*Schemes (%)*	CHP Capacity (MW(e)	*Capacity (%)*
England	1,428	*92*	3,736	*81*
Wales	58	*4*	139	*3*
Scotland	52	*3*	735	*16*
Northern Ireland	18	*1.2*	22	*0.5*
Total United Kingdom	1,556	*100*	4,632	*100*

c. Wales has a large industrial sector associated with the production of components for cars. Over the next decade or two car technology is likely to change significantly. To avoid significant unemployment it is essential that this sector remains at the forefront of the development of new vehicle technologies.

d. Wales has a higher proportion of housing with solid walls (about 47% in Wales) than the rest of the UK (about 27%). There are currently no cost-effective means for insulating solid walls, so almost half the housing stock may have low efficiencies into the future.

e. Wales has a higher proportion of domestic properties (22%) off the gas network than the rest of the UK (16%). One of the major routes for reducing fuel poverty in all types of property is to install high efficiency gas central heating. This option is clearly not available for properties not serviced by the gas network.

4.3 The adoption of CHP in Wales is summarised in the charts below that show the breakdown between sectors for the number of schemes and installed capacity. This reinforces the point that whilst a large number of schemes are in hotels, hospitals, leisure centres and educational campuses, the bulk of the capacity is in the industrial and refinery sectors.

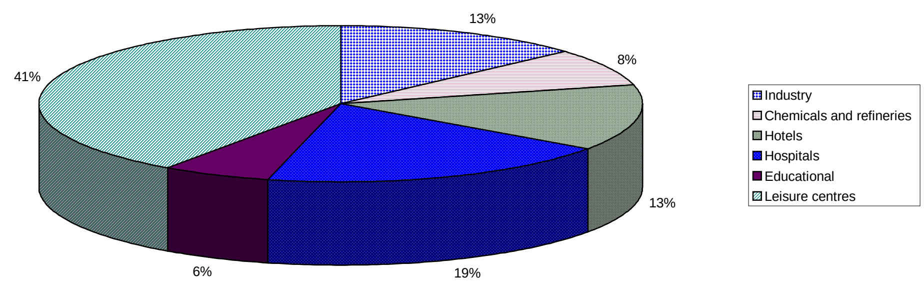

Figure 6. CHP schemes in Wales (can we get original data to improve diagram?)

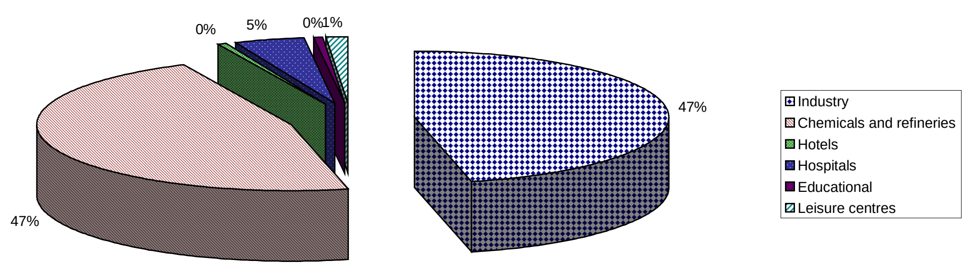

Figure 7. The capacity (MW(e)) of CHP schemes in Wales

4.4 Different aspects of energy efficiency need to be dealt with at different levels of government. For example standards on appliances and traded goods are best dealt with at the EU level, tax incentives for energy efficiency are best dealt with at the UK or GB level. The aspects of energy efficiency that are best dealt with at the level of the National Assembly are:

a. supporting Local Authorities in developing better information on their housing stock and in pursuing their HECA plans. Examples of how this is happening now are the National Assembly's funding of LA stock condition surveys; National Assembly/WLGA/EST funding of a WLGA post to work with LAs to raise the profile of energy efficiency at senior management/elected member level; and, National Assembly funded software for LAs to assist in HECA reporting. These initiatives are to be welcomed and more should be encouraged;

b. setting quality and energy standards for LA and RSL housing, including specifying energy efficiency improvements at the point of stock transfer;

c. using its procurement policy to promote markets for energy efficient products;

d. deploying additional resources, for example Objective 1 funds, to support local energy efficiency initiatives;

e. providing exemplary leadership in the commissioning and management of energy efficient buildings and encouraging staff to consider energy efficiency in all aspects of their work;

f. using its resources to ensure that all public buildings, including schools, council offices and so on, have the highest possible standards of energy efficiency;

g. working to encourage and agree improved Building Regulations for new buildings ;

h. developing and promoting educational and training schemes for business managers emphasising the range of support and schemes already available.

5. Policy Issues

5.1 A number of recommendations have, in the submissions made, been put to the Committee for consideration. These can be broadly divided into the following areas: new housing, existing housing, public buildings, public procurement and industry.

