Skills for a Low Carbon and Resource Efficient Economy

A Review of Evidence

A report commissioned by defra

Department for Environment Food and Rural Affairs

Contents

Executive Summary

Aims and Purpose of the Research
A transition to a low-carbon, resource-efficient economy is needed to meet the global challenges of climate change and sustainable development.

A low-carbon, resource-efficient economy is one in which there is a decoupling of the link between carbon emissions and economic growth. Economic activities and growth take place using less resources in this type of economy. Low carbon and resource efficiency actions form part of the larger overarching requirements of sustainable development.

In July 2007 the UK Government published World Class Skills: 'Implementing the Leitch Review, of Skills in England', which set out the actions Government will take to raise the nation's skills base, increase social inclusion, build productivity, and increase economic competitiveness. This included a commitment to putting the skills implications of the transition to a sustainable, low-carbon and resource efficient economy at the heart of that long-term drive to increase our nation's skills. The recent report from the Commission on Environmental Markets and Economic Performance (CEMEP) outlines how the threat of climate change can play a key role in stimulating investment in new technologies and innovations and help transform existing sectors of the economy creating entirely new industries.

The intention of this research work was to undertake a wide ranging high level review of the current and relevant evidence relating to the skills implications of the transition to a low carbon and resource efficient economy (LCREE). This is the first attempt to bring together the current research and stakeholder views on skills for a low carbon and resource efficient economy. By definition, the scope of the project is broad and ambitious. The specific objectives were:

1. To develop an overview of the generic and specific skills requirements for a low carbon and resource efficient economy (LCREE).
2. To develop an overview of a wide range of stakeholders understanding and awareness, as well as the demand for, generic and specific skills requirements for a LCREE.
3. To identify gaps in evidence and recommend priority areas for future research which will move the LCREE agenda forward.

Given the scope of the project this is intended as a review of current evidence and understanding through a document review and targeted stakeholder interviews. Detailed forecasting and a wider stakeholder engagement was beyond the scope of the project, though a targeted approach has ensured that key stakeholders with an interest in this area have been consulted. A broad skills "checklist" was also developed to provide examples of what LCREE skills may involve.

Methodology
The research involved undertaking a number of activities.

- ***Scoping the project*** involved a high level document review, compilation of a definition of Low Carbon and Resource Efficient Economies and definition of their associated skills requirements.
- ***Reviewing written evidence*** involved examination of all the Sector Skills Agreements, an academic literature search to see the prevalence of relevant research and review of 140 items of 'grey' literature from a range of sources.

- ***Stakeholder consultation*** involved interviews with 12 priority Sector Skills Councils as well as an additional 23 interviews of a range of public and private sector organisations including key skills providers and professional bodies.
- In addition to this, an informal stakeholder advisory group has met to provide comments on this work.

Low Carbon and Resource Efficient Economy Skills

LCREE skills involve a wide range of topic and subject areas. To bring clarity to this for consultees a draft skills checklist was compiled which categorised LCREE skills into the following over-arching subject areas:

- Design
- Waste
- Energy
- Water
- Buildings
- Transport
- Materials
- Financial
- Management
- Policy and Planning

Findings and Conclusions

The following findings and conclusions are drawn from one or more of the sources - the written evidence, views expressed during the stakeholder consultation and views of the Stakeholder Advisory Group.

Key Findings

- *Overall, the evidence base on LCREE skills is weak, with available research focused on high level and general comments.* A number of significant gaps in the evidence base were identified – these are addressed in the recommendations below.
- Moving to a Low Carbon and Resource Efficient Economy will require a fundamental transition in behaviour and application of skills and knowledge. Understanding and awareness is a crucial issue. The interchangeable use of terms such as sustainable development, green, eco, environmental is causing confusion. Each term means different things to different people and there is a lack of clarity in the economy as a whole as to the characteristics of a LCREE and consequently what the skill requirements may be.
- There was evidence of a latent demand for LCREE skills – demand is not currently being articulated by employers and as a result the current skills delivery framework is ill equipped to anticipate and respond. Organisations do not have the right levels of understanding of the skills requirements and implications of a LCREE and consequently of the importance and potential benefits of integration of LCREE skills into their businesses. Only when these links and a clear business case are made will businesses demand LCREE training. This leaves us in a 'Catch 22' situation – understanding and awareness are the key to stimulating demand for skills but in a demand led skills delivery system, an expression of demand is required from the organisations for the skills delivery sector (especially SSC's) to respond to.
- It is considered unlikely that current levels of skills training capacity will be sufficient to meet demands in the event of increased conversion of latent potential demand to actual demand, though further evidence based work and forecasting are recommended to quantify this.
- LCREE skills need to be considered by, and integrated into, the whole of the skills delivery system.

Summary of Findings

Understanding and Awareness

- Understanding and awareness is a crucial issue which refers to a holistic in-depth understanding of the issues involved in LCREE and impacted by it. It is necessary to affect the way organisations think and operate with regard to LCREE in a day-to-day context and must be in place to stimulate demand for LCREE skills and more effective skills implementation.
- A key issue affecting understanding and awareness is the interchangeable use of terms such as sustainable development, green, eco, environmental – each term means different things to different people and there is a lack of clarity in the economy as a whole.
- Written evidence on a range of LCREE and associated topics indicated lower than desirable levels of in-depth understanding and a lack of progress beyond the high level and there are many factors influencing the levels of understanding and awareness.

Priority Skills

- A range of priority generic (cross-sector) and sector specific skills were identified as priorities in achievement of a successful Low Carbon and Resource Efficient Economy.
- A lot of the identified skills are not new, they are simply skills that already exist whose availability needs to be increased or which need to be applied in new situations or adapted with further training to a LCREE context specifically in mind. There is a need to identify these transferable skills and mechanisms for their transfer.
- The most important generic skills highlighted were leadership and management skills with an emphasis required to further this agenda effectively (such as communicating the LCREE message and strategic business planning with LCREE in mind), sustainable procurement and STEM (Science, Technology, Engineering and Mathematics) skills in general.

Integration of Skills

- Integration of LCREE skills into all training taken by companies is the key to mainstreaming LCREE understanding, knowledge, skills and thinking. Several consultees mentioned that these skills have to become core to an organisations function.
- LCREE has traditionally been seen as a skill set separate to the core work of the company and the written evidence reviewed does not demonstrate a high level of integration of LCREE skills needs into current organisational priorities.
- Integration of some LCREE skills into qualifications and National Occupational Standards has started to take place in a limited capacity, but there is still a long way to go.
- A key factor highlighted as increasing integration of LCREE and associated skills into organisational priorities is an enlightened and aware director who will push these skills issues forwards. In addition levels of understanding and awareness amongst staff will impact on ability to integrate LCREE skills requirements and practices into organisational priorities.
- In many good organisations LCREE actions are taking place but there are not necessarily being integrated into general management practices of these organisations on a widespread basis.

Skills Demand Drivers and Obstacles

Drivers

- The general consensus was that most organisations will be driven to take action if this is required by legislation or if there is a clear business case (such as cost savings or increased competitiveness) to justify it. The clear business case is not currently fully appreciated.

