Employment Creation and Environmental Policy: a literature review

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Executive Summary

This study has been commissioned on behalf of TUSDAC to look at the implications of a move to a sustainable economy and to help put TUSDAC in a position where it can provide informed input into the ‘jobs and environment’ debate. The study reviews the considerable body of academic and case study work looking at the employment implications of environmental policy.

The context of a sustainable economy

Whilst the details of how the economy will change in response to the sustainable development agenda are uncertain, there is plenty of evidence to help guide trade unions, government and industry on possible directions. This comes initially in the form of scientific studies, such as those by the Intergovernmental Panel on Climate Change, and existing Government targets, such as those on greenhouse gases, waste recycling and increasing use of public transport. In addition there are other strategies and academic reports, such as the Foresight Programme and the Royal Commission’s recent report on energy policy, assessing future options for technological change.

Research overview

Research and activity in this area falls into three broad categories. The first is a study of the macro effects of environmental policies on the competitiveness of the economy, and the consequent levels of employment. The second main category consists of sector specific studies. The final category, which is less well researched, but potentially a very important part of the equation, is an assessment of what skills are required to fill potential new jobs in sustainable industries.

Macroeconomic effects of environmental policy

We found no evidence to support the argument that environmental policy has damaged the competitiveness of any country. Studies from the World Bank, the OECD and others all found that the costs of environmental regulation or other policies had very little impact on the location decisions for investment. There appears to have been no comprehensive study in the UK on this issue, although no reason to suspect the results would be different from elsewhere in the world. However, a UK based study on the competitiveness effects of environmental policy, supported by TUSDAC, may help to challenge some of the perceptions of environmental policy in the UK.

There have also been a great deal of economic modelling exercises undertaken in recent years making projections for the economy under a whole host of environmentally driven policy scenarios. Recent reviews of these studies have revealed the majority predicting positive employment impacts for such scenarios. These results have been produced using a wide variety of different assumptions, types of economic model and in different parts of the world.
The DTI have recently published their own Sustainable Development Strategy which places improvement of the resource efficiency of the economy as its primary goal. TUSDAC is already working with trade unions on greening the workplace. Evidence has shown that employee involvement increases the effectiveness of pollution prevention activities. **The TUSDAC work on employee involvement in pollution prevention could be extended and linked to the delivery of the DTI’s resource efficiency targets.**

**Sector Specific Studies**

The majority of the rest of the literature is based on studies that examine the prospects for specific economic sectors. The creation of a sustainable economy will have a much larger effect in some sectors than others. There will be job losses as well as gains. The studies reviewed have concentrated on energy, waste management, transport, agriculture and the rapidly growing environmental sector, which includes pollution abatement equipment, environmental management and consultancy, and other clean technologies.

Recent studies have demonstrated rapid growth in the **environmental technology sectors** in the EU and rest of the world. This growth is expected to continue throughout this decade but with greater emphasis on clean technologies and pollution prevention. Eventually the market for pollution abatement technologies will mature in the developed world but continue to expand in the developing world economies.

Major employment changes are expected in the energy industry as **low carbon technologies**, such as wind turbines, combined heat and power and solar panels, become more mainstream. Numerous studies have shown positive employment effects for moving the UK energy market towards greater use of renewables and improved energy efficiency. The studies show that most of the low carbon technologies are more labour intensive than conventional fossil fuel and they also highlight potential ‘first mover’ advantages for the UK from establishing a manufacturing base in certain technologies. However, the majority of these studies have been commissioned by trade associations or environmental groups. Without doubting the accuracy of the research, there could be a perception of bias in their findings. **TUSDAC could commission an independent assessment of the employment potential of a low carbon economy, perhaps as a follow up to the Royal Commission’s report and using their scenarios.**

The rest of the research reviewed looks at a variety of sectors where environmental policy has, or could generate jobs. Increased recycling rates would create new jobs in the **waste management sector**, although some of these would be low skilled. Environmentally sensitive **agriculture and forestry** is generally thought to be more labour intensive than chemical intensive practices, and such activities can attract additional Government support. The creation of better habitats and rural environments also offers spin off employment in the **tourism sector**. Finally, the Government’s ten year plan and other policies for **transport** should create more employment in the upgrading and refurbishing of both the network and the vehicles on the UK’s public transport network.
Achieving the transition

There appears to be plenty of evidence and research addressing the employment effects of environmental policies. However, there is far less asking how employment policy can react and adapt to sustainable development. The New Deal programme has included the Environment Task Force option, which has succeeded in getting some young unemployed into environmental jobs. It has received some criticism but adjustments are being made.

Some Regional Development Agency (RDA) strategies and plans have started to design specific regional activities to stimulate environmental employment, but these plans are still in their early stages and their impact is hard to assess. TUSDAC could encourage such developments by promoting good practice through the trade union networks and representatives on RDA boards.

Whilst some sector studies have investigated the sort of skills required in, for example an expansion of offshore wind technologies, there is generally little research in the area of skills requirements for sustainable technologies. In some cases such information could help RDAs or the sectors themselves plan the medium term development of sustainable industries. TUSDAC could work with Government, trade associations, RDAs and the newly established Carbon Trust to carry out skill audits for sustainable technology sectors, particularly in the energy and transport fields.
Introduction

The role of TUSDAC

The Trade Union Sustainable Development Advisory Committee (TUSDAC) was set up in 1998. Its key objective is to provide Government with a Trade Union perspective on the employment consequences of climate change, and the response to it and to allow the Trades Unions to enter into constructive dialogue with the Government on sustainable development and environmental issues.

Its terms of reference are:

- To direct trade union input into the policy process to enable constructive dialogue with Government on sustainable development and other related environmental issues.
- To provide a Trade Union perspective on the employment consequences of climate change, and the response to it.
- To help mobilise the Trade Union movement to become involved in the move towards better environmental practice in the workplace, building on existing initiatives and activities, disseminating information and experience.

Background to the report

In order for TUSDAC to fulfil these objectives it needs to be able to consider the potential implications of the UK's moves towards a more resource efficient economy in the future. In particular, this will involve a move to a lower carbon economy in line with the UK CO₂ objective (under the Kyoto Agreements and Government targets) and potential further reductions beyond. Reshaping the economy, so that less pollution is created and fewer environmental resources used, must be achieved whilst economic growth and wealth creation still continues. These values are at the heart of the UK's Sustainable Development strategy, the objectives of which are:

- Social progress which recognises the needs of everyone
- Effective protection of the environment
- Prudent use of natural resources
- Maintenance of high and stable levels of economic growth and employment

Over the medium term some established industries will have to change their practices, some new industries will grow rapidly and others may decline. Such changes are likely to involve major challenges to those industries and the people who work in them.