5.2 New Housing. The NAfW could press for higher standards under the Building Regulation powers for new housing. Experience in Milton Keynes[13] demonstrates that significant improvements can be achieved for additional costs of a few hundred pounds. The particular areas recommended include higher quality/performance standards, especially for RSL or LA new housing (where the standards are set in Wales), promoting the benefits of orientation to maximise solar gains and the testing of all buildings upon completion to ensure compliance.

5.3 Existing Housing. Here the suggestions fall into two groups, those concerned with social housing and privately owned housing. For social housing, the recommendations are to develop guidance on energy efficiency at the point of stock transfer, which this is covered by the Welsh Housing Quality Standard; support the use of CHP in community heating schemes; and to support the development and implementation of HECA within Welsh LAs. For the private sector the recommendations include a regular 'MOT' check (these are already reflected in the ***UK*** Government's plans for the sellers' pack and the forthcoming EU directive on the energy performance of buildings), increased grant aid for boiler and window replacements and the incorporation of energy efficiency in any accreditation of the work of private landlords.

5.4 Public Buildings. Here the recommendations include requiring all public sector buildings to achieve a BREEAM 'excellent' rating, promoting energy efficiency through demonstration projects and carrying out regular checks on building performance.

5.5 Public Procurement. Some of the most successful schemes in the USA and Europe have been based upon public procurement setting standards for energy efficient products. Perhaps the best known is the Energy Star scheme that has ensured that all computer equipment meets energy efficiency standards. The key is for specifications for all equipment to include a clear energy efficiency requirement.

5.6 Industry. The main recommendations here are to support the dissemination of Best Practice information and to support a programme of research and training in energy efficiency and environmental management.

5.7 Combined Heat and Power. The submissions in this area did not make specific policy recommendations but pointed to the opportunities and barriers that needed to be addressed. Those directly relevant to NAfW were the very large potential for CHP in

[13] The New Town Development Corporation was able to set higher standards as the owner of the development land. Recently English Partnerships required all new housing to achieve a SAP rating of 100, significantly better than the current Building Regulations.

public buildings, the lack of technical expertise – particularly amongst public sector estate managers, the opportunity provided by the Community Energy programme and the need for the planning process to include consideration of the management of CHP and heat loads. Finally there was a potential conflict between different schemes associated with biomass that needed to be resolved.

5.8 One of the perennial difficulties associated with policy in the area of energy efficiency is that it is a crosscutting subject that requires effective collaboration and communication between different levels, and different areas, of government. An associated issue is that important decisions regarding energy efficiency are normally taken inadvertently by people whose main focus is elsewhere; for example on the design of a new school building or the location of a new swimming pool. This combination of requiring close collaboration between different arms of government and being a minor constituent in almost all decisions, means that the impetus for energy policy has to combine an effective top-down approach with practical means for ensuring it is adequately considered.

6. Conclusions and Recommendations

6.1 There is little doubt that there is a very great potential for improving energy efficiency in Wales. It is easy to see this in everyday life with homes and factories generating heat in excess of their requirements and releasing it to the atmosphere through poor insulation and carelessness. Evidence from a wide variety of sources confirms the very substantial savings that could be made and that these could be realised without significant changes in people's lifestyles. Increased energy efficiency does not mean sitting in the cold or the dark, it means using less fuel and power to provide what we need in the right form and in the right place. The goal is not just financial savings but the much wider and more important objective of reducing emissions of carbon dioxide and so reducing the emissions contributing to global warming.

6.2 The challenge facing Wales in respect of energy efficiency is that the solutions do not fall to a single body, or even a small number of bodies, but to everyone. Whilst improvements in energy efficiency will benefit everyone, at the individual level they are not so easily recognised, and the time-scale of their effect is sufficiently prolonged, that it is easy to put off decisions on action. But these decisions have been left for too long and action needs to be taken now.

6.3 It is also easy to take the view that Wales is a small country and can have little effect on a global problem - and to use this as an excuse for inactivity. This attitude belies the principles upon which the National Assembly was founded. Wales must show the way and must do its part in achieving the global savings that are required. It cannot be acceptable for Wales to take no action because there is no guarantee that others will follow suit.

Raising awareness

6.4 The first requirement is for the people of Wales to recognise and acknowledge the need for substantial improvement in energy efficiency across Wales. There is a clear role here for the National Assembly to take a lead in promoting and encouraging this in all areas and at all levels – individual, corporate and in Government. This is clearly a crosscutting theme and links closely with the Assembly's obligation to promote sustainability.

6.5 We need a quantum change in people's perceptions of the issues and this requires a substantial campaign to promote energy efficiency and increase and raise awareness as an issue. This must target individuals, businesses and public sector organisations throughout the country and should be approached from a cross-cutting perspective and not left to individual departments to handle in isolation. It is essential that public sector managers are included in the target audience and that they are given a clear remit to lead by example and use their purchasing powers to promote energy efficiency wherever possible.