- It is considered that at the moment levels of demand for LCREE skills are lower then could be expected. This is because a significant proportion of the total potential demand for LCREE skills is latent. Organisations do not have the right levels of understanding of the importance of and the potential benefits of integration of LCREE skills into their businesses. Only when these links and a clear business case are made will businesses demand LCREE training. This leaves us in a 'Catch 22' situation – understanding and awareness are the key to stimulating demand for skills but in a demand led skills delivery system (such as the one in place in England), an expression of demand is required from the organisations for the skills delivery sector (especially SSC's) to respond to.
- Various legislation and actions have started to impact on demand for, and subsequent integration of, aspects of LCREE and associated skills. But, there has been no co-ordinated overall systematic discussion or action to stimulate demand for LCREE and consequently the optimum way to achieve this is unclear, leaving a significant proportion of latent demand unrealised.
- Supply chain pressures were also commonly cited as an important driver and are likely to play an increasing role in encouraging down-stream demand.

Obstacles

- Some stakeholders considered that low levels of awareness and leadership are leading to a short-termist approach from policy and decision makers within government, the public sector, the skills provision sector and businesses. Organisations find it difficult to plan ahead because they do not know what the future policy drivers will be.
- LCREE skills are not being comprehensively promoted by professional bodies that influence the perception of their members' skills requirements, for example through Continued Professional Development (CPD) activities.

National Capacity and Capability to Meet Skills Needs

- It is considered unlikely that current levels of skills training capacity will be sufficient to meet demands in the event of increased conversion of latent potential demand to actual demand.
- It was also highlighted that there may be a shortage of trainers in the marketplace – a factor which will significantly impact on delivery.
- A high proportion of the 2020 workforce are already in work. These people will need to be upskilled whilst within their existing jobs at all levels. There must be an effective way of reaching this group with appropriate qualifications and policies that support re-skilling and upskilling in a modular way. Many stakeholders felt that the current skills delivery infrastructure is not well suited to reaching and upskilling those already in the workforce. Those already in work require shorter specialist and background courses/modules and vocational training material which are often not available (or not available in sizeable quantities). Funding mechanisms are geared to delivery of longer term qualifications and do not support these shorter courses. In addition the practical methods of delivery are important to successful upskilling – with the private sector more flexible and able to respond to employers requirements better (e.g., on-site training).
- The skills delivery system and funding has been focussed on lower level skills. This does not maximise support of the LCREE agenda as LCREE skills have been cited as mainly being level 3 and above as well as at higher levels. In addition, there is a reported mis-match between the funding system for Higher Education and the skills required for a LCREE.
- Skills brokerage (and subsequent delivery) is reliant on well informed business advisors under the Business Support Simplification Programme. Not all business advisors are sufficiently knowledgeable about LCREE to identify issues and broker relevant support/training. Business advisors should receive specific LCREE training - best practice has been highlighted within the

East Midlands where business advisors have received specific training on resource efficiency and this model. In addition, this is a major mechanism for reaching the workforce already in place, yet there are sectors which do not use Business Link services as they are not perceived as relevant to their needs.

Evidence Base

- Research is being conducted into many aspects of LCREE, but not LCREE as a whole. Evidence is more likely to be focussed around issues such as sustainable development (which has a broader remit), low carbon, green and environmental issues.
- Most research is at a high level with only a vague focus on more in-depth specific skills requirements. In some cases research is repetitive and does not lead to any new insights. This indicates a lack of clarity in the research mission and an inability to progress to the next level (specifying skills requirements and actual actions to promote LCREE and its skills requirements).
- There was a lot more evidence available on the low carbon and energy issues and far less on the resource efficiency issues.
- A number of gaps in the evidence base were identified – these are addressed in the recommendations below.

Recommendations

Following analysis of available evidence, stakeholder interviews and Stakeholder Advisory Group feedback the following priority gaps in the evidence base have been identified.

Further Work

Recommendations for further research work arising from this study are:

- ***Latent demand*** – further development of the evidence supporting it and quantification of potential demand.
- ***Methods for stimulating LCREE demand*** – the work shows this will be a crucial first step before skills delivery will be successful. Investigation and assessment of a range of methods for stimulating LCREE demand would be sensible to inform any future campaigns to raise demand.
- ***Employer perception –*** a lot has been done on employer perception, but not to find out their opinions on LCREE specifically. Telephone interviews or a series of workshops/discussions to be carried out in order to gather employers' evidence. This would benefit the development of awareness raising campaigns and training courses and start to raise awareness amongst consultees of LCREE issues and their importance.
- ***Employee perception*** - lots of enthusiasm for LCREE has been observed coming directly from employees. Research is needed to understand the extent of this enthusiasm, what drives it and how it can best be harnessed and utilised to advance LCREE within organisations (establishing ways and mechanisms to empower employees to be able to take action).
- ***Case studies, performance and benchmarking –*** examples of good performance and best practice as well as the benefits this has brought (clarifying the business case) need to be collated (including existing work) and disseminated to promote uptake of LCREE skills and behaviour amongst organisations. There is a current paucity of benchmarking data which could help organisations to judge their performance and provide impetus to make improvements.
- ***Identification of sector specific LCREE skills requirements*** – in more depth than existing research and could include consideration of how these will be filled**.** Mapping of sectors and job role skills requirements. Priority for some sectors.

- ***Transferable skills*** – many LCREE skills exist and are transferable to new sectors and into currently available skill sets. Identification of these skills and investigation of mechanisms for transferral or upskilling.
- ***Further Investigation of the relationship between behaviour change and LCREE skills -*** implementation of LCREE is about more than just upskilling – it is about application of knowledge and thinking differently. There is a gap in the knowledge of what the key factors are in influencing organisations to change, what makes them embed LCREE skills and how influencing factors vary with company size and sector.
- ***Waste and resource efficiency research -*** not a lot is available, especially with relevance to skills requirements**.**
- ***Optimum training delivery methods –*** to identify training delivery methods fit for a range of up-skilling purposes**.**
- ***Future technologies for LCREE*** - to gain a greater understanding of where the key skill demands will be.
- ***Development of leadership framework for LCREE*** – there are a range of leadership and management skills and behaviours which it will be crucial to embed in all organisations in order to achieve and function within a LCREE. Development of a model for how these should be developed within organisations to ensure LCREE and longer term LCREE considerations become a fundamental part of management and leadership going forwards.
- ***Design skills –*** definition of sector specific requirements and increasing consideration of LCREE in design.

Other Recommendations

The following are based on the outcomes of the written evidence review, stakeholder consultation and Stakeholder Advisory Group feedback*:*

- LCREE considerations should be integrated across the whole of the skills delivery system.
- Further consideration of how SSCs, the new CES and exsiting NSAs can collaborate - to ensure that where there is latent demand it is proactively anticipated and mechanisms are put in place to deliver the appropriate skills.
- Pilot study investigating optimum methods of generic skills delivery – difficulties have been reported for employers trying to access training which is delivered in ways that are convenient for their business requirements. This practical pilot would trial and analyse a number of methods of skills delivery to produce guidance on the best and most effective practices for skills deliverers.
- Consideration should be given to suitable methods of empowering SSC's to influence the agenda with regards to LCREE (in line with government priorities) and / or to methodologies for an awareness raising campaign to raise awareness at employer level.
- Creating change in the current policies where SSC's respond only to demand lead skills needs. LCREE skills should be incorporated into majority, if not all the Sector Skill Agreements facilitating creation of sector based National Occupational Standards which will accelerate the development and delivery of sectoral skills in LCREE.
- The public sector employs large workforces and has significant purchasing power. There are a range of public sector opportunities which could be utilised to further this message and drive the demand for LCREE (such as re-writes of procurement codes).

