Climate change and employment

Case of the United Kingdom

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The carbon impacts of the measures announced by the Government in the context of the policy against climate change			
	MT carbon saved in 2020	**Min.**	**Max.**
Improvement in billing	0 – 0.1	0	0.1
Changes in renewable energy obligations	0.7 – 1.5	0.7	1.5
European emission rights market	8	8	8
Products that are more energy efficient	2	2	2
Construction of new nuclear power stations	0 – 1.1	0	1.1
Renewable fuel substitution obligation in transport	0.3 – 1.1	0.3	1.1
New carbon emission reduction measures	1.2	1.2	1.2
Follow-up of voluntary agreements on energy efficient	1.8 – 2.1	1.8	2.1
Continuation of energy suppliers' commitment until 2020	3.0 – 4.0	3	4
Continuation of building regulations initiated in 2005	2.5 – 3.0	2.5	3
Carbon neutral Government	0 – 0.8	0	0.8
Carbon neutral developments	0 – 0.4	0	0.4
Total	**19.5 – 25.3**	**19.5**	**25.3**

CO2 reduction by sector by 2010						
	Electricity suppliers	**Private sector**	**Transport**	**Domestic**	**Public sector**	
Emission rights market	3.0 – 8.0	0.3				
Renewable energy obligations	2.5					
Biomass subsidy	0.1					
Carbon Trust		1.1 + 0.1				
Buildings regulation		0.6				
Climate change agreements		2.9				
Measure in favour of SMEs		0.1				
Series of voluntary agreements			2.3			
Transport infrastructure			0.8			
Durable distribution (Scotland)			0.1			
Fuel tax			1.9			
Renewable fuel obligation			1.6			
Voluntary European agreements			0.1			
Energy efficiency commitments				1.6 + 0.5		
Building regulation				1.5		
Fight against energy poverty				0.4		
Other measures				0.2		
Replacement of boilers				0.2		
Energy efficiency of buildings				0.1		
Meters and billing				0.2	0.5	
Information on energy products				0.2		
TOTAL	**5.6 – 10.6**	**5.1**	**6.8**	**4.9**	**0.5**	**22.9 – 27.9**

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Part 1

CO_2 emission reduction policies

1. Energy supply: renewable energy obligations

Renewable energy obligations favour the development of electricity generation using renewable sources of energy by imposing a quota of renewable energy on the electricity suppliers throughout the United Kingdom holding a valid license.

This obligation is 5.5% for the years 2005-2006, but increases progressively to 10.4% in 2010-2011 and to 15.4% in 2015-2016. In 2004, the overall share of renewable energy was 3.1%.

The eligible technologies are listed. This obligation is in place until 2027.

Each megawatt produced by renewable energy shall receive an exchangeable Renewables Obligation Certificate (ROC) issued by Ofgem.

Electricity suppliers can fulfil their obligations either by presenting enough certificates to cover the required percentage of their output or by directly paying a "buy-out" price of £32.35/MWh in 2004-2005, adjusted annually by RPI. The fund recycles the proceeds it receives from buy-out payments to certificate holders at the end of a 12-month period.

Together with the climate change levy exemptions, the renewable energy obligations should bring in more than a billion pounds a year from 2010.

The impact of renewable energy obligations in place since 2002 is beginning to be felt:

- 450 MW of wind-generated electricity capacity was installed in 2005, double that of 2004: wind power is by far the main source of renewable energy specified in Britain's climate plan;
- several electricity generation projects using biomass are also mentioned.

However, the objective of 10% of renewable energy by 2010 is not yet reached. That is why, by way of complement to the ROCs, the Government launched a £500 million R&D programme to run between 2002 and 2008 on this issue.

2. The private sector

2.1. *Climate Change Levy*

The climate change levy which applies to the use of energy by industry, commerce and the public sector was introduced in 2001.

Its aim is to promote energy efficiency, encourage job opportunities and stimulate investment in new technology.

Apart from fuel consumption, the exemptions concern small businesses, transport and domestic use. The only industrial use exonerated is electrolysis, a procedure used in the production of aluminium in particular.

Climate change levy in the United Kingdom

	Gas	Carbon	LPG	Electricity	Fuel
Industry	0.15 p/kw/h	0.15 p/kw/h	0.07 p/kw/h	0.43 p/kw/h	0
Commerce	0.15 p/kw/h	0.15 p/kw/h	0.07 p/kw/h	0.43 p/kw/h	0
Public sector	0.15 p/kw/h	0.15 p/kw/h	0.07 p/kw/h	0.43 p/kw/h	0

When it was introduced, it was compensated by a drop of 0.3% in the Employer's National Insurance Contribution (NIC), which overall was translated by a net reduction in employer costs.

A study undertaken by Cambridge Econometrics concluded that the carbon emission reductions increased to 16.5 Mt cumulatively until 2005 and that between 2005 and 2010, a reduction of 3.5 Mt/year is anticipated, a rate higher than the 2 Mt estimated at its launch.

It is also estimated that the climate change levy shall have an overall reduction effect on energy demand of 2.9%/year by 2010. This estimate is based on a 15% reduction per year in the sectors in which the levy is applicable.

Cambridge Econometrics estimates the cost reduction resulting from the drop in charges to be 0.13% in 2010. For 2004-2005, the national insurance contribution exemption came to £1.2 M, compared to £772 M in climate change levy.

2.2. Climate Change Agreements

The climate change agreements were concluded between DEFRA (Department for Environment, Food and Rural Affairs) and 44 energy intensive sectors in March 2001 after two years of negotiations. These agreements are valid for 12 years, that is until 31 March 2013 and contain quantitative energy efficiency objectives and carbon emission reduction objectives for 2010.

These agreements allow the participating industries to reduce the climate change levy introduced on 1st April 2001 by 80%.

The objectives are defined at a sectoral and company level.

The sectoral agreements detail the sites covered (10,000 in all) and the processes. The companies may fulfil their commitments either by economising energy or by buying emission rights from other companies directly or within the framework of the voluntary plan for emission rights in force in the United Kingdom.

The results shall be measured every two years until 2010.

In 2004, the sectors fulfilled their commitments by reducing emissions by 14.4 Mt of CO_2 (3.9 Mt of carbon, where 1 t of carbon = 3.7 t of CO_2) per year. Although in 2002 the emission reductions came mainly from a drop in steel production, they rose by 28% between 2002 and 2004 for a rise in energy consumption limited to + 10%.

The objectives were revised and brought into line with the national emissions trading scheme announced within the European framework for the period between 2006 and 2010.

Around 500 installations are covered both by the EU Emission Trading Scheme and Climate Change Agreements. The Government of the United Kingdom received temporary exclusion for 331 installations from the European scheme. The aim is to avoid doubling each company's sale or purchase of the same differences to the emission rights allocations.

The revision of the objectives allows a forecast of 0.2 MtC in 2010 as well as 2.5 MtC per year scheduled in 2001. This figure is a balance between an increase of 0.2 MtC for the iron and steel industry and a saving of 0.2 MtC for the other sectors.

With the integration of new sectors, carbon emission should be reduced by 2.9 Mt per year, which is an additional 0.4 MtC in 2010.

2.3. Carbon Trust

Carbon Trust is an independent company created for the Government in April 2001. Its objective, within the framework of applying the climate change levy, is to encourage R&D in low carbon technology and energy efficiency.

It has taken action in three main areas:

- reducing greenhouse gas emission with immediate effect;
- developing low carbon technology;
- assisting in the understanding of the impact of climate change.

3. Building regulations

The British market of CO_2 emission rights

Launched in April 2002, the Government established the first reduction in CO_2 emission rights. Thirty three direct participants committed to reducing their emissions by 3.96 $MtCO_2$ between 2002 and 2006, against a total remuneration of £215 M.

The three objectives undertaken were to:

- ensure greenhouse gas emission reduction at competitive costs;
- give British companies some experience in emission rights trading;
- encourage the establishment of centres and expertise in emission rights trading in the City.

This 5-year pilot scheme came to an end on 31 December 2006.

At the end of 2004 there was an excess of emission rights due to some companies being given the opportunity to reduce their emissions at very low cost making the financial incentives seem like subsidies.

The announcement at the end of 2004 that there were new opportunities for reducing emissions balanced out the market again.

4. Transport

4.1. Voluntary agreements with the car industry

The agreement signed by the European Commission and the car industry, Acea in Europe, Jama in Japan and Kama in South Korea, envisages a reduction of 140g/km on average of CO_2 emissions in new vehicles put into circulation in 2008-2009, which represents an average reduction of 25% in Europe compared to the 1995 figures. The 2003 figures indicate that only a reduction of 12% has been achieved.

4.2. Vehicle tax

In 2001, a vehicle tax based on CO_2 emissions was introduced. Company car tax was also modified and based on carbon emissions.

4.3. Renewable fuel obligation in transport

In November 2005, the Government announced that it was implementing the renewable fuel obligation in transport in order to force transport fuel suppliers to sell a percentage of renewable fuel.

This obligation shall be introduced in 2008-2009 and shall represent 5% of total fuel sales for transport in 2010-2011. Its impact is estimated at a reduction in emissions of 1.6 MtC.

The 2006 budget already indicated that the compulsory proportion would be 2.5% in 2008-2009 and 3.75% in 2009-2010, which shall mean a significant increase in the consumption of biofuels in the coming years.

5. Domestic

5.1. Energy Efficiency Commitments (EEC)

Gas and electricity suppliers must fulfil the energy efficiency improvement objectives in the domestic sector and by whatsoever means: insulation, low-energy bulbs, low-energy boilers…

The only constraint is that at least 50% of housing energy savings should be made through revenue generated from realised savings or tax credits/benefits.

During the first EEC application phase (April 2002 to March 2005), suppliers fulfilled their objectives, which guarantees a saving of 0.37 MtC per year up until 2010. The following period (2005-2008) should see this figure double producing a saving o 0.62 MtC per year in 2010.

The first phase amounts to £300 per tonne of carbon for which the cost of saving, passed onto each consumer, came to £3.20 per year. This additional cost for the consumer shall reach, according to forecasts, £9 per year for the 2005-2008 period, which is around 2% of an annual gas and electricity bill of between £340 and £530 per year.

This amount shall be offset either against resulting energy savings or against an improvement in long-term comfort.

For the third phase covering years 2008-2011, the Government expects to double carbon emission reductions bringing them to 1.2 MtC per year up to 2010.

5.2. Building regulations

The energy efficiency standards for new buildings whether they are used for housing or not are regularly revised upwards.

For example, a house built in 2002 according to the standards of that year:

- has increased its energy efficiency by 70% compared to the same construction built in 1990.
- Consumes half less energy than the average in existing housing stock.

In March 2006, the energy efficiency levels of buildings improved by 27% for buildings used for purposes other than living, by 22% for houses and by 18% for flats.

The 2002 measures shall reduce fuel consumption by 40% in four years.