This study has been commissioned on behalf of TUSDAC to look at the implications of a move to a sustainable economy and to help put TUSDAC in a position where it can provide informed input into the ‘jobs and environment’ debate. The study reviews the considerable body of academic and case study work looking at the employment implications of environmental policy.
There is now a general consensus, in the trade union movement and elsewhere, that the availability of sufficient jobs of high quality for present and future generations is vital to ensuring that improvements to quality of life are realised within environmental constraints (Barry et al, 1999). As a consequence, trade unions in the UK have campaigned for the need to integrate the need for job creation with environmental protection. This report will help TUSDAC to move the debate forward both in Government and the trade union movement.

What might a sustainable economy look like?

Whilst the details of how the economy will change in response to the sustainable development agenda are uncertain, there is plenty of evidence to help guide trade unions, government and industry on possible directions. This evidence comes in the form of scientific studies, existing Government targets and strategies and academic reports assessing future options for technological change.

**Government Targets**

The Government has introduced a whole raft of targets related to sustainable development. The climate change strategy sets out policies aimed to cut UK CO2 emissions by 20 per cent by 2010. Within the strategy there are more specific targets to deliver 10 per cent of electricity from renewable sources by 2010 and rapidly increase the amount of CHP in the UK (DETR, 2000a). The waste strategy contains targets to increase the amount of recycled household waste to 25 per cent by 2005, 30 per cent by 2010 and 33 per cent by 2015 (DETR, 2000b). The Landfill Directive will set longer term targets on the amount of waste which must be sent to landfill.

**Longer term targets and indicators**

All of these targets will all have an effect on the economy and most are likely to be precursors to tougher targets in future years. At the very least, the Government should be preparing for the employment consequences of the targets already set. This may require helping declining sectors to adapt or facilitating the right training and skills provision for new industries. In the longer term, it is reasonable to take the targets as an indication of the direction a sustainable economy must take. Pressures will continue for the economy to cut pollution and reduce resource use. The Government’s indicators of sustainable development will provide other measures of sustainability. Current Government policy is that where no specific targets exist for these indicators, the aim is for the headline indicators to move in the right direction over time (DETR, 1999).

The DTI has recently published its own Sustainable Development Strategy. One of the proposals being discussed, and already floated in internal Labour Party documents, is to set up an ‘environmental productivity index’ for the UK, setting targets for increasing efficiency of resource use across the whole economy (Labour Party National Policy Forum, 2000). The DTI Sustainable Development Strategy is an important step forward and TUSDAC will want to reflect on its implications in
considering this report. The DTI will be consulting on the details of an environmental productivity index next year.

The DTI Sustainable Development Strategy places improvement of the resource efficiency of the economy as its primary goal. TUSDAC is already working with trade unions on greening the workplace. Evidence has shown that employee involvement increases the effectiveness of pollution prevention activities (Bunge et al, 1995). The TUSDAC work on employee involvement in pollution prevention could be extended and linked to the delivery of the DTI’s resource efficiency targets.

_Projections for the Future_

There is also a large body of research that looks at future trends for the economy and environment. Whilst the projections are not as certain in their outcome as Government targets, they can be taken as an indication of long term trends in the development of a sustainable economy.

The Intergovernmental Panel on Climate Change has made it clear that greenhouse gas emission have to be cut by at least 60 per cent in the next century to prevent dangerous climate change. Given that the developed world has emitted the vast majority of these gases so far, it is likely that countries such as the UK will have to cut emissions by far more (IPCC, 1996). The Government’s Climate Change Strategy acknowledged this and the Royal Commission for Environmental Pollution recently produced a report which set out a series of scenarios for delivering a 60 per cent reduction in greenhouse gases by 2050 (DETR, 2000b; RCEP, 2000). All the scenarios envisage a major increase in the use of renewable energy. For example, up to 18,000 offshore wind turbines, 15 million solar roof installations, 4,500 small scale hydro schemes up and running by 2050. Others scenarios suggest up to 2.4 million domestic CHP units or 1,000 CHP units fuelled by forestry and agricultural wastes. All of this indicates a major change in the energy sector, with a corresponding decline in fossil fuel industries starting with coal.

The US based Worldwatch Institute has documented the decline of the coal industry and predicts this will continue, even in countries like China (Dunn, 1999). The Institute has also highlighted the rapid increase in renewable energy technologies across the world, albeit from a very low base. In 1998, wind power was the fastest growing energy source (Flavin, 1998). Other academics have shown how resource efficiency could improve by a factor of four or even ten if the appropriate technologies and design techniques were used (Von Weizsacker et al, 1997, Lovins, 1999).

Sustainable development is a major feature in the Government’s programme of Foresight Panels, which looks at future scenarios and technologies facing the UK. The Panels on the built environment, transport as well as energy and natural environment are all examining aspects of the sustainable development agenda. The Panels, made up of academic experts, business leaders, civil servants and some trade unionists, are charged with identifying the barriers, challenges and opportunities for innovation in their area over the next ten to forty years.
The Energy and Natural Environment Panel, in common with other groups of experts, has emphasised the major changes in production and consumption of energy and other natural resources which will be required over this period. In its consultation paper, A Way to Go, the Panel sets out three stages of technological development, all of which will have implications for employment (Foresight Programme, 2000). The first stage is to develop and improve current technologies, particularly in heavy industries, to create a ‘breathing space’ as policies are altered to change the pattern of economic behaviour. This would include developing cleaner processing technologies and improving energy efficiency. For most sectors, this is the stage we are currently in.

The second stage they term as ‘preparing for change’. This would include acceleration of renewable energy technologies, sustainable transport modes and less energy intensive construction techniques. The Government targets for renewables, the ten year transport plan and waste strategy can be characterised as an attempt to move the UK into stage two. For this preparation to work, of course, business and society has to respond. TUSDAC can play its part in helping to move society in the direction of sustainability.

Finally the Panel argues a step change in economic behaviour will have to be achieved employing products and production methods using orders of magnitude less energy and materials. Energy will have to be based on new sources of renewable energy, hydrogen or solar. Much of this stage is more dependent on business and society than Government, although policy will be able to accelerate change. Government has the greatest role in the ‘preparation’ stage. Step changes in behaviour and technology will not necessarily happen all at once as timing may depend on technological progress or events which change public attitudes.