Following assessment of the evidence, stakeholder and Stakeholder Advisory Group feedback Pro Enviro recommend additional work not related to specific gaps in the evidence base, but which would support the effective promotion of the LCREE agenda including:

- Policy making within government should consider LCREE issues and implications. LCREE considerations should be integrated into the core work of all departments in order to 'future-proof' and provide consistency to policies.
- To avoid confusion it is recommended that government promote LCREE or another consistent definition depending on the aims of government policy. The definition chosen should be consistent with government policy.
- Government policy and direction should be formalised so a consistent approach is used. Government is encouraged to lead by example to ensure that the skills implications are factored into to policy decisions.
- A strong, consistent focus should be placed on targeting organisation directors and key decision-makers with regards to LCREE and the use of supply chain pressures to embed LCREE in targeted sectors. This should be core to government contact with this group.
- Working with the professional bodies that influence the perception of their members' skills requirements to promote better understanding of LCREE and provision of LCREE skills.
- Greater clarity on the skills for climate change adaptation and how these relate to skill requirements for LCREE.

Project Aims

Aims and Purpose of the Research

It is recognised the if the UK is to make a successful transition to a Low Carbon and Resource Efficient Economy (LCREE) we will need to develop and apply a range of skills within businesses and society. Some of these LCREE skills apply to specific sectors whilst others are generic (cross-sector skills). In addition, the great range of LCREE skills required means that some are new or relatively uncommon (such as skills associated with the implementation and use of new technologies), whilst others are already in common existence but not necessarily in use within all sectors. Further development of the UK STEM skills base will also be essential.

The intention of this research work was to form a wide ranging high level review of the relevant evidence relating to LCREE skills requirements which is supplemented by a consultation exercise with a range of relevant stakeholders. The specific objectives were:

1. To develop an overview of the generic and specific skills requirements for a low carbon and resource efficient economy (LCREE).
2. To develop an overview of a wide range of stakeholders understanding and awareness, as well as the demand for, generic and specific skills requirements for a LCREE.
3. To identify gaps in evidence and recommend priority areas for future research which will move the LCREE agenda forward.

The research sought to provide information and evidence relating to the key research questions:

1. What is the current level of understanding, awareness and demand for the skill requirements for a low carbon resource efficient economy?
2. What preliminary conclusions can be drawn in terms of existing demand and expected demand in the next 10-20 years
3. Where are the main gaps in the evidence base?
4. How do skills for a low-carbon, resource efficient economy relate to existing skills priorities for organisations, such as leadership and management?
5. What conclusions can be draw in terms of current skills availability, skills provision and capability?
6. What conclusions can be drawn on future skills needs (quantitative and qualitative), including in relation to national capacity and capability.
7. What are the main drivers for these skills (e.g. new or anticipated legislation, market demand).

Furthermore an important additional benefit of this work is the opportunity to engage with, and influence, a wide range of key stakeholders (e.g. government departments, skills providers, industry associations, industry, education sector, general public, and the voluntary sector). The consultation process enabled a two-way transfer of knowledge with key stakeholders, increasing the profile of LCREE skills as well as accelerating the rate at which these needs are qualified and addressed.

In general, the research will be used by Defra, DIUS and BERR in indentifying gaps in the evidence base and informing policy development.

Methodology and Research Findings

Scoping the Project

Given the scope and timetable for the project, clarity of mission was considered crucial. Consequently 3 initial tasks were identified which would enable a clear project scope and suitable boundaries to be developed. These tasks were:

- Strategic High Level Document Review.
- Defining Low Carbon and Resource Efficient Economies.
- Defining Skills Areas Associated with Low Carbon and Resource Efficient Economies.

Strategic High Level Document Review

Purpose and Methodology

A desk review of relevant national strategies and priorities was undertaken to identify those that will shape the future requirements for the skills required for a low carbon and resource efficient economy.

Strategic High Level Document Review			
Total Evidence Items Reviewed	11		
Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
1	Securing the Future – Delivering the UK Sustainable Development Strategy	HM Government	2005
2	The Stern Review	HM Treasury	2006
6	Prosperity for All in the Global Economy – Leitch Review of Skills	HM Treasury	2006
63	From Here to Sustainability – the LSC Strategy for Sustainable Development	Learning and Skills Council	2005
70	Securing the Regions Futures	Defra	2006
76	The Egan Review – Skills for Sustainable Communities	Office of the Deputy Prime Minister	2004
92	Our Energy Future – Creating a Low Carbon Economy	Dti	2003
93	Energy White Paper – Meeting the Energy Challenge	Dti	2007
100	Commission on Environmental Markets and Economic Performance Report	Defra, DIUS, BERR	2007
176	Energy Markets Outlook Report	BERR	2007
177	World Class Skills : Implementing the Leitch Review of Skills in England	DIUS	2007

Summary of findings

While the documents set the policy context for the UK, none of them specifically addressed LCREE skills. Indeed, within the documents there were very few mentions of either Low Carbon or Resource Efficiency.

The relevance of these high level documents is that they are concerned with Sustainable Development. Actions involving low carbon and resource efficiency form part of the larger overarching requirements of sustainable development.

Detailed summaries and highlights of the reviewed documents which set out the policy background for the UK and for the first time, brings together the relevant documentation in one place are available in Appendix 1.

Defining Low Carbon and Resource Efficient Economies

Purpose and Methodology

It was recognised during the project initiation stage that a clear definition of Low Carbon and Resource Efficient Economies (LCREE's) would be required to clarify the scope of the project, define its boundaries and the skills it encompasses. The wide range of planned project consultees was expected to vary greatly in their levels of understanding and awareness of LCREE's and associated skills requirements. It was therefore considered a priority to develop this draft definition to provide consistency to the project and ensure a clear basis for developing levels of understanding and awareness raising with the wide range of consultees.

To this end a review of high level documents was undertaken to establish the current consensus as to meaning of LCREE, and using this to put together a suitable draft definition for the purposes of this project.

The draft definition below was shown to all consultees during the evidence gathering process and comments were obtained from a wide range of organisations.

Draft Definition of Low Carbon and Resource Efficient Economies (Developed for Project Consultation and Consistency Purposes)

There does not appear to be a commonly used definition of 'Low Carbon and Resource Efficient Economy' in place. Therefore the proposed definition below was drafted to define the scope of this work.

It needs to be accepted that actions involving low carbon and resource efficiency form part of the larger overarching requirements of sustainable development. Sustainable development is a framework for integrating economic, social and environmental policy. It requires the continuous integration of environmental, social and economic considerations into decision making.

A widely used and accepted international definition of sustainable development is 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs' – Brundtland Commission.