Part 2

The United Kingdom's CO_2 emissions outlook

1. Headline CO_2 Projections to 2020

The DTI forecasts a range of possible future carbon dioxide emissions levels, which reflect four scenarios:

- a high fossil fuel price scenario;
- a central fossil fuel price scenario, where the assumed prices somewhat favour gas in generation;
- a central fossil fuel price scenario, where the assumed prices somewhat favour coal in generation;
- a low fossil fuel price scenario.

Current CO_2 projections[1] (Table 1), which do not take account of proposals set out in the main body of this report, show emissions falling up to 2010 due to measures contained in the Climate Change Programme, but increasing to 2015 as the effect of the existing measures is more than counterbalanced by the increase in energy demand and the closure of nuclear generation plants.

Emissions fall after 2015 as a significant number of coal-fired power plants retire post 2015. Taking an average of the two central scenarios, and including the EU Emissions Trading Scheme (EU ETS), the current projections suggest a 16.2% reduction on 1990 levels by 2010, which will be a shortfall of 6.2 MtC from the target of a 20% reduction in emissions relative to 1990 levels.

[1] The current projections (DTI Energy and CO_2 Emissions Projections to 2020 – UEP26) are available at : www.dti.gov.uk/energy/review/index.html

The impact of the EU ETS is shown in the table as a separate line. It is included as the reduction in the UK allocation of allowances (-8 MtC annually) announced for Phase II of the scheme. Not all of this reduction may be achieved within the UK – the scale of abatement action within the UK will depend on the level of the carbon price across the EU as a whole.

Table 1: Carbon dioxide emissions projections (1990–2020) (MtC)

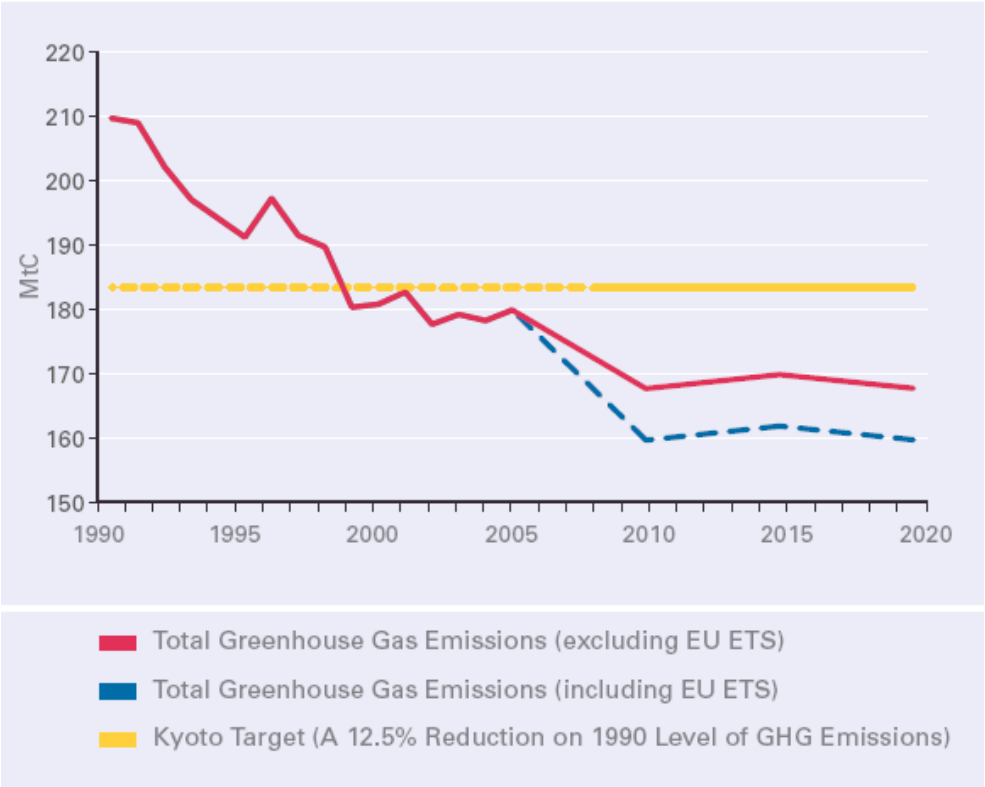
				Central Scenario Favourable to coal			Central Scenario Favourable to gas		
	1990	2000	2005	2010	2015	2020	2010	2015	2020
Power Stations	55.7	43.1	47.1	44.1	47.6	46.5	42.5	45.4	45.0
Refineries	5.0	4.9	5.6	5.7	5.7	5.7	5.7	5.7	5.7
Residential	21.1	23.2	22.3	19.8	19.9	20.1	20.3	20.4	20.6
Services	8.3	8.2	6.8	5.9	6.1	6.9	5.9	6.1	6.9
Industry	35.3	33.4	31.4	32.5	31.4	30.3	32.6	31.7	30.6
Road Transport	30.1	32.0	33.3	32.6	33.2	32.5	32.6	33.2	32.5
Off-road	1.6	1.4	1.5	1.5	1.4	1.4	1.4	1.4	1.4
Other transport	3.4	2.5	2.3	2.3	2.4	2.5	2.3	2.4	2.5
LUC[1]	0.8	-0.1	-0.6	-0.5	0.1	0.7	-0.5	0.1	0.7
Total (excl. EU ETS)	**161.4**	**148.6**	**149.8**	**143.9**	**147.8**	**146.5**	**142.9**	**146.4**	**145.8**
EU ETS	-	-	-	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Total (incl. EU ETS)	**161.4**	**148.6**	**149.8**	**135.9**	**139.8**	**138.5**	**134.9**	**138.4**	**137.8**
				High Scenario			Low Scenario		
	1990	2000	2005	2010	2015	2020	2010	2015	2020
Power Stations	55.7	43.1	47.1	44.4	48.3	49.5	40.9	41.6	39.9
Refineries	5.0	4.9	5.6	5.7	5.7	5.7	5.7	5.7	5.7
Residential	21.1	23.2	22.3	19.0	19.0	19.3	21.5	21.5	21.6
Services	8.3	8.2	6.8	5.9	6.1	6.9	5.9	6.1	6.9
Industry	35.3	33.4	31.4	32.2	30.7	29.5	32.8	31.9	30.7
Road Transport	30.1	32.0	33.4	32.1	32.3	31.7	33.1	34.0	33.5
Off-road	1.6	1.4	1.5	1.4	1.4	1.4	1.5	1.5	1.5
Other transport	3.4	2.5	2.3	2.3	2.3	2.4	2.4	2.5	2.6
LUC[1]	0.8	-0.1	-0.6	-0.5	0.1	0.7	-0.5	0.1	0.7
Total (excl. EU ETS)	**161.4**	**148.6**	**149.8**	**142.5**	**145.9**	**146.9**	**143.3**	**145.0**	**142.9**
EU ETS	-	-	-	-8.0	-8.0	-8.0	-8.0	-8.0	-8.0
Total (incl. EU ETS)	**161.4**	**148.6**	**149.8**	**134.5**	**137.9**	**138.9**	**135.3**	**137.0**	**134.9**

(1) Land Use Change

2. Progress towards Kyoto

The Kyoto target is based on a basket of greenhouse gases (GHG) of which CO_2 emissions represent the largest share. The UK remains on track to comfortably go beyond its Kyoto commitment. Thus the current CO_2 projections (UEP26) combined with the emissions of other (non-CO_2) greenhouse gases suggest that in 2010 total UK greenhouse gas emissions, without the EU ETS, will be some 20% below the base year level[2]. Including the EU ETS, the projected reduction is almost 24%. Chart 1 below illustrates the projected total greenhouse gas emissions relative to the UK Kyoto target after incorporating the current CO_2 projections (UEP26).

Chart 1: Total greenhouse gas emissions (1990-2020)



Source: DTI

3. Revisions of previous projections to 2020

Since the previous CO_2 projections (UEP 21) were published in February 2006[2], there have been a number of developments arising from the Budget announcements in March 2006, developments in UK population statistics, additional policy measures announced in the Climate Change Policy Review and responses received to the February 2006 consultation on EU ETS Phase II CO_2 emissions projections[4]. There has also been a re-assessment of fossil fuel prices. Generally, fossil fuel prices in 2010 are assumed to be higher than previously and to rise further between 2010 and 2020. This is to reflect the signs that demand for oil appears more robust to higher prices than previously assumed and supply is still expected to remain relatively tight even after expected increases in supply in the next few years. Table C2 sets out the fossil fuel price assumptions used for the current CO_2 projections (UEP 26).

Table 2: Fossil fuel price assumptions

	Central Scenario Favourable to coal			Central Scenario Favourable to gas		
Real 2005 prices	Crude Oil	Natural Gas	ARA Coal	Crude Oil	Natural Gas	ARA Coal
	$/bbl	NBP p/therm	$/GJ	$/bbl	NBP p/therm	$/GJ
2005	55.0	41.0	2.4	55.0	41.0	2.4
2010	40.0	33.5	1.9	40.0	25.8	1.9
2015	42.5	35.0	1.9	42.5	27.3	1.9
2020	45.0	36.5	1.8	45.0	28.0	1.8
	High Scenario			Low Scenario		
Real 2005 prices	Crude Oil	Natural Gas	ARA Coal	Crude Oil	Natural Gas	ARA Coal
	$/bbl	NBP p/therm	$/GJ	$/bbl	NBP p/therm	$/GJ
2005	55.0	41.0	2.4	55.0	41.0	2.4
2010	67.0	49.9	2.6	20.0	18.0	1.4
2015	69.5	51.4	2.6	20.0	19.5	1.2
2020	72.0	53.0	2.6	20.0	21.0	1.0

[2] These are available http://www.dti.gov.uk/files/file26363.pdf.

Table 3 below illustrates the revised generation fuel mix consistent with the current CO_2 projections (UEP 26) for the two central cases up to 2020, which shows how coal and nuclear plant closures affect the changing mix over the next few years.

Table 3: Electricity generation fuel mix (Twh)

Central favourable to gas	1990	1995	2000	2005	2010	2015	2020
coal	204	145	112	126	106	100	82
oil	15	9	2	2	2	2	1
gas	0	57	127	135	137	183	235
nuclear	59	81	78	75	73	34	26
renewables	5	6	10	17	33	53	53
imports	12	16	14	11	11	11	11
pumped storage	2	2	3	3	3	3	3
Total	**298**	**315**	**346**	**369**	**365**	**386**	**411**
Central favourable to coal	1990	1995	2000	2005	2010	2015	2020
coal	204	145	112	126	119	116	94
oil	15	9	2	2	3	2	2
gas	0	57	127	135	122	164	219
nuclear	59	81	78	75	73	34	26
renewables	5	6	10	17	33	53	53
imports	12	16	14	11	11	11	11
pumped storage	2	2	3	3	3	3	3
Total	**298**	**315**	**346**	**369**	**362**	**383**	**407**

Part 3

Impact of the energy policy on CO_2 objectives

Tony Blair's preface to *The Energy Challenge Energy Review Report 2006* drawn up by the Department of Trade and Industry (DTI) sets out energy security and climate change in the objectives pursued by the British Prime Minister.