Whilst this is only a crystal ball gazing exercise, the Foresight programme is a good long term framework for Government to assess the employment, training and education implications of sustainable development.
Structure of report

There is a considerable body of academic work looking at the employment implications of environmental policy. The aim of this short report is to summarise recent work and recommend areas for action or further research by DETR or TUSDSAC.

Research and activity in this area falls into two broad categories. The first is study of macro effects of environmental policies the on competitiveness of the economy, and consequent levels of employment. There is a body of economic modelling work attempting to project the effect of environmental policies, in particular energy taxation and revenue neutral green tax reform packages. This is theoretical and forward looking research. There is also some work that tries to assess the historical effect of environmental policies and regulations on the economy as a whole.

The second main category of research is more sector specific. Numerous studies have looked at the effect of environmental policies on employment in specific sectors. The sectors frequently addressed are energy, transport, agriculture and waste management. There is also a body of reports assessing the size and potential of the environmental technology sector itself, both in terms of domestic markets and export opportunities.

Another category, which is less well researched, but potentially a very important part of the equation, is an assessment of what skills are required to fill potential new jobs in sustainable industries, and whether any of these skills are available in the industries that are in decline. Is there a role for Government intervention, potentially at the regional level, to try and match the supply and demand of skills in the sustainable economy. At the outset of the research, the intention was to devote an entire chapter to this category. However, we found very little research or evidence to report and have therefore only incorporated a short summary of examples and issues which could be investigated further.

Finally, the report sets out some of the key issues which could inform future activities in this field by TUSDAC or Government.
Macroeconomic effects of environmental policy

There are two sets of evidence which examine the macroeconomic effects of environmental policy. Some research has concentrated on the past effects of environmental policy on investment flows, international competitiveness and therefore employment levels. Another body of research concentrates on scenarios of future policies and is based on economic modelling to predict employment effects.

Past effects of environmental policy

Whenever a Government introduces a new environmental policy, some will predict the measure will damage the competitiveness either of the national economy or a certain sector. If this were true then the implications for employment would naturally be some concern to government.

Heavy manufacturing industries, in particular, have traditionally been responsible for mass employment in the UK. The emergence of cleaner technologies and stricter environmental standards can appear to represent a threat to these jobs. Several studies have looked at the evidence for this hypothesis, however, and failed to find it conclusive.

Most manufacturing industries have declined due to wider economic circumstances and their declining competitiveness. In a 1990 survey of plant closures in the UK, environmental costs were cited as an important factor in only 1 of the 193 cases, affecting just 0.2% of redundancies. Recessionary factors, import penetration and exchange rate fluctuations were found to be more influential causes of job losses (Fothergill and Guy, 1990 in Secrett, 1999). This is further supported by surveys in the US on job losses and environmental regulation costs. The US Bureau of Labor Statistics show that environmental related layoffs were 0.14 per cent of the total layoffs between 1995 and 1997 (Renner, 2000). Another study reviews the estimates of costs of environmental regulation before they were introduced and compares the figures to the actual costs incurred. The estimates were frequently more than double the actual costs, and some were much higher (Goodstein and Hodges, 1997).

More recently, the OECD has published a report ‘Foreign Direct Investment and the Environment’ which tested two hypotheses. First it asked whether investors were seeking out ‘pollution havens’, so that new manufacturing investment was more likely to be sited in countries where environmental regulations were slack and pollution abatement costs low. The report concluded that “differences in environmental standards and/or abatement costs, do not seem to have made a significant difference to firm location decisions” (OECD, 1999). Secondly, it asked whether FDI had the reverse effect of creating cleaner processes than other types of investment, so called ‘pollution halos’. Again the report found no evidence to back that thesis.

The World Bank has also published research on similar issues. It looked at US company investment in four developing world economies: Mexico, Venezuela, Morocco and Côte d’Ivoire. They similarly found no evidence that either low
pollution abatement costs were attracting investors or that new investment was in any way concentrated in so called polluting sectors (Eskeland and Harrison, 1997). One reason put forward for this was that some abatement costs may fall with economies of scale, so expanding existing plant may still be preferable to setting up a separate facility in another country. Some theories even suggest that higher environmental standards might enhance the long term competitiveness of certain companies and sectors because they stimulate innovation (Porter and van der Linde, 1995). A recent study by the Economic Policy Institute in the US has assessed economic data to test this hypothesis. They conclude that the consensus of the economic profession is that environmental regulation has had no reliably measurable negative impact on the competitiveness of US firms. And in one case, in terms of import competition from developed countries in the 1980s, firms facing higher levels of regulation fared better than those without it (Goodstein, 1997).

Studies of this kind are always subject to many caveats as it is very difficult to control for other policy changes and economic circumstances. However, the conclusions of these above studies are in line with other evidence reviewed in the previous paper presented by DTI & DETR to TUSDAC (Coates, 2000). There appears to have been no comprehensive study in the UK on this issue, although no reason to suspect the results would be different from elsewhere in the world. However, a UK based study on the competitiveness effects of environmental policy, supported by TUSDAC, may help to challenge some of the perceptions of environmental policy in the UK. Depending on the resources available, research could be a survey of reasons for plant closure, an examination of one sector and the effect of different environmental policies, or comparisons of estimates of costs of environmental policy to the actual costs after implementation.

Economic modelling of future environmental policies

The UK Government, and the majority of European countries, have started to implement a shift in the base of taxation, increasing taxes on energy, waste and resources. A new study published by the European Commission documents such tax shifts from nine of the fifteen EU member states. In addition Switzerland is also introducing a green tax reform. Whilst the details of packages in each country are different, most include taxes on energy or CO2 and cuts in employer’s social security contributions (Ekins & Speck, 2000). In the UK the Climate Change Levy, Landfill tax and Aggregates tax are all helping to fund cuts in employer’s National Insurance Contributions, as well as a variety of special funds for sustainable activities like recycling, renewable energy, conservation or energy efficiency investment.

Such tax reforms are now commonplace in Europe and can be expected to continue, it is important to review the numerous studies addressing the employment implications of this kind of fiscal reform. All of these studies have used economic modelling to predict employment and other consequences of policy change.

There have been two recent reviews of these types of economic modelling exercises. A team led by the University of Bath reviewed six different models that have been used across Europe to examine the effects of increasing carbon/energy taxes and
cutting labour taxation (Heady et al, 2000). The key difference between economic modelling techniques (general equilibrium and econometric) in this field is whether the models assume there is involuntary unemployment in the labour market at any time, which is linked to the effect of policies on wage levels. There will also be differences in estimates of elasticities of demand for capital, labour and energy across different sectors. The results from each model will be sensitive to a greater or lesser degree to the assumptions made about the economy. There is no time to go through these differences in detail, but the important point to note is that both the University of Bath study and the Bosquet paper, discussed below, looked at a wide variety of models and simulations.