Low-Carbon Economy is a popular term that refers to an Economy which has a minimal output of Greenhouse Gas emissions into the biosphere. Globally implemented Low Carbon Economies are often proposed as a means to avoid reduce the impact of climate change, and protect the planets natural resources.

The aim of a Low Carbon Economy is to integrate all aspects of the economy, manufacturing, agriculture, transportation and power-generation etc. around technologies that produce energy and materials with minimal Greenhouse Gas emission; and thus, around populations, buildings, machines and devices which use those energies and materials efficiently, and, dispose of or recycle its wastes.

A Low Carbon Economy should also be one that breaks the link between economic growth and increased use of carbon resources.

Resource efficiency can be defined as maximising the output of product or service from a given level of materials and energy. It is about increased productivity, and hence profits; about ensuring the greatest return on investment; and about the identification and exploitation of competitive advantage.

Low Carbon and Resource Efficient Economy (LCREE) Skills

The skills required to create an effective and expanding economy that minimises the amount of carbon emissions per unit of output, through the development and implementation of technologies and behaviour which utilises carbon resources in an efficient way and breaks the link between economic growth and carbon emissions.
The skills needed to achieve and maintain a successful LCREE are drawn from a very wide range of subject areas. These subject areas are categorised as:

- Design
- Waste
- Energy
- Water
- Buildings
- Transport
- Materials
- Financial
- Management
- Policy and Planning

Some of the individual LCREE skills within these subject areas will be new and groundbreaking. Others will be more established skills which, although not traditionally thought of as LCREE skills, will contribute to the achievement of LCREE's. Thus it is important to realise when considering skills that moving towards a LCREE cannot be compartmentalised – as indicated by the wide range of subject areas, it is a cross-cutting issue and its skills requirements need to integrated across the board. Likewise it will be necessary to realise that although some of the skills required to achieve LCREE's are sector specific, many are generic skills which have cross-sector importance.

Summary of Findings
A range of feedback was received on the definition. Opinions varied depending on the consultees viewpoint but overall the majority of consultees broadly agreed with the definition in general.

Opinions varied on the definition and specific issues that arose were often heavily dependant on the viewpoint and agenda of the consultee, indeed some of the comments made by different consultees contradicted each other. It was clear that some consultees were unclear on what LCREE skills were as this was often being confused with other issues such as sustainability, climate change adaptation, environmental and green skills. The development of the definition went a long way to removing the confusion.

In general, comments were in the areas of:

- Inclusion of targets for carbon emissions reduction, and reference to existing strategies required.
- It is fine to refer to sustainable development within the definition.

- Use of the term 'sustainable economy' would be clearer than LCREE and in line with some sectors thinking.
- Definition found to be confusing and ambiguous by some consulteees.
- More emphasis needed on embedded carbon and greenhouse gas emissions.
- Agreement that some skills are generic and applicable across a range of sectors.
- Should a low carbon economy reverse the link between carbon emissions and growth or just break it?

A range of comprehensive anonymous examples of comments on the LCREE definition received during the consultation process is available in Appendix 2.

Defining Skills Areas Associated with Low Carbon and Resource Efficient Economies

Purpose and Methodology

A draft skills checklist was developed by Pro Enviro to clarify the skills area of importance for a Low Carbon and Resource Efficient Economy (LCREE). It defined the scope and range of both generic and sector specific skills areas.

Please note that due to the aims and timescales of this project, this checklist was a draft and in no way intended to be a final complete checklist. The checklist was developed as a project aide and as a tool for gathering opinions and comments.

The checklist was used during the subsequent consultation process to help consultees understand the potential scope of skills and think more clearly about them in their responses. The checklist also formed a baseline from which to assess the nature and depth of consultees understanding and awareness of the skills requirements for LCREE's and provide intelligence on the gaps in generic and specific skills provision and evidence.

The skills checklist is split into a range of different subject areas referred to as Tier 1. Sitting below each Tier 1 subject area are a number of skills sub-sectors referred to as Tier 2 - these are general skills categories which could be made up of a number of individual skills. Tier 2 is further sub-divided into more specific skills areas referred to as Tier 3. During this consultation Tier 1 and where suitable, Tier 2 skills were discussed with a range consultees including the Priority Organisations listed in Appendix 3. For the purposes of this project, Tier 3 was too detailed to be consulted on at any kind of depth.

The Tier 1 skills areas are:

1. Design
2. Waste
3. Energy
4. Water
5. Buildings
6. Transport
7. Materials
8. Financial
9. Management
10. Policy and Planning

The full draft skills checklist is available in Appendix 4.

Summary of Findings

A range of comments were received from a wide variety of consultees including Sector Skill Council's, universities, professional bodies, regional development agencies and public sector organisations. The main points are summarised below:

- **Overall Comments and Checklist Approach –** The majority of consultees considered the checklist to be a comprehensive attempt to cover the range of skills areas required.

  Naturally comments were influenced by the levels of understanding of LCREE as well as the particular viewpoints and agenda's of the consultees. This meant that some of the comments were not specifically related to the LCREE agenda and so had limited use in assessing the checklist, but did nevertheless provide insight into the understanding of consultees. Particular comments were received where it was felt certain skills areas were missing from the list or that the way the list was structured/emphasised needed adjusting (these are discussed below).

  In terms of approach one consultee considered that skills lists alone will not work as we have not reached the general levels of understanding and awareness of why it is important to develop these skills. Some consultees felt that it was very business orientated and looking at the supply-push skills rather than skills that would increase demand for these skills or skills that would drive the low carbon economy (high value skills). There was a comment on the fact that the checklist did not cover skills delivery. One suggestion was for the checklist to be based around types of people needed (job roles) as opposed to skills.

  Through its very nature, the skills checklist does not place any higher importance on raising awareness as the first stage of achieving a LCREE. A suggestion to remedy this was to put in place an overarching upper tier to cover these aspects, with the existing skills areas sitting below this.
- **Generic (Cross Sector) Skills Requirements -** Many of the LCREE skills discussed are generic – with management, leadership and communication often being highlighted. A large proportion of the comments gathered during this research related to generic skills requirements.
- **Existing Skills Areas -**
  Skills areas highlighted include;
  Energy - energy price forecasting, avoidance as opposed to minimisation, carbon skills, energy storage, nuclear skills (from development to running to inspection), power generation and networking/grid connection skills, specification of renewables for building work (this overlaps with buildings and construction).
  Waste – industrial symbiosis, packaging design, reuse and remanufacture, specific waste to energy skills.
  Buildings and Construction – retrofitting for LCREE as opposed to new build skills, renewables planning and specification.
  Management Skills – putting together business plans for LCREE funding (interplay between energy management and financial skills), energy price forecasting/prediction, innovation skills (commercialisation of ideas, entrepreneurial skills), risk management, life cycle analysis (to help with ability to think holistically and less rigidly at problems), behaviour change skills need to be reflected more strongly, delivery skills (such as negotiation, management of change, leadership, visioning, understanding of sustainable development principles, environmental decision making, environmental management systems, behavioural, PR and marketing.

  It was felt that management was not the right title for this Tier 1 skills area as it does not reflect the strategic and leadership aspects which are important. Suggestions for renaming include 'management and leadership' and also merging of financial and management skills areas into 'Business Development Skills'.