Up until recently, the United Kingdom benefited from great autonomy in its supply of energy due to the exploitation of the oil and gas fields in the North Sea and a nuclear power station which provides for 20% of its electricity requirements. The oil and gas fields are rapidly depleting, as did the coal fields exploited in the UK, and, as with the exploitations, the nuclear power station needs to be renewed in the next few years.

The decision to replace and/or modernise the nuclear power stations and coal power stations seems to have been taken with this objective in mind.

The United Kingdom's energy dependency is a new phenomenon and what is more, it has appeared in a context of competition from China and India in the search for supply sources.

The philosophy developed by the British government to cope with this dual evolution is a balanced approach between technical advances and increased efficiency, on the one hand, and between regulations resulting from energy policies developed by its cabinet and the market endowed with many virtues, on the other.

1. Putting a price on carbon

The only way the international community can limit the increase in carbon emissions is by making the governments, industrialists and individuals pay the price.

One of the key roles of the government is to put in place a framework which, by putting a price on carbon, creates a financial incentive to incorporate the impacts of climate change into the activities.

To this end, the British government supports the application of the Kyoto protocol on a European scale via the emission permit market and suggests a few improvements and clarifications:

- clarify the method of determining the allocation allowance;
- clarify the allocation distribution criteria in order to ensure that it offers the most incentives for a low carbon economy;
- call into question the foundation based on a carbon emission background and replace it by a standard methodology valid for all sectors. The emission allocation could be based upon an average emission per product determined through comparison (*benchmarking*);
- evolve towards trading the entire emission rights allocation (and not only the growth margins);
- increase the number of sectors and gases concerned (aluminium and PFC are directly targeted);
- ensure a continuity after 2012 of the investments agreed within the framework of joint implementations and CDMs.

2. Saving energy

In order to achieve a 60% reduction of CO_2 emissions by 2050, it is not only necessary to reduce the carbon intensity of energy consumption but also to save energy.

Measures have already been taken to facilitate the reduction of the energy intensity of the British economy by 7% between 1990 and 2010. But more needs to be done. For example, on average, existing housing consumes four times more energy for heating than new builds.

2.1. Carbon neutral developments

Three main objectives:

- develop the five levels for the code for sustainable housing;
- introduce energy performance certificates for homes;
- develop a new policy on climate change.

2.2. Developing services to promote energy efficiency

Energy efficiency commitments are one of the main political mechanisms for promoting energy efficiency in the housing sector. The aim is to develop new opportunities for energy suppliers to sell energy services and no longer just energy: heating, lighting, power services for the home. The necessary innovation time and the reduction of energy consumption *via* these services could become an obligation from 2011. The regulatory obligation would therefore become a valuable service.

2.3. Improving information and knowledge in all sectors of society

Householders are more likely to invest in energy efficiency improvements and to reduce the waste of energy if they are provided with timely, specific and relevant information on their energy use and how much it costs. Combined with the information in Home Information Packs showing where energy efficiency improvements can be made, and better and more timely information will help householders make decisions on where and how they can make real savings on their energy bills. This will complement existing work by the Energy Saving Trust and measures set out in the UK Climate Change Programme.

2.4. Promoting incentives for each sector of society

Government policy to address emissions from business has so far been primarily focused on the energy intensive industries, through their participation in the EU Emissions Trading Scheme and Climate Change Agreements. Corporate leaders[3] have called for the Government to address the gap in its current policy coverage by developing "strong new policy instruments" to "focus on the large, non-energy intensive users of energy in the commercial and public sectors". The Energy Efficiency Innovation Review demonstrated that there are significant opportunities in the large non-energy intensive sectors to improve energy efficiency which are not currently being exploited.

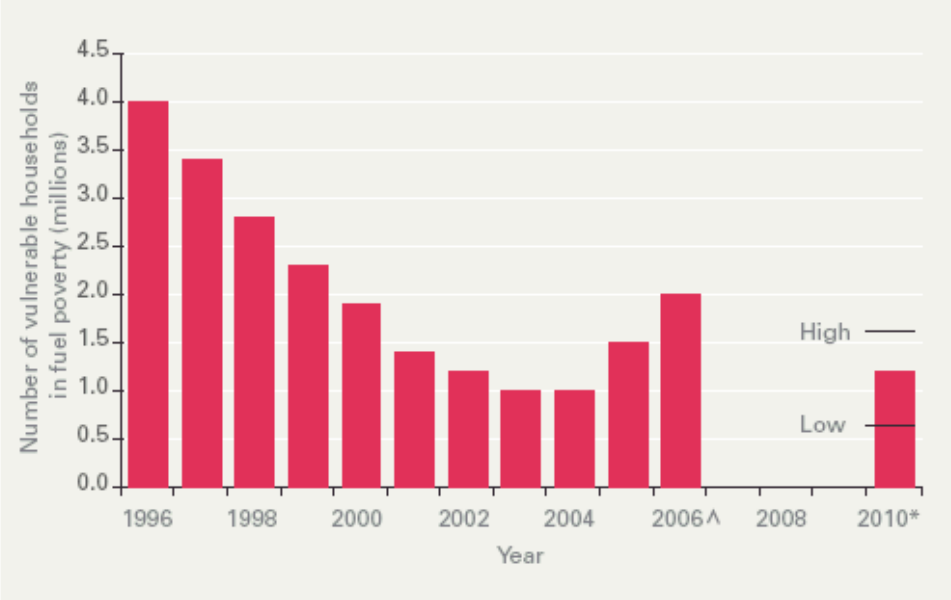
[3] The Corporate Leaders Group have highlighted "that there is a need for further policy action if we are to realise the potential economic and environmental benefits of energy efficiency". The UK Business Council for Sustainable Energy have also pointed to this gap in our energy and climate change policies and called for "strong new policy instruments" to "focus on the large, non-energy intensive users of energy in the commercial and public sectors".

Government believes that large commercial and public sector organisations have significant potential to achieve cost-effective carbon reductions. These large organisations cover about 15 MtC of emissions and analysis suggests they could cost-effectively save 0.5 MtC per year by 2015, rising to 1.2 MtC per year by 2020.

3. Climate change agreements

Businesses and the public sector are subject to a tax on energy consumption: the climate change levy, aimed at reducing energy demand. The climate change agreements allow participating industries to reduce this levy by 80%. They commit to energy efficiency and carbon emission reduction objectives. The climate change agreements shall remain in force until 2013. The climate change agreements were put in place in 2000 and during the first five years of their implementation they affected 6,000 businesses, covering 14,000 sites in 54 sectors.

Chart 2: Historic and projected numbers of vulnerable households in fuel poverty in England after economic effects (millions)



^ Positions in 2005 and 2006 are based on the modelling of the impact of income and energy prices movements on the number of vulnerable households in fuel poverty.

* Position in 2010 is based on modelling and shows central price scenario as the main bar, with lines indicating the level of fuel poverty under the low and high price scenarios. These are based on an oil price in 2010 of US $40/barrel (bbl) under the central case, $20/barrel under the low case and $67/barrel under the high case.

Source: DTI, 2006

3.1. Show the example

By 2012, all government buildings shall be Carbon Neutral, and then by 2020 a 30% reduction in emissions will have been achieved. Local authorities, including those in London, shall also be invited to participate in the reduction of CO_2 emissions.

Public purchases and orders shall also be included.

3.2. Fuel poverty

Energy Efficiency measures can help consumers cut their electricity and gas bills. They can be one of the ways to help tackle the problem of fuel poverty, and ensure that the most vulnerable consumers can afford to heat their home to an adequate standard.

Fuel poverty is defined as the need to spend more than 10% of income on fuel to maintain a satisfactory heating regime. Between 1996 and 2003, the number of vulnerable households in fuel poverty fell from around 5 million to around 1.5 million across the UK. Strategies to end fuel poverty depend ultimately on improving housing standards and rising incomes, policies that have been given priority.

Rising energy prices will now, however, reverse the downward trend in fuel poverty. Figure 1 showed that fuel poverty remained broadly unchanged relative to 2003, with analysis suggesting that the total number of vulnerable households in fuel poverty is likely to rise by around one million households in England between 2004 and 2006.

3.3. Distributed energy

One way of reducing emissions, diversifying energy sources and, in some cases, lowering costs, is by producing energy at the place at which it is consumed.

These proposals are in addition to the proposals made in the Renewables section to bring forward renewable generating capacity.

The Government and Ofgem will lead a comprehensive review of the incentives and barriers that impact on distributed electricity generation including CHP. This Review will report in the first half of 2007. Its scope will include, but not be limited to:

- the economic and other incentives on suppliers to buy electricity from distributed generators;
- the economic and other incentives on DNOs to connect new generators and to invest in upgrading distribution networks in order to accommodate increasing amounts of distributed generation;
- the incentives on DNOs to engage in innovation aimed at minimising the costs and capturing the benefits of distributed generation.

Options for resolving potential barriers to the sale of electricity by small generators, for example:

- licensing procedures (including exemptions);
- technical standards for connection and for network operation.

The Climate Change and Sustainable Energy Act 2006 empowers government to require all energy suppliers, through licence modifications, to offer to acquire exported electricity. The Secretary of State has to make a decision whether to use these powers twelve months after commencement, that is, in the second half of 2007. If energy suppliers do not develop a system to acquire electricity from microgenerators, Government will intervene.

Government will undertake a wide-ranging review of the long-term potential and challenges of distributed generation, including Combined Heat and Power, as an alternative or large-scale supplement to centralized generation. Incorporating a range of scientific, technical, economic and behavioural issues, it will be taken forward as part of a Foresight Project looking at sustainable energy management in the built environment, by the Office of Science and Innovation.

The Microgeneration Strategy will be implemented aggressively by Government, and the powers acquired by Government under the Climate Change and Sustainable Energy Act 2006 will be exercised where appropriate. Key policies included:

- easier access to the monetary benefits of Renewable Obligation Certificates;
- producing reports on energy measures for local authorities – including promoting microgeneration – that authorities will have to have regard to in the exercise of their functions;
- promoting community energy projects;
- a review of communications activity to assess how to improve information provision;
- a new power for Parish Councils to promote microgeneration in their own parishes.