The University of Bath study also looked at a ‘bottom-up’ methodology developed by AEA Technology to examine the employment impact of energy taxation on manufacturing industry across Europe. The ‘bottom up’ modelling relies on specific information on the costs and characteristics of individual technologies available across different manufacturing sectors. The study concludes that both top down and bottom up models show the potential for modest employment gains flowing from an environmental tax reform (Heady et al, 2000).

In another recent study, from a World Bank economist, evidence from 139 simulations in 56 different economic models for environmental tax reform are reviewed (Bosquet, 2000). The studies reviewed include econometric and general equilibrium models and again the conclusion is that the majority of studies reveal positive employment implications of a tax shift. On important finding from both studies is that the assumptions of the different models have less effect than expected. The majority of both general equilibrium and econometric models predict positive employment effects. This contradicts what was previously thought to be the case, that assumptions about involuntary unemployment in general equilibrium models means they are less likely to predict employment gains from such a tax shift. Another interesting conclusion from Bosquet points to the fact that the simulations which take into account the stimulation of energy saving and clean technologies by energy taxes demonstrate greater employment creation than those which do not.

Heady et al recommend that more research is requires on the sensitivity of the assumptions across different models on the final results. They also argue that one weakness of the top-down economic modelling is the treatment of capital flows. They question whether capital may be more elastic than assumed in many of the models reviewed and suggest that further research into this is required. However, the evidence from OECD and the World Bank on foreign direct investment does appear to back up claims that capital movement is not as sensitive to energy costs as some would argue.

Economic models can only be as good as their assumptions, but the balance of evidence points to a positive effect on employment from environmental policy. This correlates with the studies described earlier reviewing the competitiveness effects of existing and previous environmental policies.
The majority of the rest of the literature on environment policy and employment is based on studies that examine the prospects for specific economic sectors. The reality is that in ‘greening’ the economy some jobs will be created whilst others will be lost. Most of the research on the link between environmental policy and employment has tended to focus on individual case studies. Less has been done on the details and distribution of which sectors will shed jobs and which will create them (Voisey and Hewett, 1999). The creation of a sustainable economy will have a much larger effect in some sectors than others. Studies have concentrated on energy, waste management, transport, agriculture and the rapidly growing environmental sector, which includes pollution abatement equipment, environmental management and consultancy, and other clean technologies.

The studies reviewed below all have differing assumptions about prevailing economic circumstances and future policy. Some only look at direct job creation effects, whilst others take into account the displacement effects of job losses elsewhere in the economy. Others also take into account the indirect job creation effects of respending in the local economy from those directly employed. Where possible these distinctions are made in the text. One should not, therefore, add up all of the numbers below in an attempt to demonstrate a specific figure for the potential of job creation with environmental policy. Time restraints also mean that the review is almost certainly not a comprehensive one. It simply tries to illustrate the breadth of studies which have shown, in one way or another, the potential for employment creation in environmentally beneficial economic behaviour.

The ‘environment’ sector

The UK already has a well-established pollution abatement sector in air and waste pollution control, contaminated land remediation and water treatment. It is difficult to determine the size of this sector because of definitional problems. However, definitions are becoming more standardised across OECD countries and a study by ECOTEC found that in 1994 there were around 462,000 people employed in end of pipe pollution abatement in the EU (ECOTEC, 1994). A more recent estimate for the European Commission shows the rapid growth in these sectors. Depending on the definition, the Commission estimate that the environmental industry now employs between 1.5 and 3.5 million people in the EU (European Commission, 2000). The latter figure is a wider definition than the original ECOTEC study and includes employment in clean technologies, renewable energy and conservation. Even so, the rapid increase in employment is evident and the greatest growth in employment opportunities is likely to come from the expansion of clean technologies, such as Combined Heat and Power (CHP), renewable energy sources, such as offshore wind, and environmental services such as environmental management.

The European Commission study notes that the expansion of domestic markets for ‘end-of-pipe’ pollution abatement technologies will probably mature and slow down towards the end of this decade. The reason for this is that focus will have moved on to
the development of clean technologies, preventing many of the pollution problems the abatement technologies are designed to deal with. However, the developing world will still offer many market opportunities. Depending on where the manufacturing of pollution abatement equipment is then sited, job creation in this sector may slow down in the EU.

**Low carbon technologies**

Climate change is perhaps the most serious environmental problem facing the world. The Government aim is to cut carbon dioxide emissions by 20% from 1990 levels by 2010. Frequently, measures to reduce greenhouse gas emissions are portrayed as a hindrance to economic growth and likely to cost jobs. However, moving towards a low carbon economy not only has the potential of transforming the way our economy is powered, but also supporting high quality jobs for present and future generations.

Shifting from one set of energy technologies to another will involve some job loss as well as gain. However, there is evidence that renewable energy and energy efficiency activities are more labour intensive than fossil fuel and nuclear power. For example, the Worldwatch Institute calculates from German industry figures that in 1998, 1.2 per cent of German electricity use was creating 15,000 jobs in wind power. At the same time 33 per cent of electricity use was creating only 38,000 jobs in nuclear power. They predict that by early this decade, there would be more jobs in the German wind power industry than the nuclear one (Renner, 2000).

**Combined heat and power**

Combined Heat and Power (CHP) is a technology for capturing the waste heat created in electricity generation and converting it into useful heat. The average efficiency of CHP plants is 75% compared to 37% for traditional power stations (CHPA, 1998). The Government has a target to increase CHP capacity to 10 GWe by 2010, a doubling of UK capacity. Forum for the Future estimates that this target would achieve a 1.7% reduction in emissions from 1990 levels (Ekins et al, 1999).

The expansion of CHP is also likely to support a substantial number of jobs. A New Economics Foundation (NEF) guide cites a CHP unit in Nottingham to exemplify the job creation from a community heating system. Around 125 jobs were created, of which 100 were involved in laying new pipe-work, 17 in installing meters and heating controls, and 8 in operation and maintenance (NEF, 1998). Forum for the Future have calculated that a 3,000 MW CHP programme covering 9 cities - including Sheffield, Newcastle, Leicester, Belfast and London - could create 140,000 job years over a 10-15 year period. Accounting for the displacement of jobs lost through conventional generation, the researchers estimate this scheme would produce a net gain of 7,875-12,535 jobs in manufacturing, installation and servicing (Secrett, 1999). This, of course, would only be a proportion of the Government target on CHP. The CHPA are due to publish a new study on the employment implications of expanding CHP, but this was not available at time of writing.
The Royal Commission report suggested that a large number of domestic CHP units may be installed over the next few decades. This is a new micro-power technology that would vastly improve energy efficiency in the home. Mass installation on the scale the Royal Commission predicts would require a merging of skills across professions. CHP units require heating engineering and electrical skills to install, so professional bodies, industry and Government may want to work together to facilitate such training. Domestic CHP is a technology being pioneered in this country. The potential for manufacturing job creation has not yet been studied, is clearly an opportunity for the UK.