6.6 Alongside this the wide range of help and advice available should be expanded and promoted. Bodies such as the Carbon Trust, which works with industry and business, and, the Energy Savings Trust, concerned with domestic, small business and transport energy, have been established to facilitate and accelerate improvements in energy efficiency. These have developed a range of programmes to support this work and awareness of these bodies and their programmes, and the contribution they can make in improving energy efficiency needs to be promoted.

6.7 The National Assembly Government needs to identify an individual, or a unit, responsible for coordinating the promotion of energy efficiency on a Wales-wide basis and across all sectors, and for monitoring the action being taken***.***

National Assembly lead

6.8 But promotion on its own is of little benefit. The National Assembly needs to take a lead and to set out the principles on which developments throughout the country should proceed. It should start with a policy that specifies that all procurement should be assessed on a life-cycle basis, thereby ensuring due consideration of energy running costs. Next all National Assembly buildings should seek to adopt the highest practical standards in respect of energy efficiency. In order to achieve this the National Assembly should undertake BREEAM assessments of all of its buildings and identify those that fall short of the 'excellent standard' and the work necessary to reach this. In some cases this might not be practicably possible and in others it might be that funds are not available to undertake this work immediately. However, the National Assembly should identify and recognise the contribution it is making to poor energy efficiency.

6.9 The Minister for Finance, Local Government & Communities has already agreed to the Committee's request for careful consideration to be given to the installation of photovoltaic solar panels on the new National Assembly Building and the Committee looks forward to seeing the results of this investigation

6.10 These same principles should be applied to all public bodies and local authorities in Wales and the Welsh Assembly Government should use the powers it has in relation to these bodies to achieve a greater awareness of the level of savings that could be achieved and the action necessary, and the costs involved, in doing this. In addition the National Assembly should seek ways to promote CHP in appropriate public buildings and complexes.

Industry

6.11 Industry and business should be encouraged to follow similar processes in respect of their own buildings. While we cannot ignore the realities of short-term decision making in industry, and the pressures that permit this short-termism and poor energy efficiency, industry and business must be encouraged to realise that in the longer term improvements in energy efficiency are not optional.   What is more, the last two decades of declining fuel prices are not likely to be repeated, and they can expect a future in which increases in fuel prices will result from taxes on carbon emissions. Successful businesses will be ones which recognise these changes and plan ahead to meet them.

6.12   Commercial and industrial property developers, including bodies such as the WDA, should seek to construct buildings to the highest possible standard of energy efficiency. While at the present time this can sometimes lead to increased capital costs, these can be offset by enhanced capital allowances and savings from lower running costs.   However, these do not always provide sufficient incentive for the developers. The Assembly should investigate ways to overcome this ‘split incentives’ barrier through either regulation or financial aid linked to repayment from savings.

6.13 Business support agencies should be encouraging Welsh firms to switch to and develop low carbon technologies. Support for this is available through the Carbon Trust’s “Low Carbon Innovation Programme” and the deployment of new technologies through its Action Energy programme. In addition ELWa should take a leading role in ensuring that workplace and skills training is promoted and up to date with the latest technical developments.

Domestic

6.14   At the domestic level there is a clear need for substantial improvements in energy efficiency. Building Regulations have a major effect on the construction of new houses and the Committee recognises that these are likely to have a major impact on the standards to which house builders construct new properties.   The National Assembly should support moves to improve the energy efficiency of new housing. This may involve providing suitable training for construction workers since it is often on-site practice that represents the biggest obstacle to the use of innovative construction and insulation techniques.

6.15   Improvements in the design and construction of new housing will have a significant effect on energy efficiency but it will be many years before the existing housing stock is replaced by new properties. It is important therefore to continue to encourage and support improvements to insulation in private houses. For historical reasons, the housing stock in Wales is proportionately older than that in England (47% built before 1945 compared with 40%) and with a greater preponderance of solid walls the cost of improving insulation consequently higher.

6.16   Currently, financial assistance is available only to people in receipt of ‘passported’ benefits which inevitably is only a small part of the population.   The Committee considers it unlikely that there will be any significant increase in the level of home-owner investment in home insulation unless there is a greater incentive to do this such as from a greater sharing in the cost by the Government.

Research and Development

6.17 From an industrial point of view there are clear opportunities for business to invest in research and development of new designs and new products and the pressures in this sector mean there are clear market opportunities that businesses in Wales can compete for. The National Assembly already has in place a new range of programmes to encourage and promote research and development, innovation and investment and these should be reviewed to ensure that maximum benefit is to be obtained from the opportunities in this sector. There is a win-win to be had here; jobs and investment in a sector which is likely to continue to expand in the future and a significant impact on the use of energy made in Wales with all the consequent benefits that come from this.