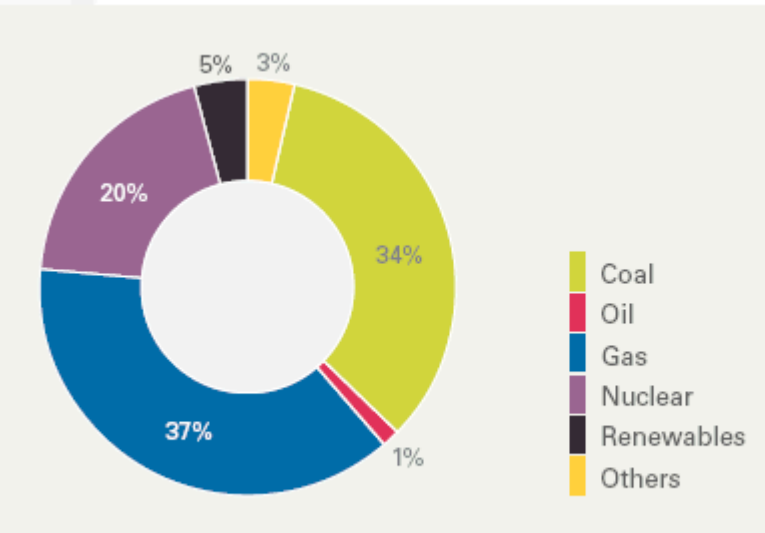
Government will consult on changes to the Planning system with a view to making it easier for householders to install microgeneration equipment on existing houses by removing the need to submit a planning application. Alternative fuels for heat.

4. The challenges of new electricity generation for 2020.

Over the next two decades, the UK will need substantial new investment in electricity generation capacity to replace closing coal, oil and nuclear power stations and to meet expected growth in electricity demand.

Around 8GW (roughly a third of current capacity) of the UK's coal power stations must close no later than 2015 as a result of EU environmental legislation. And, based on published lifetimes, more than 10GW of the UK's nuclear power stations will close by 2023. In total, the UK is likely to need around 25GW of new electricity generation capacity by 2025, equivalent to more than 30% of today's existing capacity.

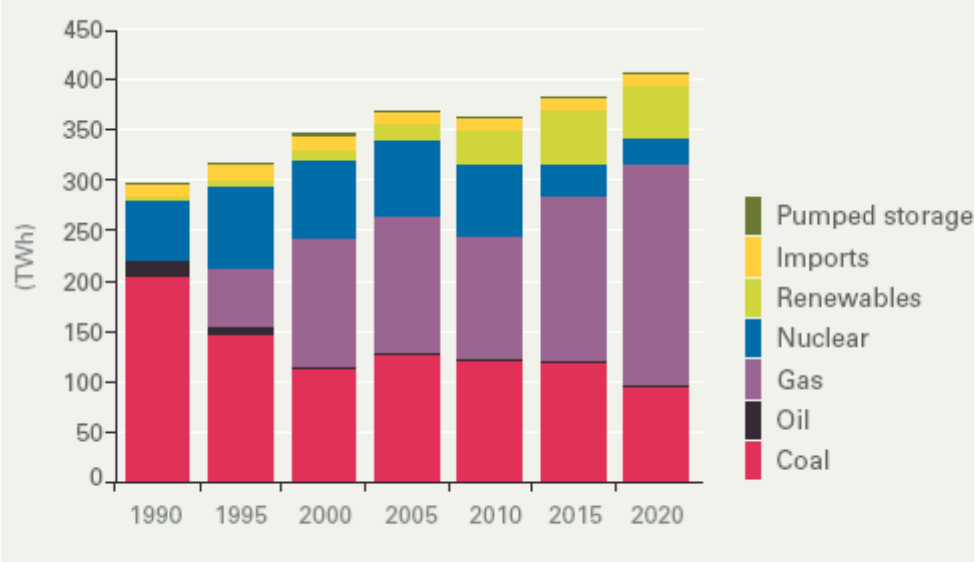
Chart 3: UK electricity generation mix (2005)



Source: DTI, 2006

Government's latest energy projections[39] based on a central set of assumptions show that, without changes to the current market framework, many of the closing coal and nuclear power stations would be replaced by gas-fired stations, along with some renewables (see chart 15). Under this scenario, the percentage of the UK's electricity supplied by gas-fired power stations could rise from 37% today to around 55% by 2020. This would reduce the diversity of the UK's generation mix, with more than half of the UK's electricity supply dependent on a single fuel type. This increased dependency on gas for electricity generation would also be happening at the very time the UK becomes increasingly reliant on imports for its gas supplies.

Chart 4: Electricity generation mix – projections to 2020



Source: DTI, 2006

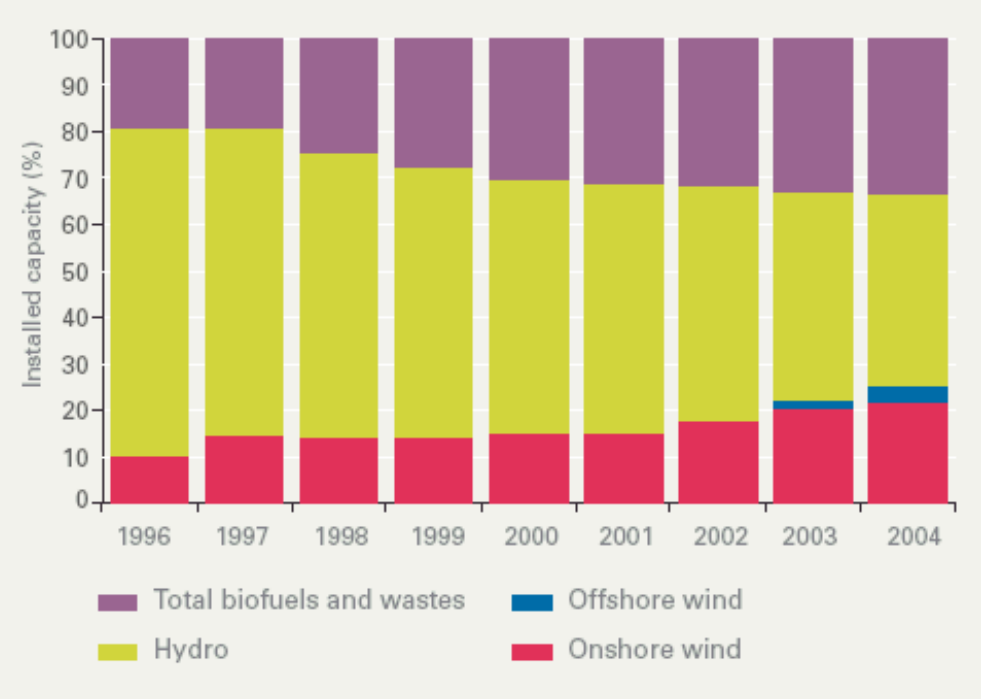
In this context, the Government:

- confirms and strengthens its commitment to the Renewables Obligation;
- clarifies its position on new nuclear build;
- brings forward proposals to improve the planning process for large-scale electricity generation;
- sets out its aim to strengthen the EU Emissions Trading Scheme (ETS) post-2012 so that it provides a stable and transparent investment framework for business;
- introduces new arrangements for the provision of forward-looking energy market information and analysis relating to security of supply.

4.1. *Electricity Generation – Renewables*

Renewable energy, derived from sources such as the sun, the wind, waves, tides and biomass (including waste), is a vital and growing component of our diverse energy mix. If we could derive more of our energy from the renewable sources all around us, we could reduce our reliance on imported fossil fuels. And as renewable energy produces very little carbon or other greenhouse gases, it helps us cut emissions, and plays an important part in tackling climate change.

Chart 5: The contribution of different technologies to the UK's overall electricity generation from renewable sources



Source: DTI, 2005

The Government therefore proposes to strengthen the framework that supports the development and deployment of renewable technologies. With this strategy, the Government believes that its can achieve 20% of its electricity coming from renewable sources by 2020.

Renewable energy is an integral part of the Government's long-term aim of reducing CO_2 emissions by 60% by 2050. As it produces very little carbon dioxide and other greenhouse gases, it plays an important part in tackling climate change.

Recognising the important contribution that renewable forms of energy can make to energy policy goals, in the 2003 Energy White Paper Government set a target of 10% of electricity supply from renewable energy by 2010, subject to the costs being acceptable to the consumer, with a further aspiration to derive 20% of our electricity from renewable sources by 2020.

To help achieve this, the Government has introduced a number of measures to incentivise the development and deployment of renewable sources of energy in the UK, including the Renewables Obligation (RO) and some £500m of public funding for various support programmes.

As a result, the amount of UK renewable electricity generation has increased substantially since 2002. Total generation from RO-eligible renewable sources was around 4% of total electricity supplied to UK consumers in 2005, up from 1.8% in 2002.

About 1.7 GW of wind power is now connected to the grid, enough to supply power to almost one million homes[41]. Chart 4 below indicates that energy from biofuels and waste and from onshore and offshore wind continue to provide a growing proportion of overall supplies of energy from renewable sources. There are also a significant number of projects currently in the planning pipeline, with over 11GW of renewable projects in planning across the UK.

The Renewables Obligation (RO) is the Government's main support mechanism for the expansion of renewable electricity in the UK. Introduced in 2002, the RO obliges electricity suppliers to source a rising percentage of electricity from renewable sources.

The level of the obligation is 6.7% in 2006/07. Under current policy, it would rise annually to 15.4% in 2015/16, then remain at that level until the obligation ceases in 2027.

The Government has identified the following three steps for strengthening and widening the impact of the RO:

- extending Obligation levels to 20% (when justified by growth in renewable generation);
- amending the RO to remove risk of unanticipated ROC oversupply; and
- adapting the RO to provide greater support to emerging technologies and less support for established technologies. The Government's preferred option for achieving this is through a "banding" system, ensuring that current ROC rights for existing projects and for those built prior to implementation of changes are preserved. Any changes would be introduced in 2010.

The Government announced in March 2006 that it would look again at the role of co-firing within the RO as part of the Energy Review. Its believe that co-firing could play a greater role in contributing to our renewable energy and carbon reduction targets with reduced levels of support and we will be consulting on changes to the co-firing rules.

Measures on Renewable Energy

In order to support the development and deployment of renewable technologies, the Government proposes to strengthen and modify the Renewables Obligation (RO) to provide longer-term certainty and create a greater incentive for investment into those technologies that are further from the market.

This will include:

- extending Obligation levels to 20% (when justified by growth in renewable generation) – this will be made cost-neutral to the consumer by freezing the buyout price from 2015;
- consulting on amending the RO to remove risk of oversupply of ROCs;
- consulting on possible adjustments to the RO ("banding") to provide greater support to emerging technologies and reduced support for more established technologies;

- providing new funding for renewables through the Environmental Transformation Fund;
- working with industry, Ofgem and the National Grid to accelerate access to the electricity grid for renewable electricity generators; and
- working with the Devolved Administrations to ensure that across the UK, planning systems for renewables projects can reduce delays and uncertainty for developers and others, while maintaining the openness, fairness and accountability of the current system.

4.2. *Electricity – Cleaner Coal and Carbon Capture and Storage*

For many decades electricity generated from coal-fired power stations has played a major part in meeting the UK's electricity needs. Even with the growing importance of gas in the generation mix, coal-fired generation continues to meet around a third of electricity demand on average and during the winter of 2005/2006, in response to high gas prices, it met about half of demand. This illustrates the important contribution made by coal fired generation to the UK's energy security and the flexibility of its energy system.