**Renewable energy sources**

Tidal power, hydro power, wind power, solar power, energy crops and wave power are all examples of renewable energy sources that are likely to play an important role in reducing climate altering greenhouse gas emissions. Renewable energy sources are also generally more labour intensive than conventional sources of power, and so are more likely to generate additional employment opportunities.

The Government has set out to achieve 5% of electricity demand from renewables by 2003 and 10% by 2010. Modelling by Forum for the Future shows that the Government's policy to set a 10% renewable energy target would have a positive effect on overall employment. It concludes that extra labour in renewables operation and maintenance would be responsible for an employment increase of 3,000 (2.9%) by 2010. This does not take into account any manufacturing jobs that could also be created. Under the 10% scenario, 65% of new jobs would come from energy crops and agricultural and forestry wastes because of the relatively high employment intensities and capacity to build these technologies (Ekins et al, 1999).

A wider study carried out for the European Commission looked at the prospects for renewables and employment generation across the whole of the EU. The scenario looked at roughly doubling renewable capacity in the EU by 2020. (European Commission, 1999) When broken down, it projected around 13GW of renewable capacity in the UK by 2010, slightly more than the Forum study above. The job creation prediction was 15,000 for the UK. However, some EU countries fared much better in terms of employment in the modelling. In Denmark, for instance, the model projected 73,000 jobs being created. This is likely to be more due to manufacturing of renewable energy equipment than their own production. The study also emphasised that a large proportion of renewable industry jobs would be created in the biomass area, which would be largely rural based jobs, possibly using some of the skills being underused in the declining agricultural sectors.

The model was mainly based on changes to policy at a European level and did not make assumptions about changes in domestic policy, so one could expect if the UK adopted more favourable policies towards certain renewable energy technologies, that more manufacturing jobs would be created in the UK. The UK Government should bear such results in mind when devising a strategy for supporting renewable technologies like solar and offshore wind. As the evidence below shows, there are job creation opportunities in renewable energy operation, but the greater prospects are in manufacturing and export.
Solar Power

Global sales in Photovoltaics (PV) could reach 3,500 MW annually by 2010 with a global turnover of £11 billion. The Association of UK PV Manufacturers has estimated that some 19,000 jobs could be created in Britain with a 15% share of this market (in Secrett, 1999). This figure assumes the manufacturing of solar panels would take place in the UK. There is probably little difference in the costs of manufacturing solar panels in the USA, UK or other EU countries, so the decisions on where to site such manufacturing will be influenced by where the early markets are set up. So far the UK has a poor investment in solar energy. Solar manufacturers in Europe are more likely to set up plants in countries such as Germany where installation rates have reached 11MW annually, helped by a government programme for solar roofs. Forum for the Future have developed a strategy for bringing solar PVs to the British market and estimate that capacity could be raised to between 392-500 MW by 2010 (Sinha, 1999). The European PV Industry Association has estimated that production, installation and maintenance of PVs could directly employ 294,000 people in the EU by 2010. (Renner, 2000). First movers in the solar market will almost certainly reap benefits of the manufacturing jobs. The question for the UK is whether this would be the most cost effective way of using public money.

Offshore Wind

In a report for Greenpeace, the consultancy Border Wind (1998) has calculated that 10% of UK electricity could be practically generated from offshore wind by 2010. It revealed that if the manufacture and supply of components were based in the UK, some 11,300 jobs could be created directly in the industry by 2010. When the indirect multiplier effects previously calculated by ECOTEC were considered, the total estimate for job creation was 36,000.

In its latest report ‘Offshore Wind, Onshore Jobs’, Greenpeace (1999) argues that that the UK has one third of Europe’s offshore wind resource and that we could produce three times our electricity needs from offshore wind alone. It highlights how wind power has the potential to regenerate old manufacturing communities in the North East of England who have the transferable skills, technology and expertise necessary for supporting the industry. Yet, the reality is that the UK is currently lagging behind other European countries where offshore wind is also viable. The Government could consider the opportunities to provide the long term support the industry needs. For example, the Danish Government has been supporting its wind industry for a number of years and as a result now controls 60% of the global market and employs 15,000 people in Denmark (Greenpeace, 1999).

Home energy conservation
Household energy consumption is responsible for around 25% of the UK’s carbon dioxide emissions. The Government estimates that over four million households cannot afford to heat their home adequately. Home energy conservation measures will therefore have an important role to play in achieving the UK’s 20% carbon dioxide emissions reduction target and to meet its commitment to cut fuel poverty in 600,000 vulnerable households by 2001-04. The Government recently announced a New Home Energy Efficiency Scheme (HEES) designed to tackle fuel poverty by offering insulation and heating packages to vulnerable groups in society, such as the elderly, who find it difficult to adequately heat their homes. A comprehensive long term strategy to tackle fuel poverty is also being developed.

The Warm Homes and Energy Conservation Coalition, supported by environmental groups, pensioner groups and trade unions, estimated that a package of home energy conservation measures would create some 20,833 jobs directly. There would also be an estimated further 8,333 jobs created through multiplier and respending effects (cited in Secrett, 1999). On this basis, the enhancement of the HEES scheme is likely to generate new employment opportunities whilst also tackling environmental and social concerns. The mix of jobs range across different skills. Fitting most insulation is reasonably low skilled, assessing energy saving needs is primarily market research, whilst installation of new central heating systems obviously required considerable skills. Part of the fuel poverty strategy should be to assess whether the industry has the capability of delivering the increases in energy conservation work required to tackle the social problems.

**Fuel cells**

The fuel cell, where chemical processes are used to store or generate electricity, could become a major technology in the development of a sustainable economy. There are many applications for fuel cell technology. Motor manufacturers are developing applications for vehicles although most of this work is not based in the UK. As fuel cell vehicles are still at the early stages of development it is not possible to determine the potential employment impacts in the car industry. Although, if the fuel cell were to become an alternative to the internal combustion engine, and no UK car manufacturing plants had this expertise, it may place further pressure on their long term viability.