Policy and Planning – Life cycle analysis, built environment skills(forward planning and development control, spatial aspects of technologies), policy maker and strategic skills, outreach/communication skills.
Transport – Social science issues around changing travel options and supporting this.
Materials – skills for production of renewable materials from crop sources.
Design – skills in specification methodologies and standards, calculation of embedded and operational carbon, product design for repair.
Finance – financing energy/low carbon technologies, impacts of regulatory measures, energy procurement skills.

- **New Skills Areas -**
  Skills areas highlighted include;
  - *Land Management and Production* – production of crops for renewable materials, agricultural skills for lower carbon, natural cycles and biodiversity, land treatment, land contamination and nature conservation.
  - *IT skills* – to be collated under a separate Tier 1 heading.
  - *Repair skills* – actual repair and design for repair.
  - *Carbon skills*

A summary of comments on the skills checklist which were received during the consultation process is available in Appendix 5.

Review of Written Evidence

Sector Skills Agreements

Purpose and Methodology
Sector Skills Councils (SSC's) are a crucial part of the skills landscape.As such, it was considered important to review their written evidence as part of this work. All SSCs have a role to play in a transition to a LCREE, though given scope of the project, a number of priority SSCs were identified and prioritised on the basis of their likely engagement and direct interest in the LCREE agenda.

Each of the SSC's is required to facilitate the production of a Sector Skills Agreement (SSA). The SSA is intended to outline the skills priorities for the sector and provide direction to the ongoing work of the SSC. Producing an SSA is a five stage process:

- Stage 1: A sophisticated assessment of each sectors' needs to cover the long-term, medium-term and short-term, mapping the drivers of change in the sector five to ten years down the track, and determining skill needs.
- Stage 2: A review of the range, nature and employer relevance of current training provision across all the levels.
- Stage 3: An analysis of the main gaps and weaknesses in workforce development, leading to agreed priorities to be addressed.
- Stage 4: A review of the scope for collaborative action – engaging employers to invest in skills development to support improved business performance – and an assessment of what employers are likely to sign up to.
- Stage 5: A final agreement of how the SSC and employers will work with key funding partners to secure the necessary supply of training.

Within the Agreements are set benchmarks and milestones that are negotiated with the key delivery partners to monitor progress and employer buy-in.

SSAs are subject to constant updates and development to ensure they are responding to the changing needs of business.

As they should reflect skills priorities in their industrial sectors, SSA's should form a good guide to the position of SSC's with regard to LCREE. As such, a review of SSA's produced by all SSC's was undertaken to understand the extent and context of each SSC's involvement with the LCREE agenda.

The SSA's of each Sector Skill Council were reviewed with a view to finding evidence of understanding of Low Carbon and Resource Efficiency and associated skills requirements, types of actions undertaken which could impact on LCREE skills development as well as integration of LCREE and associated requirements into future SSC plans

Summary of Findings

Priority SSC's
Although sector agreements and action plans have been developed for all the priority SSCs over a number of years, there is very little mention of specific Low Carbon or Resource Efficiency skills gaps, shortages or requirements. There are some limited references to environmental drivers but these mainly deal with environmental legislation and resource management.

Summarised information on each priority SSA is shown below:

SSC	Notes on SSA
Asset Skills	Drivers include legislation and resource management. No specific reference to Low Carbon and Resource Efficient Economy.
Cogent	5 key activities identified. Biofuel and renewable mentioned. Drivers include requirement for improvement in environmental performance (reduction in impact), resource management, legislation. No specific reference to Low Carbon or Resource Efficient Economy.
Construction Skills	5 drivers identified. No specific reference to Low Carbon or Resource Efficient Economy, although sustainability is referred to and with legislation highlighted as driver.
E-Skills	4 objectives identified. No specific reference to Low Carbon or Resource Efficient Economy or environment.
Energy and Utility Skills	5 main priorities Drive for technical skills/competencies, environmental protection, resource efficiencies Limited mention of renewable energy and climate change
Improve	Some regions included environmental skills as priority. Drivers include changing market conditions –sourcing of raw materials, waste management, resource efficiency. No specific reference to Low Carbon or Resource Efficient Economy. Drivers include changing market conditions –sourcing of raw materials, waste management, resource efficiency.
Lantra	12 key priorities highlighted. Action plan refers to environmental diplomas and technical skills. Change factors include legislation, resource management, climate change.
Skills for Logistics	6 priorities. No specific reference to Low Carbon or Resource Efficient Economy or

	environment
Proskills	Drivers include legislation, resource usage, improved technologies. No specific reference to Low Carbon or Resource Efficient Economy skills gaps or shortages.
SEMTA	Drivers include legislation.
Skillfast	Drivers include environmental legislation, resource usage, technical processes.
Summit Skills	5 priorities outlined. Include renewable and environmental technologies and integration of environmental technologies into other activities.

Non-Priority SSC's
Not all the non-priority sector councils have sector agreements or action plans developed to date. Where they are present and available for review, there is very little mention of specific LCREE skill gaps, shortages or requirements within the SSA's. There are some limited references to environmental drivers which mainly deal with environmental legislation and resource management, but overall the non-priority SSC's appear to be less aware of LCREE issues than the priority ones.

More detail on the content of all the SSA's is available in Appendix 6.

Grey Literature

Purpose and Methodology
A wide ranging review of written evidence and research relating to Low Carbon and Resource Efficient Economy (LCREE) skills was required as part of this work to enable Defra to develop an understanding of:

- Which organisations are aware of and understand the requirements of a LCREE as well as at what levels they have engaged with this topic.
- The degree of integration/mainstreaming of LCREE issues into the work of a range of organisations.
- What stakeholder organisations are identifying as priority skills requirements and current and future skills gaps.
- Identification of gaps in the LCREE evidence base.

In total 95 organisations were contacted (as well as all the regional development agencies) to ask if they had produced, or knew of any, written evidence on skills requirements for LCREE. Organisations contacted included; Sector Skills Councils, Public Sector Organisations, Professional Bodies and Key Skills Providers - the full list of organisations contacted is available in Appendix 3.

140 documents were reviewed for evidence of:

- Low Carbon and Resource Efficient Economy (LCREE) skills requirements.
- LCREE skills requirements (directly mentioned or strongly inferred).
- Factors affecting demand for LCREE skills.
- Future considerations for LCREE skills.
- Skills availability, provision and capability.
- Skills delivery infrastructure.
- Integration/mainstreaming of skills.
- Identification of gaps in the evidence base.

An assessment was made of the usefulness / relevance of each item of evidence in terms of the presence of content relating to specific discussion of skills requirements which further clarified LCREE skills requirements.

Following review, as part of the quality control process, an assessment was made of the robustness of the evidence provided by each document. This included consideration of:

- Credibility and reliability.
- Objectivity.
- Extent to which evidence is rooted in wider understanding of the issues.
- Extent to which evidence can be generalised into broader conclusions.