Chart 6: Illustrative annual carbon emissions from 500MW electricity generation plant[4]

Plant type	Carbon emissions (millions tonnes / year)
Conventional coal	0.90
Efficient coal	0.69-0.74
Efficient coal with biomass	0.60-65
Natural gas	0.36
Natural gas or efficient coal with carbon capture and storage	<0.10

Coal-fired generation will therefore continue to play an important role in the UK's energy system, provided that its environmental impact can be managed effectively. As Table 5 below shows, coal-fired generation is the most carbon intensive of the major forms of electricity generation, emitting, for example, considerably more carbon than gas-fired generation. This underlines the importance and urgency of reducing the environmental impact from coal-fired generation.

There is the potential to increase further the efficiency of coal-fired generation and thereby improve its environmental performance. This is an important component of the Carbon Abatement Technology (CAT) strategy,[5] which sets out the Government's approach to supporting the development of low carbon technologies for power generation. £25 million was initially allocated to support technology demonstration

[4] Source DTI 2006
[5] Strategy for Developing Carbon Abatement Technologies for Fossil Fuel Use, DTI, 2005.

within the CAT strategy and this was supplemented by an additional £10 million in the 2005 Pre-Budget Report.

Carbon capture and storage (CCS) involves capturing carbon from a process that produces carbon, such as the burning of fossil fuels, and transporting it to a site where it is stored underground in geological formations and thereby prevented from entering the atmosphere.

CCS might reduce the carbon emissions from the combustion of fossil fuels in electricity generation and industry by 80 to 90% relative to the same plant without CCS. CCS in conjunction with electricity generation offers particular promise. The world still is and will continue to be highly dependent on electricity generation from fossil fuels. In the UK, for example, fossil-fuel based generation accounts for about 70% of UK electricity supply and about 30% of the UK's carbon emissions. So if CCS were economic and technically feasible on a large scale, it could have a major impact on global carbon emissions.

Before CCS can happen in the UK, a legal and regulatory framework needs to be established which would enable operators to bring forward CCS projects that are safe, that minimise potential environmental risks and that assign responsibilities appropriately between the public and private sectors.

The Government will continue to work with international partners to amend international legal frameworks to provide the legal basis for CCS. Storage beneath the seabed is particularly important to the UK because of the available capacity associated with depleted oil and gas reservoirs as well as deep saline aquifers. Such storage falls under the international agreement called the London Convention which exists to protect the marine environment through preventing the dumping of wastes in oceans and seas world-wide. While this prevents marine pollution, it creates uncertainty over what types of CCS projects with carbon dioxide storage in the marine area are legally allowed. The Government has pushed strongly to clarify these rules, and in April 2006 a draft amendment was prepared which would allow geological storage of carbon dioxide beneath the seabed. A separate international agreement, the OSPAR Convention, exists to provide further protection of the marine environment in the North East Atlantic. Signatories to the Convention have agreed to start work to clarify and if appropriate amend the Convention to facilitate subsea geological storage of carbon dioxide, and the Government is supporting this initiative.

In the light of the significant cooperation that the UK is undertaking with Norway, the Carbon Abatement Technology Strategy's £10 million call for demonstration and the recent announcement of the Environmental Transformation Fund, the next step would be a commercial demonstration of CCS, if it proved to be cost-effective. Following HM Treasury's recent consultation on CCS, we will do more work on the potential costs of such demonstration projects.

4.3. Electricity – Nuclear power

Nuclear power is a source of low carbon generation which contributes to the diversity of our energy supplies. Under likely scenarios for gas and carbon prices, new nuclear power stations would yield economic benefits in terms of carbon reduction and security of supply.

The economics of new nuclear build depend on expectations about future gas and carbon prices, as well as expected costs of building, operating, decommissioning and dealing with the waste of a new nuclear plant. Based on a range of plausible scenarios, the economics of nuclear now look more positive than at the time of the 2003 Energy White Paper. However, it will be for the private sector to make commercial decisions on investment in nuclear.

The Government believes that nuclear has a role to play in the future UK generating mix alongside other low carbon generation options.

Any new nuclear power station would be proposed, developed, constructed and operated by the private sector who would also meet decommissioning and their full share of long-term waste management costs.

The government will undertake further assessment which will help developers in identifying the most suitable sites. It will be up to the potential participants of new build to discuss with the owners appropriate access to suitable sites. Government will monitor whether an appropriate market in suitable sites is developing.

Government has asked HSE to take forward proposals to introduce a pre-licensing, design authorisation procedure, and the Environment Agency to introduce a similar system of pre-authorisation.

Government is setting out a proposed framework for the consideration of the issues relevant to new nuclear build and the context in which planning inquiries should be held. This framework would be set out in a White Paper to be published around the turn of the year.

The government is seeking views on a policy framework in which national strategic and regulatory issues are most appropriately discussed through processes other than the public inquiry. The inquiry should focus on the relationship between the proposal, the local plans and local environmental impacts. The inquiry should weigh up these issues against the national strategic or regulatory material considerations, which will have already been established. The inquiry should also examine the local benefits of the development and how specific local impacts of the construction and operation of the plant can be minimised.

As is proposed for the more contentious onshore wind projects, Government will appoint a high-powered inspector, whose role will be to ensure that planning inquiries are run to clearly defined timescales, and maximum use is made of the powers and efficiencies set out in the major infrastructure projects rules.

Government will engage with industry and other experts to develop arrangements for managing the costs of decommissioning and long term waste management based on the principles set out in this text.

Government intends to appoint an individual with senior management or financial experience of major capital investment projects to lead the development of arrangements for the costs associated with new build decommissioning and waste management.

5. Sustainable Transport

Transport dominates the UK's use of oil with 74% of supply used to power the cars, planes, buses, trains and lorries that we depend upon. This produces 42 million tonnes of carbon (MtC) per annum or around a quarter of all current UK carbon emissions. Good transport services are essential for a successful economy and society. They provide access to jobs, services and schools, deliver goods to shops, and allow us to enjoy our free time.

Although emissions from this sector have increased since 1990, growth in emissions is slowing down, and is not expected to grow as strongly in the future. Emissions from transport are projected to reach a peak around 2015 and thereafter fall. This is on the basis of projections that growth in demand for transport moderates, fuel efficiency in transport continues to improve and lower-carbon fuels, especially biofuels, increase their market share.

Current government policies tackle transport emissions using a full range of policy levers. Since 1997, the Government has introduced a range of economic instruments to incentivise take-up of lower-carbon transport fuels and vehicles, including the Renewable Transport Fuel Obligation, reforms to Company Car Tax and Vehicle Excise Duty. These are supported by EU voluntary agreements on new car fuel efficiency, measures encouraging people to make more sustainable travel choices and record investment into public transport to give people a viable alternative to travelling by car.

Analysis for the recent Climate Change Programme Review showed that existing Government policies in transport would save similar amounts of carbon in 2010 (proportional to sector emissions) as in other sectors and that had we not acted emissions from transport would have been 15% higher in 2010.

Nonetheless, the Government recognises the scale of the environmental challenge for transport and the urgent need for robust action to tackle the problem of rising carbon emissions. The government is committed to taking action in the near term whilst also looking to the future and our long-term goals. That is why he have already put in place a range of policies which taken together will have a significant impact on transport emissions. The government is working in four ways to tackle the emissions from transport in both the near and the long term by:

- reducing the carbon content of transport fuel;
- reducing the carbon emissions of vehicles;

- encouraging moves toward more environmentally-friendly transport;
- working in Europe to include aviation in emissions trading, and to consider including surface transport.

Government intends the level of the Renewable Transport Fuel Obligation to rise above 5% after 2010/11 provided robust carbon saving and sustainability assurance schemes can be developed, technical vehicle and fuel standards are adequate and costs to consumers are acceptable.

Government will engage with key organisations, the European Commission and other EU member states to ensure that the potential for future inclusion of emissions from surface transport in the EU Emissions Trading Scheme (ETS) is given serious consideration.

Government will continue to work with the European Commission and relevant stakeholders in developing successor arrangements to the current Voluntary Agreements on new car fuel efficiency when those Agreements expire in 2008/09. This must include consideration of all options, including mandatory targets with trading.

Government reaffirms its support for the inclusion of aviation in the EU ETS and continues to take a leading role in its promotion. It continues to explore options for the use of other economic instruments and reserves the right to act alone or bilaterally if progress towards agreements at international level proves too slow.

Government will develop a Transport Innovation Strategy in close collaboration with the ongoing energy innovation framework and the National Institute of Energy Technologies. This will comprehensively review current policies and explore others, such as second generation biofuels and hydrogen, where necessary.

Government has embarked upon a programme to enhance consumer information on transport emissions and climate change. This will be informed by continuing current research into public attitudes and behaviours towards climate change and transport.

6. TUC response to the Government's Energy review 2006

6.1. *Eliminating fuel poverty*

The Government has acknowledged that the total number of vulnerable households in fuel poverty is likely to have increased by around one million in England between 2003 and 2006, with a proportionate increase in the devolved administrations[6]. Even the one million figure is likely to be an underestimate. The DTI estimates that for each 1% increase in prices, 40,000 households are plunged into fuel poverty.

Whichever figure is used, the level of fuel poverty in 2006 is now greater than it was in 2001 when the Government's Fuel Poverty Strategy was published, and is moving back towards the levels seen at the close of the 1990s.

A key issue for the Energy Review is how to protect domestic consumers, particularly the most vulnerable in society.

Also, the TUC believes that to tackle fuel poverty, high priority should be given to:

- a review of the Winter Fuel Allowances for the elderly, as we suggested in our 2006 Budget Submission;
- a review of the link between fuel poverty and child poverty;
- smart meters and energy bills. Smart metering and billing could create a step change in energy awareness and see an end to estimated bills – one-third of all energy bills are estimates. The TUC welcomes the smart metering pilot project announced in Budget 2006;
- a major increase in funding for domestic microgeneration and CHP district heating schemes. About 2 million households are not connected to the gas grid, and are dependent on expensive, CO2 rich sources of energy. Microgeneration technologies, widely deployed among these households, could both reduce fuel bills and emissions[11]. The £50 million announced in Budget 2006 for microgeneration installations in 25,000 schools and housing association properties is a welcome start, but much larger programmes are required.

[6] Parliamentary answer, House of Lords, 25 Jan 2006: Column WA169.

6.2. Coal recommendations

Currently, around 5,000 staff are directly employed by the UK's current network of 17 coal-fired power stations[7]. Combined with secure contracts for indigenous coal, these technologies offer considerable employment potential in construction, power generation and mining, allied to significant manufacturing export potential to emerging, coal-dependent economies such as India and China. The successful development of technologies associated with clean coal/carbon capture and storage offers a significant short-term solution to CO2 and security of supply challenges, but with a vital role in the longer-term energy mix. Twelve coal-fired stations out of the 17 available have now signed up to the sulphur limits required under EU law, having either already installed desulphurisation equipment or planned to do so. This means that coal will not be constrained out of the system, but it does not guarantee UK coal will be burned, of course.