However, a UK company, Innogy, is poised to begin manufacture of fuel cells for electricity storage. This application would make intermittent renewable energy sources such as wind, more economically viable as their output could be stored and used when electricity demand is high. The manufacture of such products would require the sort of assembly and engineering skills available in the West Midlands, where car component manufacturers are under pressure. These regional and skill links could be supported by Government or RDAs, to ensure the UK economy benefits from the scientific developments already achieved.

**Waste and recycling**
The recovery and reprocessing of materials more cheaply than primary sources of production generates not only new areas of economic activity but also new employment opportunities. A recent DEMOS report called ‘Creating Wealth from Waste’ argues that an intensive recycling programme in the UK would create between 40-55,000 additional jobs. In Germany, there is a thriving recycling industry due to tougher waste minimisation regulations than the UK. Recycling firms make a substantial contribution to the German economy with there being more than 1,000 recycling businesses employing at least 150 people each (Murray, 1999). Demos has calculated that between 25-40,000 new jobs could be created through the expansion of manufacturing and processing of reusable and recycling materials in the UK, with the potential of a further 15,000 jobs created in collection and sorting (Murray, 1999). It has to be noted, of course, that some of these jobs will be low skill and low quality.

In 1997/98 there were around 27 million tonnes of municipal waste (which includes all waste under the control of local authorities or agents acting on their behalf) which is up from 25.2 million tonnes in 1995/96. In 1997/98, 24.6 million tonnes of this municipal waste came directly from households of which 85% was disposed of by landfill (DETR, 2000a). As part of its Waste Strategy 2000 for England and Wales, the Government has set a target to recycle or compost at least 25% of household waste by 2005 and to increase this to 33% by 2015. A study by the London Planning Advisory Committee and the Environment Agency revealed that recycling 25% of London’s municipal waste (90% of which is household waste) would create some 679 jobs in collection and sorting, and a further 1394 jobs in processing (Murray et al, 1998). This indicates that the Government’s first target to recycle or compost 25% of household waste would generate a significant number of jobs in London alone, which could be mirrored across England and Wales. The target to increase recycling or composting to 33% of household waste by 2015 would help reinforce the recycling sector’s contribution to the UK economy.

**Agriculture and conservation**

If agriculture is to be developed in an environmental sustainable way, farming practices will need to shift from being chemically intensive to lower input methods, including organic. Most of the employment estimates for environmentally beneficial farming are based on organic, as it is at one end of the spectrum. A report by Friends of the Earth calculates that converting 25% of Britain's crop and livestock farming to organic methods would create between 30-45,000 jobs (Jenkins and McClaren, 1995). This was based on the evidence that organic farming practices are more labour intensive. (Lampkin and Padel, 1994) A later report highlights that organic systems, which need more labour, average 10% higher on-farm employment than conventional methods and generally leads to, increased farm processing and direct marketing (Secrett, 1999).

In 1997, the Sustainable Agriculture, Food and Environment (SAFE) carried out surveys of farms that had converted to organic practices across the UK. It found an increase in employment, both on the field and in other farm activities such as processing and marketing. SAFE estimates that in the 816 organic farms surveyed...
there had been an increase in 400 full time jobs in non field labour (SAFE, 1997; Barry et al, 1998).

In the UK there has been an emergence of agri-environmental schemes that pay farmers to protect and enhance the environment. The English Countryside Stewardship Scheme (CSS) is a voluntary scheme run by the Ministry of Agriculture Fisheries and Food (MAFF) that been shown to create new jobs for farmers, contractors and other small rural businesses (Brooke and Rayment, 1999). The Tir Cymen scheme in Wales was created to encourage environmentally sustainable farming in 3 areas of rural Wales. Over the 1992-1995 period, 204 casual jobs and 62 person years of environmental work have been created (Barry et al, 1998; ADAS, 1996). A recent All Party Select Committee on Agriculture and the Countryside recommended that the Tir Cymen approach be replicated across Wales. Calculations indicate that it would cost £23 million per year and would generate 1,230 person years in full time jobs and save £11 million in welfare benefits (Barry et al, 1998).

The RSPB has estimated that wildlife conservation supports more than 10,000 full time jobs in Britain (Rayment, 1997). The Abernethy Forestry reserve in Scotland, which supports 87 full time jobs, exemplifies how wildlife conservation activities can be a major source of employment in a local area (Rayment, 1997; Brooke and Rayment, 1999). There will also be some spin off employment opportunities created by the agencies such as English Nature or National Parks, who provide advice and support to farmers on environmentally beneficial techniques and conservation skills.

To date, the job creation potential of agri-environmental and wildlife protection schemes has not been fully exploited by the UK Government, although policy is beginning to move faster in the direction of sustainable agriculture. A 1998 report for the European Commission (EC) compiled by the Association for the Conservation of Energy, FoE, GMB and UNISON suggests two ways in which the Government could reform policy so that the environmental and employment benefits of sustainable agriculture are realised. Firstly, it recommended that the Government should adopt a pesticide reduction target to complement existing policies that encourage the use of the least damaging pesticides. The MAFF report, ‘Towards Sustainable Agriculture’ set out indicators of progress which included pesticide use and organic conversion, but no targets are yet in place. (MAFF, 1999) Secondly, it recommended that the Treasury and MAFF should invest larger budgets in agri-environmental and wildlife conservation schemes such as the CSS scheme. Since then, the England Rural Development Programme has increased the availability of support for Environmentally Sensitive Areas, Energy Crops and other sustainable agriculture initiatives. External evidence appears to suggest the potential for employment gains in rural areas through such schemes.

**Woodland and forestry management**

Like the agricultural sector, forestry has experienced rapid productivity gains in recent years, and employment is declining. Brooke and Rayment (1999) recognise that one of
the key issues in relation to job creation is the length of the forest rotation because after planting little employment is created until harvesting which can be some 40 years later.

One estimate states there are 45,000 farm woodlands that provide a negligible financial return to farmers because they are not managed correctly (Secrett, 1999). Woodland management schemes are a means of enhancing their economic and environmental value whilst also creating jobs. For example, the Marches Woodland Initiative is a five year partnership set up in 1997 which has created jobs especially for local forestry contractors. It is estimated that around 15 new jobs have been created – one for every 50ha of woodland brought into management (Brooke and Rayment, 1999). Reintroducing coppicing could also create jobs directly in woodland management and indirectly in carpentry and making products such as building materials, fencing and furniture. A Friends of the Earth report estimates that if 500,000 ha of broad-leaved woodlands were planted and managed for timber production (the amount needed to substitute the UK’s tropical timber imports) some 3,300-4,400 additional jobs could be created (Rice, T, 1995).