Summary of Findings

The documents were grouped into the following subject categories:

Subject Category	Relevant	Not-Relevant	Total
Agriculture and Land Management	6	1	7
Construction, Planning and the Built Environment	13	7	20
Design	1	2	3
Energy and Engineering	21	19	40
Finance	2	0	3
Green Jobs / Employment	3	3	6
IT	1	4	5
Management and Leadership	2	9	11
Resource Efficiency and Waste	2	4	6
Skills	3	14	17
Sustainability / Sustainable Development	2	9	11
Sustainable Procurement	3	1	4
Other	4	3	7
TOTAL	**63**	**76**	**140**

Each of the subject categories is summarised below.

Specialist Research Area	Agriculture and Land Management		
Total Evidence Items Reviewed	7		
Total Number of Useful / Relevant Evidence Items	6		
Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
119	Climate Change and the European Countryside: Impacts on Land Management and Response Strategies (Scientific Report of the CLIO Project 2006)	Various	2006
120	Climate Change and the Rural Economy	Country Land and Business Association	2001
123	Skills Audit of Horticultural R&D	National Horticultural Forum	2004

124	Review of Bioenergy Research	BBSRC	2006
125	Review of BBSRC Funded Research Relevant to Crop Science	BBSRC	2004
134	Climate Change and the European Countryside: Impacts on Land Management and Response Strategies (Summary Report of the CLIO Project 2006)	Various	2006
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
122	Strategy for Non Food Crops and Uses Action Plan	Defra	2006
Overview of Evidence			

The research in this field tends to be sector specific, e.g. biofuels, horticulture etc. Some aspects of the research are strong whilst others are weaker, leading to particular knowledge gaps. There is acknowledgement that the situation in the EU and US is similar and a good first step should be to correlate worldwide research to avoid repetition.

The reports emphasise the need for many agricultural sectors to evolve faster than at present to cope with climate change. This is particularly important as agriculture is able to help other emissions creating sectors through carbon management, carbon sinks, energy substitution and providing alternatives to fossil fuels. Agricultural sectors should be encouraged to do this and guided on the correct path by greater cross-agricultural sector collaboration and greater governmental policy and regulation.

Much of the research undertaken is qualitative and there is a demonstrable need for more tools such as CALM (Carbon Accounting for Land Managers).

Within the documents, skills are not directly referred to a great deal. The research identifies policy and collaboration as the way forward. In addition where it is the focus of the document, such as in document 123, it is mentioned that there is no international or even national database of available training, which will be required if a collaborative approach is to be undertaken.

Where skills are mentioned this tends to be at sector specific levels. In terms of LCREE, it is clear that there is a proliferation of recent research but much of it seems to be covering the same ground. It suggests (although does not quantify), the need for a movement toward LCREE coupled with policy change and increasing co-operation. However, there does not appear to be any clear leadership or cohesive approach.

The work suggests that until there is a clear pathway and government policy as well as a national database of required skills, available training and a route map to closing the identified skills gaps, LCREE will continue to be a priority, without actually being tackled effectively.

Specialist Research Area	Built Environment, Planning and Construction
Total Evidence Items Reviewed	20
Total Number of Useful / Relevant Evidence Items	13
Relevant Evidence Items	

Ref Number	Title	Organisation	Year
9	A Green Profession? RICS Members and the Sustainability Agenda	Royal Institution of Chartered Surveyors	2007
48	Sustainability in the Built Environment Skills Matrix (Leaflet)	Joint Work by 3 SSC's	2008
88	Draft Brownfield Skills Strategy	English Partnerships	2008
89	Brownfield Skills Evidence Base	English Partnerships	2008
118	Build to Last – Reviewing Sustainable Construction	National Skills Academy for Construction	
128	Low Carbon Skills in Construction	Sus Con	
131	Skills Gap Analysis	National Skills Academy for Construction – CITB Construction Skills	2005
132	Employer Attitudes and Motivations to Learning and Training – Wave 3 Presentation	National Skills Academy for Construction – CITB Construction Skills	2006
133	Employer Attitudes and Motivations to Learning and Training – Wave 6 Presentation	National Skills Academy for Construction – CITB Construction Skills	2008
141	Great Skills Debate – Regeneration England	University of Manchester	2005
143	Joining Up Participation in Environmental Planning	Environment Agency North West and Manchester City Council	2006
145	Sustainability Skills Matrix for the Built Environment Functions	Joint Work by 3 SSC's	2008
156	Skills for the Built Environment	Institution of Civil Engineers	2001
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
21	East Midlands Construction Resource Efficiency Club – 24 Month Report	East Midlands Centre for Constructing the Built Environment	
50	Carbonlite Programme Leaflet	Association for Environment Conscious Building	2007
53	Anglia Ruskin Department of the Built Environment Website	Anglia Ruskin University	
67	Low Carb Lane	Designs of the Time 2007	2007
87	Brownfield Scoping	English Partnerships	2007
90	Regeneration Research Study	English Partnerships	2004?
142	Creativity, Networks and Openness	University of Manchester	2007
Overview of Evidence			
The research being carried out in the Built Environment, Construction and Planning sector is aimed directly at reviewing the opinions of companies and current employees in the field (which includes other relevant professionals such as architects) as well as incorporating some supporting organisational research (eg English Partnerships, Institution of Civil Engineers) . The research being carried out by a number of organisations seeks to identify the current and future skills requirements as well as skills gaps in the sector. Formulation of route maps and methodologies for closing skills gaps in the sector is rarely attempted within the research, although individual tools and highly specific training courses are offered.		

All the documents reviewed continually refer to skills on a high, vague level without going into the detail of specifying specific skills. The majority of the documents subscribe to the point of view that up-skilling is a necessity to maintain/increase workflow for companies, rather than as a strategic methodology for attempting to achieve a low carbon and resource efficient future.

Document 141 goes as far as to point out that there is a difference between education, skills and capabilities but does not develop this idea further. The one document which does attempt to look at a more strategic methodology is document 128, which talks about the development of a training centre which has been designed specifically with a low carbon future in mind. The 2008 skills matrix is realistically an initial step which could form a baseline for a more detailed skills matrix to be developed (which could then be used to assess skills gaps).

From a business point of view the main drivers for up-skilling in order to achieve a more sustainable future are increasing customers, potential employee and stakeholder demands and legislation. Up-skilling therefore tends to take place in reaction to external pressures, as opposed to an internal desire to up-skill (for example; for strategic or altruistic reasons). The research is largely repetitive and is derived from interviews of employers, rather than from the point of view of employees, customers or government. Membership organisations within the sector appear to be quite active, but their focus is to protect / further the interests of their member companies rather than any strategic plan for developing for LCREE.

Document 88 refers to a project that looks at the delivery of skills although no specific LCREE skills are mentioned.

There does seem to be some progress over time in terms of a better understanding of integration between the social, environmental and economic aspects of sustainable development, and the need to integrate across sectors. Things are moving forward in terms of LCREE with respect to identifying skills gaps and providing training to meet current needs, but there appears to be no structured strategic approach toward specific LCREE skills and future strategy.

The level of understanding of LCREE appears to be low within member companies, most of whom only consider how LCREE will affect the demands of their customers. The majority are aware of sustainability issues, although there are a significant number who aren't. The SusCon document is the only one which appears to be taking a more strategic approach.

As far as these documents go in terms of LCREE skills, there is clear identification that these skills need to be mainstreamed and integrated and some, limited, ideas for achieving this are specified.