Coal-fired power stations, 2005.

Power station	MW
Kilroot	520
Lynemouth	420
Eggborough	1,960
Drax	3,870
Cottam	2,008
West Burton	1,972
Kingsnorth (+oil)	1,940
Ironbridge	970
Ratcliffe	2,000
Rugeley	1,006
Aberthaw B	1,455
Tilbury B (+oil)	1,029
Didcot (+gas)	1,940
Ferrybridge C (+biomass)	1,955
Fiddler's Ferry (+biomass)	1,961
Cockenzie	1,152
Longpannet	2,304

Source: Digest of UK Energy Statistics, 2005, table 5.11.

[7] Except employment in the Coal mines. There are around 4,400 miners in deep mines, including about 100 in small licensed mines, and a further 3,500 working in opencast production. UK Coal's interim report to June 2005 shows that deep-mined coal production fell by more than a quarter over this period, to just 11 million tonnes.

Cleaner Coal Technologies – the way forward

As yet none of the cleaner coal technologies available have been installed in the

UK. The Government has, however, put up a grant of £35 million to demonstrate carbon abatement technologies. These will be available for fossil fuel operations generally.

The task group may be timely, in that independent forecasts from France's Alstom and Germany's Siemens, reported in the *Financial Times*[20], reveal that about 40% of orders for electricity turbines for the next decade will be for coal-fired units. The shift is reportedly triggered by technological changes that reduce the amount of pollution from coal firing, and by concerns over rising gas prices.

- **Supercritical boilers** - Supercritical variants of the traditional coal-fired power station were first developed in the USA during the 1960s. According to one estimate, over 85% of new coal-fired capacity that was commissioned globally between 1997 and 2000 used supercritical technology but there are none in the UK. New or retrofitted plants in the UK would operate with a maximum efficiency of 44-45%, 20% higher than the best conventional coal station.
- **Integrated Gasification Combined Cycle (IGCC)** - The Integrated Gasification Combined Cycle (IGCC) is an outgrowth of the gas-fired Combined Cycle Gas Turbine (CCGT), the technology that has dominated the UK market since electricity privatisation. The basic difference between these two technologies stems from the presence of a gasifier and gas clean up equipment in an IGCC. This allows it to burn synthetic gas (or syngas) produced from coal. Thermal efficiency of IGCCs is over 40%, with very low sulphur and NOx emissions. There are none in the UK but some in the US have been running for 10 years.
- **Carbon Capture and Storage Technologies** – CO2 emissions can be captured and stored in under sea gas and oil fields. The most common technology for capture is based on IGCC technology. As in an IGCC plant, coal is reacted with oxygen in a gasifier to produce a synthetic gas (syngas) consisting mainly of carbon monoxide and hydrogen. The gas is cleaned, and most of the sulphur contained in it is removed. However, before this gas is burned in a gas turbine (as it would be in an IGCC), the carbon monoxide is removed by reacting the syngas with steam to form carbon dioxide. The carbon dioxide is then separated. Some or all of the hydrogen gas is then burned in the gas turbine, with any remainder being used for other applications (e.g. industry or transport).
- **Oxyfuel combustion** is more speculative and experimental that pre- or post combustion capture. It involves burning the coal in an oxygen and CO2 rich mixture rather than air. This produces a waste gas stream rich in CO2 from which the CO2 much easier to capture. Its main drawback is the need for an expensive, energy intensive air separation unit. There are proposals for oxyfuel schemes that do not require such a unit, but these are radical and untested.

The EU is moving towards inclusion of clean coal in the seventh framework programme and a Zero Emissions Fossil Fuel Power Plant (ZEFFPP) Technology

Platform has been established to look at both research and deployment of these technologies.

Incentives and other Support Mechanisms

The TUC favours an overall incentive scheme for the production and use of lower carbon and zero carbon energy. Examples of support mechanisms relevant to coal are:

- Market obligations modelled on the Renewables Obligation to generate a defined amount from a particular fuel. This could be relevant to the development of clean coal technology and carbon capture and storage technologies.
- Carbon credits for designated technologies. These could take the form of purchase of carbon credits by the state or contracts for differences guaranteeing a carbon price beyond the timescale of the existing EU ETS. Most new coal-fired plant is being built in Germany because of the more stable environment for investment.
- State Aids – such as EU support for coal (restructuring, operating and investment aids) or the 15% direct subsidy limit for a country's overall energy portfolio. Of considerable importance here, the EU is currently carrying out a stakeholder consultation.

Coal recommendations synthesis

The UK coal industry can make a vital contribution to the UK's energy security for decades to come.

The TUC welcomes the Government's support for the Clean Coal Task Group.

The TUC also welcomes the Chancellor's announcement in March 2006 of a consultation on the barriers to commercial deployment of CCS in the UK and the potential role of economic incentives in addressing those barriers. Regulatory uncertainty is preventing new, cleaner generation capacity from being built. The market for coal in power stations in the UK has grown by 27% since 1999 and generators have committed hundreds of millions of pounds to flue gas desulphurisation capacity.

Other markets can also be expanded and supplied by deep mine coal, such as the coking coal market from a new mine at Margam, South Wales.

The TUC welcomes the commitment made by the Energy Minister, Malcolm Wicks, at the Coal UK Annual Conference in February 2006 to hold discussions with coal industry stakeholders on the extent of available deep mine reserves. There are several hundred million tonnes available via both operating and mothballed mines and many more hundreds of millions in as yet unaccessed reserves, such as the Witham Prospect in Lincolnshire.

The DTI' s review supports an overall incentive scheme for the production and use of clean, lower carbon and zero carbon indigenous energy. This should also have a security of supply component built into it.

The question of the future ownership structure of the industry should be kept under constant review. Any decision to bring the industry back into the public sector must be based on the stewardship record of the private countries producing coal: is the nation's energy security being properly defended?

6.3. Nuclear recommendations

Nuclear power provides around 19% of electricity generation, or 8% of UK total energy needs. Nuclear's share of electricity generation would fall to around 7% by 2020 under current plant closure programmes.

Electricity generated from nuclear power currently displaces about 14 million tonnes of carbon a year[21], or about 9% of total UK emissions in 2004.

The 12 nuclear plants currently employ around 38,000 staff at all grades. Unless there are further plant expansions beyond that announced for Dungeness B, three further stations will cease operation by 2008, within the following closure programme:

Nuclear plant closures, 2006-2035

Plant	Final operating year	Capacity, megawatts
Sizewell A	2006	420
Dungeness A	2006	450
Oldbury	2008	434
Wylfa	2010	980
Hinckley Point B	2011	1,220
Hunterston B	2011	1,190
Hartlepool	2014	1,210
Heysham 1	2014	1,150
Dungeness B	2018	1,110
Heysham 2	2023	1,250
Torness	2023	1,250
Sizewell B	2035	1,188

By 2020, around 20% of total electricity production in nuclear will have been retired or close to retirement. Even if renewables reach the 20% target by that date, it will only have substituted for nuclear and made no net additional contribution towards the 2050 CO_2 reduction target.

A future nuclear replacement programme providing one-fifth of electricity generation – perhaps eight stations – would add at most 10% to existing stocks of high and intermediate waste, and about 5% of low level materials[8]. But safe storage of long-term radioactive waste in a manner that secures public confidence is required irrespective of a new build programme.

Most low-level waste is currently disposed at the national facility at Drigg, Cumbria. The UK currently has no long-term policy for the management of intermediate and high level radioactive wastes, although the Committee on Radioactive Waste Management is likely to make recommendations in mid-2006.

Of course, the key challenge of much nuclear waste is the period of hundreds of thousands of years over which it must be effectively isolated from people and the environment. The overall cost of an accelerated programme of decommissioning existing sites is estimated at around £70 billion.

Provided satisfactory answers can be provided on the long-term economics and waste issues, TUC policy supports that at least some of existing nuclear capacity be replaced, as part of a low carbon energy mix.

The TUC note that replacing existing capacity would add marginally to the existing legacy of radioactive waste. Nonetheless, it is absolutely essential that the Government implements a robust radioactive waste disposal strategy, if public support for new nuclear build is to be secured.

6.4. Renewables recommendations

Renewable energy plays a direct part in tackling climate change and security of supply issues. Currently, about 4.3% of electricity is generated from virtually carbon-free renewable sources[9] – wind, hydro, biomass, wave and tidal power and micro generation – and by 2010, this is likely to double to around 8%, close to the Government's 10% target by that date. Around half of this (6,000 megawatts; 5% of electricity) is likely to come from onshore wind[25], enough to power 3.3 million homes.

According to the BWEA, 6,000 megawatts of onshore wind power will be drawn from around 3,500 wind turbines, avoiding at least 6 million tones of CO_2 emission from fossil fuels.

The TUC urges the Government to support the Renewables Advisory Board's target of 30% of electricity from renewable sources by 2030; develop supporting institutional arrangements for the planning regime; and extend the Renewables Obligation.

Similarly, a successful microgeneration strategy could contribute help reduce emissions by 15% by 2050 (see below).

[8] Radioactive wastes in the UK, NIREX, October 2002.
[9] Renewables Advisory Board, 2006.

7. Energy Challenge: Industrial and employment opportunities

7.1. Wind and Wave power

Many thousands of jobs will follow the successful development, manufacture, installation and maintenance of large-scale wind and wave-related technologies – estimates range from between 10,000 and 45,000 jobs in the UK by 2010[10]. In Scotland[11], 7,000 direct jobs could be created in a diverse marine industry, supported by sustainable research development and skills bases. Marine energy[12][30] capacity could contribute up to 10% of Scottish energy, as well as supplying major international export markets. In 2004, 3.6 per cent of electricity was generated from renewable sources, enough to power around 2.5 million households.

At present, the UK is the world-leader in wave and tidal power technology, and while a number of experimental systems are in place in the UK, the industry remains concerned at the relatively low level of initial government support. One company, Ocean Power Delivery, not only has a prototype called Pelamis (with 90 per cent UK content) operating in the Orkneys, but an order for three full sized plants in Portugal, with an option on more. However, in the absence of UK orders these additional units may be manufactured in Portugal.

Meanwhile, in Denmark, 29,000 people already work in the renewables sector. After 15 years of investment, wind power contributes 16.7% of energy generation; wind technology is a major export industry (29). In Germany, 30,000 people work in wind generation, with renewables contributing nine per cent of energy needs, against a national target of 12.5% by 2010. Overall, 150,000 people now work directly or indirectly in the renewable energy sector, with an annual turnover of 12 billion euros.