Tourism

Some parts of the country will benefit economically from a higher quality environment. The South West RDA, for example, has identified tourism as one of its key growth industries. The Rural Development Commission (1997) has estimated that tourism spending in the English countryside is worth over £8 billion a year and supports 350,000 rural jobs.

(Statistics from the Rural Development Commission, 1995)

Visitors are attracted to the countryside for a variety of reasons, the most popular being for bird watching and angling. The RSPB argues that wildlife tourism is often critical to sustaining local economies because it can help to mitigate the
unemployment caused by seasonal mainstream tourism. For example, a study in the 1990s of local economies in Scotland found that between £19,000 and £27,500 of visitor spending was sufficient to support one local job (Surrey Research Group, 1993 in Brooke and Rayment, 1999). Of course, not all tourism activity will necessarily be environmentally beneficial, as the extra traffic and development may have detrimental effects. However, where the tourism is dependent on a healthy environment then a virtuous circle of employment creation and environmental protection can be built up.

**Transport**

There are two employment issues in the transport field. First is the indirect role of transport infrastructure in stimulating economic activity and second is the direct job creation of different transport modes.

The traditional view of road building has been that it is a good source of jobs and that roads provide an important access route for attracting companies to locate in a previously remote area. A similar point can be made about public transport infrastructure. The Worldwatch Institute has shown that building public transport infrastructure is more labour intensive than building roads (Renner, 1991). Research by the Heriot Watt University has shown that rather than having a local multiplier effect, a new road linking an ailing, peripheral area with a healthy, developed area can make it easier for the developed area to compete for business and jobs to the detriment of the peripheral area. In this way a new road link can serve to suck jobs out of the peripheral local economy rather than bring new ones (McKinnon, 1994). Again the same point can be made about major improvements in public transport infrastructure. The impact of infrastructure is an important issue for the regional distribution of employment, rather than absolute levels.

There is less research into the direct employment effects of transport modes. In the report ‘Less Traffic, More Jobs’, ECOTEC and Friends of the Earth developed a Sustainable Transport Strategy (STS) that projected the direct employment consequences of the growth in train, bus and cycle usage, based on targets set by the Royal Commission in 1994.

<table>
<thead>
<tr>
<th>Sector</th>
<th>STS Target</th>
<th>Manufacturing</th>
<th>Infrastructure</th>
<th>Operation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle</td>
<td>10% increase by 2005</td>
<td>8000</td>
<td>1000</td>
<td></td>
<td>9000</td>
</tr>
<tr>
<td>Bus</td>
<td>80% increase by 2010</td>
<td>4000</td>
<td></td>
<td>27000</td>
<td>31000</td>
</tr>
<tr>
<td>Rail</td>
<td>70% increase by 2010</td>
<td></td>
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<td>90000</td>
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Economic modelling by ECOTEC found that policies to promote public transport, cycling and walking would lead to 130,000 new jobs by 2010. They also concluded that any job losses in car manufacturing and maintenance would be compensated for by the creation of new jobs in the public transport sector (Jenkins and McClaren, 1997). However, the Government’s policy is to discourage car use, not car ownership, so there is less likelihood of job losses in car manufacture under foreseeable sustainable development policies. Motor manufacturing is now completely integrated across Europe so demand for cars in the UK will only be one factor of many to affect the manufacturing base. Regulations and voluntary agreements to improve the environmental performance of cars in the EU is also as likely to maintain the demand for new vehicles.

The Government’s Transport Plan for the next ten years sets ambitious targets for increasing public transport use and reducing private car use. It has pledged to increase rail use by 50% from 2000 levels, to increase bus use by 10% from 2000 levels and to triple the number of cycling journeys. (DETR, 2000c) It is difficult to quantify what the employment implications of these policies will be. The ECOTEC modelling above is based on Royal Commission targets set in 1994, and is not directly comparable to the ten year plan targets. It nonetheless provides a useful indication of the likely employment impacts of the Government’s current public transport targets. The report supports the view that the Government’s integrated transport strategy will not only benefit the environment but also create a significant number of additional jobs. The Government’s plan also backs this up with an analysis of the public transport supply industry and its capability to deliver the rolling stock, new buses, signalling equipment etc. required to deliver the investment set out. (DETR, 2000c)

**Water**

The introduction of the European Wastewater Treatment Directive had a positive impact on improving water quality and generating jobs. For example, Severn Trent estimated that it spent £40 million per year on environmental schemes that supported 23 full time staff either directly employed or via contractors. During 1996/97 North West Water invested £275 million in the construction and upgrading of six wastewater treatment works which led to employment for 160 people. The same water company also invested £500 million into its ‘Sea Change’ programme for reducing pollution along the North West Coast which is estimated to have generated 280 new jobs (Barry et al, 1998). The Association for the Conservation of Energy, Friends of the Earth, GMB and UNISON, have suggested that as part of the Government’s Welfare to Work programme, water companies should be encouraged to take on staff for specific environmental projects. However, it is highlighted that participants should be given training that allows them to develop transferable skills enabling them to take up similar kinds of work afterwards (Barry et al, 1998).
Third sector - ecological enterprises

Ecological enterprises are local voluntary or community organisations that generally operate on a not for profit basis. They have a central social purpose, which is to protect and conserve the environment. The ecological sector is rapidly expanding in the UK. Paperback, a worker co-operative based in London, is the largest independent wholesaler of recycled papers in Britain. Magpie Recycling Co-operative in Brighton is another ecological enterprise mainly self funded through collection charges. It employs 30 people in four businesses that recycle household and commercial waste, provide home delivery of organic food, and recycle furniture (SEL, 2000). Ecological enterprises often contribute to local economic development because they tend to stay in their local vicinity as they grow establishing local trading markets.

Their embeddedness in the local community also means that most additional jobs benefit local people. Ecological enterprises can also act as Intermediate Labour Markets (ILMs) providing training and work experience to the long term unemployed so that they can take up socially useful employment. For example, Create based in Liverpool which aims to train long term unemployed people to repair and reconstruct old fridges, washing machines and other white goods (Barry et al; Newby, 1998). It started in 1997 with 12 trainees and has expanded to 30. Heatwise, operated by the WISE group, is another ILM that identifies employment and training opportunities for local people through improving the heating and insulation of local housing. In 1994, the group employed 785 people – 230 were permanent employees and 565 were trainees on various programmes (Barry et al, 1998).
Achieving the transition

The research evidence clearly demonstrates employment creation opportunities in a sustainable economy. Government policy in creating the right market framework to encourage environmentally beneficial economic activities will play an important role. Most of the positive employment effects are will simply be additional benefits from environmental policies which are beyond the specific remit of this report. But below we highlight some areas that have particular relevance to the employment creation aspects of the debate.