Skills development

6.18 Much of the work in this sector, particularly work relating to the improvement of insulation in homes is labour intensive. It also requires highly skilled manpower both for the installation of improved energy efficiency measures and in the development of new products for this sector. Wales will not be able to benefit from developments in the sector unless it has sufficient numbers of properly skilled people to undertake the work. It is therefore important that ELWa and other bodies involved in the provision of training recognise this as a priority sector and ensure that suitable training opportunities are available for people throughout Wales. It should also ensure that training is market driven and keeps up with latest technological developments.

Local Authorities

6.19 The National Assembly can go only so far in creating awareness and encouraging changed attitudes. If improvements in energy efficiency are to be made then these need to be lead and co-ordinated at a local level. The Committee believes that Local Authorities should be supported in taking a firmer and clearer responsibility for energy efficiency in their areas.

6.20 Local Authorities already have obligations for reporting on domestic energy efficiency in their area through the Home Energy Conservation Act. The returns from Welsh Authorities could usefully be collated by the National Assembly to provide an on-going view of domestic energy efficiency in Wales. Authorities can gain some support for fulfilling their HECA options from the Local Authority Support Programme run by the EST. The National Assembly should provide sufficient additional financial support to ensure that every Authority has a HECA officer.

6.21 The Assembly can provide further support by providing information and support for Authorities to use the resources available through the wide range of programmes, particularly EEC, HEES and Community Energy, for improving energy efficiency and increasing the small scale use of CHP.

Annexe C. Combined Heat and Power (CHP)

Most electricity is currently produced in power stations where a fuel is used to produce heat, the heat is used to raise steam which is then used to drive a turbine which generates electricity. The steam exhaust from the turbine is regarded as waste heat and is discharged through the cooling towers associated with such stations. The water condensed in the process is recycled through the plant for re-use.

Most heating applications require heat at temperatures lower than 100°C, the temperature of steam. Thus the exhaust from the electricity generation process is potentially useful. However to be commercially viable it is necessary to have a suitable heat demand located close to the electricity generation site. Where the heat can be used then there is a case for designing the plant to deliver both heat and power; hence the name, Combined Heat and Power (CHP).

In broad terms traditional electricity generation stations had an overall thermal efficiency of around 30% (the worst were 20% and the best as good as 40%). Modern gas turbines can achieve thermal efficiencies of 50% to 60%. However a CHP plant will achieve an overall thermal efficiency in excess of 75%. There is some flexibility in the ratio of electricity to heat outputs, commercial schemes produce about 2.5 times as much heat as electricity.

The energy efficiency savings CHP provides can cut energy costs for businesses, increasing their competitiveness. Community heating schemes using CHP provide affordable warmth and cheaper electricity from a secure local source to take disadvantaged people out of fuel poverty. Wherever it is used CHP reduces carbon emissions compared to the alternative of separate heating and electricity generation and is a significant component of the UK Government's Climate Change Programme.

The UK government set targets for CHP, namely 5000MW installed by 2000 and 10,000MW installed by 2010. At the end of 2000 there was 4632MW installed. Since then there has been a significant downturn in the CHP market. The reasons for this are detailed in the body of the report (see paragraphs 2.24 and 3.27-29)

However the outlook is not entirely bleak. For industries who can use both the heat and electricity generated on their own site, the economics of CHP still make sense and most existing CHP plant will continue to be fully utilised. There maybe some additional capacity added by large industrial users. Industrial scale units are in the range 1 – 100MW electrical output.

For several public service sites and a number of commercial sectors, particularly large hotels and leisure centres, CHP also remains very attractive. These sites have significant and continuous heat loads and can use the electricity on-site. These installations are generally on a scale less than 1MW and remain cost-effective.

In the domestic and office sector CHP can potentially be used wherever there are heat distribution networks providing district or community heating. At present less than 5% of such networks are connected to CHP units, instead they use standard boilers. As these boilers come to the end of their life they should, and many will be, replaced by suitable CHP units (often with boiler back up to meet peak heat loads). These units are in the range 10kW to 100kW electrical output.

A more recent development has been of a range of so called micro-CHP units with electrical outputs in the range 1 – 10kW. These units have been designed to be replacements for standard domestic and commercial boilers and are undergoing field trials by a number of companies at present. The existing units are based upon a Stirling engine and they achieve an electrical efficiency of 15% but an overall thermal efficiency of more than 90%. Thus when such units replace an old gas boiler there is usually a reduction in gas use and a significant output of electricity as well as the heat required.

Micro-CHP units are expected to cost between £600 and £400 more than a conventional boiler and are likely to be leased to customers rather than sold direct. Provided that the field trials are successful, and that the regulations regarding export of electricity and connections to networks can be resolved, they are expected to enter the mass market before 2005