Specialist Research Area	Design		
Total Evidence Items Reviewed	3		
Total Number of Useful / Relevant Evidence Items	1		
Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
78	Clean Design Study	*Emda*	2008

Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
30	Design for Life CPD for Design Professionals Multimedia Workshop Series	East Midlands Centre for Constructing the Built Environment	2007
121	The Carbon Emissions Generated In All That We Consume	The Carbon Trust	2006
Overview of Evidence			
From the evidence reviewed as part of this work, the activities covering "design" are limited in the producer sector and in their infancy. The sector suggests that there is much to be gained and a willingness to learn on the part of producers. The main design skills identified centre around product life cycle, design for disassembly / recyclability and the waste hierarchy. Within the constraints of the project the evidence is limited and would require further investigation of design skills for LCREE within each sector.			

Specialist Research Area	Energy and Engineering
Total Evidence Items Reviewed	40
Total Number of Useful / Relevant Evidence Items	21

Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
5	Skills for a Low Carbon London	London Energy Partnership	2008
13	Energy Skills Discussion Paper	Pro Enviro for *emda*	2007
18	Investigation into High-Level Skills Shortages in the Energy Sector	Energy Research Partnership	
19	Key Issues and Technologies for UK Energy Innovation	Energy Research Partnership	
20	Energy Efficiency Training and Awareness – Post Completion Project Report Form	East Midlands Centre for Constructing the Built Environment	2008
23	Renewable Electricity Generation Technologies	Institute of Physics	2008
33	Employment and Skills Study 2003	Electricity Training Association	2003
35	LEP Skills research summary report	London Energy Partnership	2006
36	Renewable Supply Chain Gap Analysis	DTI	2004
40	Occupational and Functional Map – Renewable Energy Sector	Energy and Utility Skills SSC	2007
41	Microgeneration Report	Summit Skills SSC	2007
65	Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London – Phase 1	London Energy Partnership	2006
66	Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London –	London Energy Partnership	2006

	Phase 2		
73	Assessment of Microgeneration for Renewable Skills Requirements	Summit and Energy & Utility Skills for the Welsh Assembly Government	2007
75	Renewables Labour Market Information Report	Cross Sector Renewables Working Group	2007
106	Powering a Sustainable Future – Policies and Measures to Make it Happen	World Business Council for Sustainable Development	Post 2006
144	Moving Closer – Identifying Skills Gaps and Developing Solutions: UK Wide	Summit Skills SSC	
157	The State of the Nation	Institution of Civil Engineers	2008
163	Renewables Briefing Paper	Royal Institute of Chartered Surveyors	2006
167	Occupational and Functional Map of the UK Renewable Energy Sector	Energy and Utility Skills SSC	2005
174	Market Requirement Proposal Document – Energy	North East Energy Resource Efficiency Programme	2007
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
24	Renewable Electricity Generation Technologies Evidence 1	Institute of Physics for Innovation, Universities, Science and Skills Select Committee	2008
25	Renewable Electricity Generation Technologies Evidence 2	E.On UK for Innovation, Universities, Science and Skills Select Committee	2008
26	Skill Needs in the Energy Industry	Energy Institute	2008
31	The Henley Report – Educating Engineers for the 21st Century	Royal Academy of Engineering	2006
32	Engineering UK Report (2005)	The Engineering and Technology Board	2005
54	Occupational and Functional Mapping of the Renewable Energy Sector	Energy and Utility Skills	2007
60	Effect of Energy Markets Regulation Onto EU's Technology Portfolio	IPTS, European Commission	2000
74	Feasibility Study for the Establishment of a Centre of Excellence for Installers	North West Development Agency	2006
79	Exploring the Skills Requirements of the UK Renewable Power Industry	Energy and Utility Skills SSC	2003
80	East of England Skills for Energy	DTI, LSC Norfolk, Cogent, ECTIB, E&US, SEMTA	2004
109	Walking the Talk on Energy and Climate	World Business Council for Sustainable Development	Post 2006
129	Energy Efficiency	Institute of Physics	2004
130	Response to Energy Review Consultation	British Nuclear Energy Society	2006
136	Nuclear Operational Plan	National Skills Academy for Nuclear	2008
149	Evidence to the House of Commons Science and Technology Committee Enquiry	University of Sussex Energy Group	2005

	– Carbon Capture and Storage Technology		
150	HM Treasury Consultation – Carbon Capture and Storage. A Consultation on Barriers to Commercial Deployment	University of Sussex Energy Group	2006
151	Affecting Consumer Behaviour on Energy Demand	University of Sussex Energy Group for EDF Energy	2007
154	The Future of Engineering Research	Royal Academy of Engineering	2003
155	Planning for a Sustainable Future – White Paper	Institution of Civil Engineers	2007

Overview of Evidence

It is clear from the majority of documents reviewed in the Energy and Engineering Sector that there are concerns over core skill loss and this is a priority for the sector in order for it to be able to support future renewable technology development. Most of the documents refer to these core skills as STEM skills; Scientific, Technology, Engineering, and Maths. The loss of skills has been attributed to, retirement, and natural wastage. However, it is now becoming difficult to replace these losses due to the lack of graduates from university courses going into engineering.

While there is an opportunity in renewable technologies to bridge some of the high level skills through research activities, there are also worries that when the research funding ends the knowledge and individuals are subsequently lost. The renewable energy industry has identified a number of skill areas that are seen as transferable skills such as, marine engineering, gas / oil industry skills etc.

At the trades level, the fitting of alternative / renewable technologies into buildings is seen as mainly additional technology knowledge for plumbers, electricians etc.

Where "environmental skills" are mentioned together with engineering, as with the Institute of Civil Engineers "The state of the nation" report, they are seen as a specialist area or consultancy, not as potential additional skills that need mainstreaming into existing roles.

There is also recognition of the need to build new low carbon energy efficient infrastructure. The Royal Institution of Chartered Surveyors has reacted to client demand by attempting to raise the general awareness of renewable technologies amongst its members.

Poor government procurement policies resulting in low industry confidence are blamed for a lack of investment in the necessary skills. While there is a general understanding of the need for more renewable, energy efficient technologies and resources, there is little to connect this understanding to the broader LCREE skill set. The work that has been conducted on skills requirements for the sector remains focused on traditional engineering / management skills, with a few exceptions, there is little detail on specific existing or new LCREE skills that are required.

Specialist Research Area	Finance
Total Evidence Items Reviewed	2
Total Number of Useful / Relevant Evidence Items	2

Relevant Evidence Items

Ref	Title	Organisation	Year

Number			
114	Sustainability – The Role of Accountants	Institute of Chartered Accountants of England and Wales	2004
117	Environmental Management Accounting	International Federation of Accountants	2005

Overview of Evidence

It is clear that there is now a growing focus on developing the UK's economic policies to support Low Carbon Resource Efficient Economies. There is a wish to develop clearer synergies between industry, government and other public bodies, as a way to achieve the efficiencies needed in a new low carbon market place.

The potential apparently exists for the UK to become a leader with new products and services, but this can only be achieved through working together with aligned policies.