Skill requirements

The previous section demonstrated a number of potential growth areas for employment in a sustainable economy. The skills likely to be required will vary from highly technical and scientific, through manufacturing, engineering, agricultural to semi-skilled or unskilled labour. Some of the studies do begin to assess the types of skills which may be required in different sectors. Installation of CHP needs the merging of two currently separate sets of skills: electrical and heating engineering. Offshore wind could easily use some of the existing skills in the offshore oil sector or shipbuilding. The Government’s transport plan identifies the potential shortage of signalling expertise in the upgrading of the railways.

There seems to be little systematic research available, however, to look at the levels of skills that will be required or the quantity of different skills. The Government is responding to shortages of teachers, health professionals and police by boosting recruitment and offering incentives for training. There may be a role for Government, through the Learning and Skills Council in preventing potential skill shortages for some sustainable technologies.

Role for the RDAs

Assessments of regional skill base and identification comparative advantages in the regional economy are two of the functions of the newly set up RDAs. A number of them are looking at energy technologies. The Northern Energy Initiative (TNEI) is producing a regional energy strategy that will identify opportunities for renewable energy in particular.

The South West RDA has made sustainable development a strong feature of its Economic Strategy and the South East England Development Agency (SEEDA) is helping the environmental technology sector in the region co-ordinate and disseminate information about its products. The Yorkshire and Humberside RDA will be producing an environmental economic strategy. Obviously the RDAs are at very early stages of developing and funding activities. It is too early to make an assessment of their impact. **TUSDAC could encourage such integration of sustainability into regional strategies by promoting good practice through the trade union networks and representatives on RDA boards.**
Environmental Task Force

The Environmental Task Force (ETF) was launched as part of the New Deal for young unemployed people in January 1998. It has largely been led by Training and Enterprise Council (TECs), Local Authorities (LAs), ILMs and environmental and conservation groups. Activities undertaken are mainly concerned with conservation, gardening and landscaping. There is little doubt that such projects raise the skills and self esteem of the participants and that they often provide valuable environmental services to local communities. However, a recent evaluation of the New Deal for Young People found that the option generally led to only temporary or transitional employment and attracted a disproportionately high number of young people without qualifications. Most lacked basic skills and were either on probation or community service. The Environmental Task Force option was viewed as ‘a last resort’ for difficult to place clients (Hasluck, 2000).

Groundwork, the social and environmental organisation, has been involved in delivering the Government’s objectives for the ETF across the country. It has developed a number of recommendations for transforming the ETF so that it is no longer viewed as a ‘soft’ New Deal option and has the potential to support sustained environmental employment. These include:

- **To increase the use ILMs.** For example, Groundwork Creswell operate ILM projects in home composting, landscape design and environmental heritage in the old coalfield areas of North Notts, North Derbyshire and South Yorkshire. ILM employees are paid £120 a week and offered training, job searching advice and mentoring.

- **Longer training times.** The training period of 26 weeks should be extended to account for the fact that most New Deal clients on the EDF option will have low numeracy and literacy skills. In many cases, personal development activities will be needed to prepare clients for the disciplines of a job training situation. For example, in Rochdale, Oldham and Tameside, Groundwork holds the franchise for the Prince’s Trust Youth Volunteer Programme through which offers New Deal clients 12 weeks of support for personal development.

- **To develop a Green Apprenticeship.** The aim of an apprenticeship would be to use ETF funds to help professionalise environmental employment and provide longer term support to clients interested in developing specialist environmental skills. Groundwork is currently piloting the scheme in Merseyside. In Australia, the Green Jobs Unit previously ran an similar environmental traineeship programme which targeted sectors in the Australian economy such as land conservation and restoration, waste management and water industry where there is a growing jobs market.

Since this Groundwork report was published, the Government has continued to review the operation of the ETF and current statistics show that 45% of those leaving the ETF immediately enter work. It is, of course, only able to address short term employment issues and is not designed to create jobs in sustainable industries that did not exist before.
Options for further work by TUSDAC

Macroeconomic effects of environmental policy

There appears to have been no comprehensive study in the UK on the competitiveness effects of environmental policy, although no reason to suspect the results would be different from elsewhere in the world where no evidence has been found that environmental policy has a detrimental effect of competitiveness or jobs. However, a UK based study on the competitiveness effects of environmental policy, supported by TUSDAC, may help to challenge some of the perceptions of environmental policy in the UK. Depending on the resources available, research could be a survey of reasons for plant closure, an examination of one sector and the effect of different environmental policies, or comparisons of estimates of costs of environmental policy to the actual costs after implementation.

Resource productivity

The DTI have recently published their own Sustainable Development Strategy which places improvement of the resource efficiency of the economy as its primary goal. TUSDAC is already working with trade unions on greening the workplace. Evidence has shown that employee involvement increases the effectiveness of pollution prevention activities. The TUSDAC work on employee involvement in pollution prevention could be extended and linked to the delivery of the DTI’s resource efficiency targets.

The low carbon economy

Numerous studies have shown positive employment effects for moving the UK energy market towards greater use of renewables and improved energy efficiency. The studies show that most of the low carbon technologies are more labour intensive than conventional fossil fuel and they also highlight potential ‘first mover’ advantages for the UK from establishing a manufacturing base in certain technologies. However, the majority of these studies have been commissioned by trade associations or environmental groups. Without doubting the accuracy of the research, there could be a perception of bias in their findings. TUSDAC could commission an independent assessment of the employment potential of a low carbon economy, perhaps as a follow up to the Royal Commission’s report and using their scenarios, or in conjunction with the Carbon Trust.

The role of RDAs

Some RDA strategies and plans have started to design specific regional activities to stimulate environmental employment, but these plans are still in their early stages and their impact is hard to assess. TUSDAC could encourage such developments by
promoting good practice through the trade union networks and representatives on RDA boards.

**Sustainable skills**

Whilst some sector studies have investigated the sort of skills required in, for example an expansion of offshore wind technologies, there is generally little research in the area of skills requirements for sustainable technologies. In some cases such information could help RDAs or the sectors themselves plan the medium term development of sustainable industries. **TUSDAC could work with Government, trade associations, RDAs and the newly established Carbon Trust to carry out skill audits for sustainable technology sectors, particularly in the energy and transport fields.**
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