Offshore Wind Onshore Jobs - A New Industry For Britain: an evaluation realized by Greenpeace[13]

This report assesses the potential job benefits arising from offshore wind power development in the UK, and in particular the North-East of England. Input/output modelling is used, in conjunction with conservative assumptions on the rate of growth of electricity supply and other variables, to ensure that job creation estimates are defensible. To illustrate the potential for future offshore wind growth, three scenarios are used in which the contribution from offshore wind power provides 10%, 20% and 30% of the UK's total electricity supply by the year 2020.

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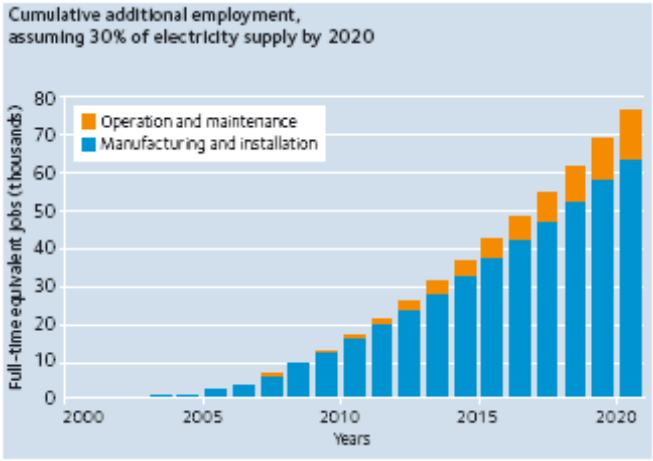
[10] Exploring the skills requirements of the UK Renewable Power Industry, Electricity Association, 2004.
[11] *Harnessing Scotland's Marine Energy Potential*, Forum for Renewable Energy Development in Scotland's Marine Energy Group (MEG), 2004
[12] *Going for green growth: a green jobs strategy for Scotland*, Scottish Executive, 2005.
[13] A report by Energy for Sustainable Development (ESD) Ltd for Greenpeace UK.

The principal findings are as follows:

- the rate of growth of offshore wind power will need to increase rapidly, reaching around 5 gigawatts (GW) per year by 2020 in order to achieve the highest scenario;
- under the highest scenario, employment from offshore wind power would reach 76,000 additional full time jobs by 2020, compared to the 2003 level. The majority of these (some 64,000) would be in manufacturing and installation, as illustrated by the chart below.

Chart 7



In this report, Greenpeace estimate that more than 50% of the manufacturing jobs created would be near the top of the supply chain and therefore likely to be physically situated close to the centre(s) of turbine production. Therefore, in order for the maximum jobs benefit to be realised in the North-East, it is essential that new wind turbine manufacturing be located in the region.

Operation and maintenance jobs have long-term stability and will grow in line with installed capacity. Manufacturing and installation jobs are less permanent, but the North-East has a good opportunity to create manufacturing jobs that can be sustained throughout the period of growth in the European market, and can be supported into the longer term assuming that contracts are awarded for refurbishment and replacement as early turbines reach the end of their design life.

The North-East is in a very strong position to exploit the opportunity presented by the new growth in the offshore wind power industry:

- the region's ports enjoy easy access to the large proposed wind development areas on the east coast, and to other European sites;
- the long industrial history and established manufacturing capacity of the region, coupled with its strong skills base and competitive labour costs, makes the North-East a natural target for inward investment;
- an existing regional renewables supply chain is well coordinated and supported.

Underlying unemployment rates mean that the North-East's workforce could support the rapid growth of wind turbine manufacturing, and benefit greatly from the economic activity so created.

Some important players are already established in the region, and targeted public support to the renewables sector is growing, enhancing the North-East's research, technology and skills base.

Although projections are necessarily approximate and uncertain, it is possible that with appropriate policies and incentives as much as half the projected new jobs could be brought to the North-East.

7.2. Microgeneration

Currently in the UK, about 275 installers employ 600 people in the microgeneration sector (small wind turbines, solar panels, ground source heat pumps, ceramic fuel cells, etc). While potentially millions of households and small businesses could take up these technologies, there are currently just 82,000 microgeneration devices installed in the UK. Buildings (domestic, industrial, commercial) account for about 47% of CO_2 emissions. Microgeneration has the potential not only to cut emissions but also to encourage individuals to change behaviour.

Householders seem genuinely interested[14] in making a difference to the environment, with than a quarter (28%) saying they are willing to install a domestic wind turbine. A recent Energy Savings Trust study[15] revealed that microgeneration could reduce carbon emissions by up to 15% by 2050, or sooner with the right package of support.

The Government has an opportunity to tackle the barriers to the development of a microgeneration industry: legislation - for an equal price for electricity bought from and sold through the grid; high unit and installation costs (e.g. £6,000 for a domestic wind turbine); the level of subsidy and VAT still payable; and consumer awareness.

The TUC welcomed the announcement in Budget 2006 of a further £54 million for DTI's Low Carbon Buildings Programme, aimed at boosting the manufacture of micro power units, leading to lower costs. While this will help fund the installation of microgeneration technologies in a range of buildings (schools, social housing), the scale of this programme is small by some EU comparison:

- in Germany, a market incentive programme granted funding to 300,000 applications for solar panels and other small installations;
- in Sweden, 10% of all households use ground source heat pumps.

[14] ICM Opinion Survey, 22.02.06.
[15] *Potential for microgeneration – study and analysis,* Energy Saving Trust, 2005.

7.3. A new biofuel industry

The TUC welcomed the Transport Secretary's announcement in November 2005 of plans to introduce the Renewable Transport Fuel Obligation (RTFO).

This would require 5% of all UK fuel sold on UK forecourts to come from a renewable source. We would urge the government to move rapidly to implement this measure. With carbon emissions from transport now 10% above 1990 levels due to increases in car usage and road freight, there is a strong case to bring forward the planned implementation date of 2010, along with the duty incentive, currently 20p a litre.

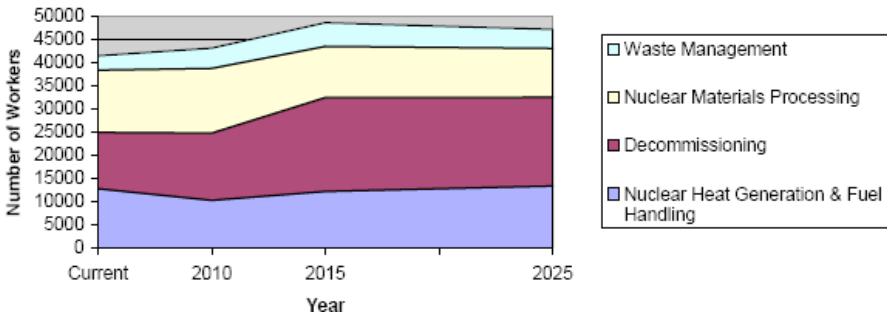
The RTFO is predicted to save around 1 million tonnes of carbon dioxide emissions in 2010, equivalent to taking 1 million cars off the road. Its successful implementation will support a new UK industry, employment growth and cuts in emissions. The TUC welcomes the announcement of a possible enhanced capital allowance (ECA) scheme for the cleanest biofuels production plant, subject to state aids approval.

7.4. Nuclear industry

Two-thirds (63%) of nuclear industry employers report skills gaps in critical areas of business, recruitment difficulties and an ageing workforce, according to a skills audit by Cogent, the Sector Skills Council for the Chemical, Nuclear, Chemical, Oil & Gas, Petroleum and Polymers industries. Prospect, Amicus and TGWU are represented on the Board.

This significantly unionised industry employs about 56,000 workers in all grades, with around 42,000 in scientific, engineering and technical roles. A forward-looking Sector Skills Agreement in the nuclear industry is now in progress, leading to an action plan with industry to deal with skills issues in the short to long term – including skills needs as decommissioning work come son stream. In an employers survey in 2005, a majority (72%) of companies reported skill gaps, including: project management (39% of respondents); and technical & practical skills (22%). Employers have responded with increased training (61%).

Workforce Demand Projections 2005 - 2025



Source Cogent 2006

The development of a comprehensive skills strategy is constrained by various factors: that the DTI's consultation document makes no mention of skills; the lack of clarity on the future role of nuclear power; and therefore the difficulty of planning the next 15 years' worth of manufacture and construction activity.

8. Scenario for a low carbon generation electricity

8.1. *Energy efficiency and jobs*[16]

Improving energy efficiency in buildings is a particularly effective way to stimulate employment in the places where it is needed most, and to employ people who have the greatest trouble in finding jobs. In terms of direct employment, energy efficiency in buildings is a labour intensive sector, engaging many small, geographically dispersed installation companies. Furthermore, lower fuel bills mean more money to spend on non-energy items (and the labour intensity in sectors stimulated by general consumption exceeds that in the energy supply sector). Thus indirect employment is stimulated by the energy savings, for years after the work is completed. Ultimately, energy efficiency contributes to economic efficiency and growth, which creates more wealth and employment opportunities.

Despite economic growth in the l990s, joblessness remains a very real problem for several million people in the UK. This is a tragedy for those who are unable to find work and a major drain on public finances. The problem is concentrated in particular locations, notably large cities and former industrial areas. Job losses in manufacturing have left many people, particularly men, ill equipped to benefit from the new job opportunities which are arising as the economy grows. Unemployment, poverty and poor housing are all concentrated in Britain's cities. Each of these problems can reinforce the others, in a cycle of decline. Energy efficiency improvements are an essential aspect of urban renovation, and offer a possible way to improve people's job prospects and living environment in Britain's cities.

Seven energy efficiency investment programmes were studied to identify the jobs created. Direct employment was calculated by interviewing implementing agencies, using published reports, and where necessary by extrapolation from the amount spent in each sector. The indirect employment was calculated using an input-output modelling approach.

[16] A report by the Association for the Conservation of Energy to the Energy Saving Trust -2000.

8.2. *Summary of case study findings*

Table 6 summarises the cost, energy saving and employment data for the 7 case studies, for purposes of comparison. In terms of direct employment per unit of expenditure, the Heatwise scheme appears the most successful. However, indirect employment gains are negligible, and the programme is not a cost-effective means of saving energy. The strength of this type of scheme is that it can provide training and operate as an 'intermediate labour market' for people who have been in long-term unemployment. Furthermore it assists low-income families to be able to afford to heat their homes. The Home Energy Efficiency Scheme also assists low-income families, and is more cost effective in terms of energy savings. These two programmes create significant amounts of direct employment, in places and skills groups which suffer high unemployment. However one must note that similar direct employment gains might be possible with alternative uses of government funds in labour intensive sectors or job creation programmes.

The Standards of Performance and Fridgesavers schemes created a smaller number of direct jobs than the other case studies. In the case of SoP this in part reflects difficulties in calculating employment stimulated in the manufacturing sector, which was excluded. In the case of Fridgesavers some manufacturing employment is included, but installation work (which accounts for a high proportion of direct employment in many case studies) is not necessary for refrigerators. The investments are funded by a levy on electricity consumers rather than from public funds. Therefore the net employment gain is likely to be greater than in the grant funded schemes, where funds might otherwise have created jobs elsewhere.

The Manweb and Shetlands demand side management schemes were small, localised programmes which created some employment as a side effect of delaying the need for investment in new electricity supply infrastructure. In terms of total (direct plus indirect) additional employment per unit of expenditure, the 1995 Building Regulations are the most effective of the programmes. Furthermore the cost to the public sector is negligible, cost effectiveness in terms of energy savings is high, and over 90% of the additional jobs are in manual occupations. A levy on electricity consumers rather than from public funds. Therefore the net employment gain is likely to be greater than in the grant funded schemes, where funds might otherwise have created jobs elsewhere.

	HEES 1991-1996	Heatwise 1996	SoP 1994 - 1998	Fridgesavers 1997-8	Manweb DSM	Shetland IRP	Building regs 1995
Total expenditure	£359 million over 6 years	£4.8 million	£138 million over 4 years	£6.35 million	£243,000	£736,000 over 4 years	£98.8 million over 2 years
Average annual energy savings	720 GWh/year over 15 years	1.7 GWh/year over 15 years	840 GWh/year over 15 years	20.9 GWh/year over 11 years	N/A	1 GWh/year over 15 years	872 GWh/year over 15 years
Value of energy savings	£21.24 million/year over 15 years	£82,000/year over 15 years	£42 million/year over 15 years	£1.14 million/year over 11 years	N/A	£50,000/year over 15 years	£21.3 million/year over 15 years
Simple payback period	17 years	>50 years	3.5 years	6 years	N/A	13 years	5 years
Blue collar employment	7,800 person-years over 6 years	194 person-years	736 person-years over 4 years	58 person-years	Approx. 5 person-years in total	7 person-years	2,768 person-years over 2 years
White collar employment	840 person-years over 6 years	86 person-years	840 person-years over 4 years	7 person-years	See above	7 person-years	180 person-years over 15 years
Indirect employment	22,000 person-years over 15 years	Negligible	12,000 person-years over 15 years	475 person-years over 15 years	Not estimated	Not estimated	7,000 person-years over 15 years
Direct employment per £m invested	24 person-years	58 person-years	11.4 person-years	10.2 person-years	20.6 person-years	19 person-years	29.8 person-years
Indirect employment per £m invested	61 person-years over 15 years	Negligible	87 person-years over 15 years	75 person-years over 15 years	Not estimated	Not estimated	70 person-years over 15 years

Conclusion

There are three main reasons why energy efficiency has positive effects in terms of job creation:

- manufacturing and installing energy efficiency measures is a labour intensive sector compared to energy supply, and to many sectors in which the government chooses to invest public sector funds. This effect accounts for direct employment gains of 10 to 30 person-years of employment per £1 million spent, and almost 60 person-years where job creation and training are made a priority;
- if the energy savings are cost effective, the result is that consumers divert expenditure from energy into the more labour intensive general consumption sector. This effect typically generates an additional 70 person years of employment in the wider economy per £1 million spent, over the lifetime of the energy saving investment;
- work in manufacturing and installing energy efficiency measures is accessible to people who suffer the highest rates of unemployment in the UK, given that it is manual labour, and the work is dispersed across the country. Indeed, where programmes aim to assist the fuel poor the work is concentrated in areas where unemployment tends to be highest.

These effects are demonstrated in the 7 case studies presented here:

- in the Standards of Performance and Fridgesavers programmes, approximately 10 person-years of direct employment were created per £1 million of total investment. The Home Energy Efficiency Scheme and two small demand side management schemes generated approximately 20 person-years of additional employment per £1 million invested. The 1995 Building Regulations generated 30 additional person-years of employment per £1 million of total investment. Heatwise created almost 60 person-years of employment per £1 million invested, mainly for trainees who had previously been in long-term unemployment. However this is the one case in which it could be argued that no net employment resulted, since public sector funds could possibly have been used to create a similar number of jobs in other ways, and indirect job gains were negligible. There were however substantial lifestyle gains for programme beneficiaries;

- indirect employment gains of approximately 70 person-years over 15 years were estimated for four of the seven schemes, per £1 million spent. This effect relates to the re-spending of money saved by householders who benefit from cost-effective energy savings. It does not include the 'multiplier effect' whereby local businesses benefit from the demand stimulus created by re-spending of wages and demand for secondary inputs and services. This effect is not quantified, but can be expected to contribute to re-vitalising the economies of areas where energy efficiency investments create jobs;
- in the Home Energy Efficiency Scheme, Fridgesavers and Building Regulations case studies approximately 90% of the employment was in blue collar occupations. In the remaining studies approximately 50 to 70% of new jobs were in this category. The Building Regulations applied to all new homes, and therefore additional work was spread across the country. The small demand side management schemes created jobs in remote and/or depressed areas. The remaining case studies mainly aimed to assist the fuel poor, and therefore the work was concentrated in areas of poorer housing, lower incomes and higher rates of unemployment. The Home Energy Efficiency Scheme and Heatwise, in particular, created conditions whereby employment benefited the people and places most in need of the work.

Saving energy, cutting carbon dioxide emissions and assisting people to keep warm are quite rightly the main aims of energy efficiency initiatives. Job creation and training can be made part of the process, or will arise as a beneficial side-effect.

1. Less traffic, more jobs: the direct employment impacts of developing a sustainable transport[17]

The transport sector in the UK is dominated by the car for passenger transport and by lorries for freight transport. Cars account for 86 per cent of distance travelled by people excluding walking. Lorries account for around three quarters of freight transport[18]. This dominance of the internal combustion engine has made a significant contribution to local, regional and global environment threats including climate change; urban air pollution; acid rain; habitat destruction; and resource depletion. It is also getting worse. The increasing numbers of cars and the increasing dominance of road traffic outstrip what progress has been made in increasing energy efficiency and undermine attempts to achieve air quality targets.

Reducing CO emissions to a sustainable level provides one of the constraints for 2 transport sector development. The EU has agreed to stabilise CO emissions at 1990 levels by 2000. This, however, is considered by the IPCC as "*only a very modest first step*

[17] ECOTEC 1997, report for *Friends of the Earth Trust.*
[18] Department of Transport, 1996. *Transport Statistics Great Britain 1996 Edition*. London, HMSO.

to reach stabilisation of carbon dioxide concentrations"[19]. Friends of the Earth, in developing the concept of environmental space as a policy tool, has calculated target reduction levels for UK CO emissions of 88 per cent by 2050 and at least 30 per cent[20] by 2010. Substantial reductions in the CO emissions from the transport sector will be needed if such targets are to be reached. Current emissions from road traffic alone exceed the total UK emissions permitted in 2050 according to this approach.

ECOTEC report assesses the direct impact on jobs of pursuing sustainable policies for surface-level passenger transport in the UK. It takes as its starting point the provisions of the Road Traffic Reduction (National Targets) Bill. This would require the Secretary of State for Transport to draw up and implement a plan to ensure that traffic levels fall by 10% by 2010, over 1990 levels. Secondly it uses targets published in the Royal Commission on Environmental Pollution's eighteenth report *"Transport and the Environment"* to forecast future use of trains, buses and bicycles. By combining the two, a sustainable transport scenario (STS) has been created. This is used to assess the effects of traffic reduction and the promotion of alternatives on jobs in the transport related industries.

Sustainable transport policies involve more than traffic reduction. New technology is required to increase vehicle efficiency and reduce pollution from the traffic that remains. Assumptions are therefore made about the uptake of such new technology, and its effect on employment is assessed. Finally, as policies to reduce traffic and promote alternatives are liable to change ownership patterns, the employment effects of an increase in car leasing are considered.

2. Driving Change

The Direct Employment Effects of the Scenarios within Car-based Industries

	Total Employed (2010)	Change from current (Number)
Current employment	1,072,000	
STS baseline	1,029,000	- 43,000
High Technology Scenario	1,049,000	- 23,000
High Lease Scenario	1,043,000	- 28,000
Combined High Technology and High Lease	**1,064,000**	**- 8,000**

To model the impact on employment in the car-based industries, Friends of the Earth commissioned top economic consultants ECOTEC Research and Consulting Ltd. ECOTEC used the baseline STS to predict the effect of traffic reduction on the car related industries. This suggested that about 43,000 jobs could be lost from the industry, mainly in vehicle maintenance and repair. Secondly, ECOTEC used

[19] Inter-Governmental Panel on Climate Change, 1996. Op cit

[20] McLaren, D., Bullock, S. And Yousuf, N., 1997 (forthcoming). *Tomorrow's World: Britain's share in a sustainable future*. Earthscan, London.

assumptions on the uptake of greener technology and the increased use of car-leasing to assess the likely effect of sustainable transport policies as a whole on the car-based industries. The combined effect of these policies is to reduce job losses in the car-based industries to about 8,000. Reducing the environmental impact of the car is fast becoming a key battleground for firm survival in the car industry. The results of the high technology scenario in particular show that in terms of employment this means that jobs in those firms that act decisively and with foresight today by investing in the next generation of vehicles with radically lower environmental impact will be more secure than those in firms which are left behind.

3. Job Generators

The increases in cycling, bus travel and rail travel included in the STS will all generate employment. Friends of the Earth therefore augmented the work of ECOTEC by making conservative estimates of how increases in travel demand in these modes will create jobs (see table below).

Direct Employment Impacts of the Cycle, Bus and Rail Components of the STS

Sector	Jobs (number)
Cycle	9,000
Bus	31,000
Rail	90,000
TOTAL	**130,000**

Taking account of these gains shows that the net effect of the STS on direct employment would be likely to be positive. The net impact according to the different variations on the STS is given in the table overleaf.

If the environmental and employment benefits of moving toward a sustainable transport system in the UK are to be realised then a range of policies that complement and reinforce each other is required.

The Road Traffic Reduction (National Targets) Bill provides the ideal vehicle to ensure these policies get debated in Parliament. And even if the Bill is not taken up this year, the Budget provides an excellent starting point for the new Government to make progress on: shifting the burden of taxation off labour and onto transport pollution; cutting perverse subsidies that prolong the dominance of the current unsustainable transport system; shifting public expenditure priorities in the transport sector toward public transport; and installing price differentials to encourage greener car and greener fuel technologies.

Estimate of the Net Direct Employment Impact of the STS (jobs)			
	Car-based Industries	Cycle, Bus and Rail Industries	Net Effect
Baseline STS	- 43,000	+ 130,000	+ 87,000
High Technology Take-up	- 23,000	+ 130,000	+ 107,000
Combined high-tech, high lease	**- 8,000**	**+ 130,000**	**+ 122,000**

These measures aimed at creating the sustainable transport system that we all want will integrate economic and environmental objectives in a way that would strengthen environmental protection, create jobs and benefit all sections of the community.

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