While there are clear references to skills such as eco-design to develop new products, there is a failure to recognise LCREE skills amongst the more common skills. It is also not generally recognised that future roles may change with significant integration of what are currently seen as specialist LCREE skills.

It has been suggested by other sectors, including academia, that a more specialist body is required to provide the policy direction and to define accurately what the LCREE skills should be. There is also a recognition of "cart before horse" as the markets and technologies are still immature. However does the UK have time to wait and let the new low carbon markets evolve, with its associated skill sets?

The accountancy sector have a very internal view, although at an institutional level appears to have a general understanding of LCREE, and want to be part of the changing environment. There is a suggestion that the existing skill sets of the accountancy world should be used more to bring clarity to sustainability. There is little in the evidence reviewed that would suggest they are looking at the skills of accountants and how they need to be developed, it is still at an awareness raising stage.

There are exceptions though, and what appears to be a growing knowledge base looking at Environmental Management Accounting (EMA), assurance and performance measurement within the scope of Environmental Management Systems (EMS). The development of international (LCREE) as well as EMA accounting practices needs to be pursued.

Specialist Research Area	Green Jobs / Employment
Total Evidence Items Reviewed	6
Total Number of Useful / Relevant Evidence Items	3

Relevant Evidence Items

Ref Number	Title	Organisation	Year
10	Background Paper on Green Jobs	United Nations Environmental Programme	2008
11	Green Jobs: Towards Sustainable Work in a Low Carbon World (Preliminary Paper)	Green Jobs Initiative	2007

59	European Commission DG Environment	European Commission	2006
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
12	Professions in Partnership for Sustainability – Evaluation Report	Forum for the Future	2007
58	Climate Change and Employment	European Commission	
61	Environment and Employment	European Commission	1997
Overview of Evidence			
Much of the research in this area is covering similar ground, although from differing perspectives. All of the documents reviewed agree that there is, and will continue to be, a greening of employment (and consequently skills), but there is a distinct lack of specific skills listed. Where skills are referred to, they tend to be at a higher level e.g. project management, financial. It is clear that there is little empirical evidence to back up the need for more green jobs in the future and that evidence is particularly sparse for developing world countries. A differentiation is commonly made between 'green jobs' and the 'greening' of jobs. Some documents refer to green jobs replacing/superseding existing jobs, implying that individual jobs can be defined clearly as either green or not-green. However, most of the documents understand that as environmental issues become more and more important, they will continue to affect aspects of most jobs. There is an acknowledgement that the driver for green jobs is not necessarily understood / appreciated by the industries themselves. The industries are reactionary and this leads to the need for a strategic approach from government and professional bodies, to stimulate demand to ensure the economy (be it local or global) is prepared for the future challenges it will face. It seems that there is a clear groundswell of support for the greening of employment, and an acknowledgement that what is required is a cross-sectoral cross-country approach, and many of the research bodies involved express an interest to be at the forefront of this, but to date little action seems to have been taken.			

Specialist Research Area	Information Technology		
Total Evidence Items Reviewed	5		
Total Number of Useful / Relevant Evidence Items	1		
Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
38	Technology Counts IT and Telecoms Insights	E-Skills UK SSC	2008
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
37	High Tech: Low Carbon The Role of Technology in Tackling Climate Change	Intellect	2008
39	IAP ICT ENV Draft Aggregated	Information Age Partnership	
43	Maastricht Economic and Social Research	United Nations University	

	and Training Centre on Innovation and Technology Website		
127	Microsoft Response to Developing the Future 2007	Microsoft	2007

Overview of Evidence

Of the documents reviewed, there is a mix of university and sector research undertaken over the past couple of years, however, none of it has any relevance to the parameters of the project, with very little reference to skills in general. There are some references to environmental and social factors, eg eco-design but the majority refers to actual products currently in use or under development to meet future requirements.

Overall the documents state that there is a general shortage of skilled IT & Telecoms personnel, with fewer going through the academic route of A levels or degree.

Specialist Research Area	Management and Leadership
Total Evidence Items Reviewed	11
Total Number of Useful / Relevant Evidence Items	2

Relevant Evidence Items

Ref Number	Title	Organisation	Year
104	Business Leadership Towards a Low Carbon Economy	Chartered Institution of Marketing	2007
111	Chronos – From Personal Values to Corporate Actions	World Business Council for Sustainable Development	

Non - Relevant Evidence Items

Ref Number	Title	Organisation	Year
15	A Competitive Response to Climate Change	Institute of Directors	2007
28	Realising Value from Online Learning in Management Development	Chartered Management Institute	2007
29	Management Futures Report	Chartered Management Institute	2008
49	Skills Shortages and Recruitment Agency Behaviours	Association for Consultancy and Engineering	2007
56	Shape the Agenda	Chartered Institute of Marketing	2007
57	The Business of Climate Change – Creating a Low Carbon Britain	The Institute of Chartered Accountants	2008
108	Promoting Small and Medium Enterprises for Sustainable Development	World Business Council for Sustainable Development	
112	Corporate Responsibility and the Modern Business Leader	Institute of Chartered Accountants of England and Wales	2007
115	An Overview of Corporate Social Responsibility	Institute of Chartered Accountants of England and	

		Wales	

Overview of Evidence

Although a reasonable amount of evidence related to this topic was found and reviewed during the course of this research, much of it was not found to be directly relevant or useful in identifying skills requirements for Low Carbon and Resource Efficient Economies (LCREE). The evidence reviewed included software marketing leaflets, research reports and reports of executive level consultation. Sources of evidence were mainly professional bodies as well as the World Business Council for Sustainable Development.

The evidence and scope of research shows that the importance of sustainability and low carbon economy as a management and leadership issue has begun to register with professional bodies (and presumably with companies too) – hence the existence of this research.

It should be noted that although none of the work looked specifically at the issue of LCREE skills, they all overlapped with or looked at areas that included LCREE skills. One concern is that although it is clear these issues are being taken seriously and the professional associations appear to be moving forwards with this agenda, to date the research itself is at a high level and fails to highlight specific skills of importance. None of the evidence reviewed discussed skills directly, but cross-sector skill requirements in the following areas could be strongly inferred from two of the sources:

- Strategic transformational initiatives – major projects and investments that develop innovative ways to significantly reduce greenhouse gas emissions. For example; new business models, fuel switching, demand side management, low carbon technologies.
- Energy efficiency audits, metering and monitoring of energy usage, behaviour change and staff motivation, process and maintenance of existing equipment, purchase of new equipment.
- Carbon trading capability, carbon trading sensitivity in investment decisions.
- Managing and reporting on fuel consumption.
- Green marketing.
- Network and vehicle management for distribution.
- Social and environmental challenges and what they mean for business.
- Extending sustainable development awareness down the supply chain and forwards in the lifecycle of products.
- Underlying challenges involved in sustainable development – dealing with complex, unpredictable, distant and long-term impacts, and short-term self-interest.
- Developing and communicating a business case for sustainable development.
- Mobilising resources and influence to address sustainable development issues and corporate priorities.

Specialist Research Area	Resource Efficiency and Waste
Total Evidence Items Reviewed	6
Total Number of Useful / Relevant Evidence Items	2

Relevant Evidence Items

Ref Number	Title	Organisation	Year
55	The Feasibility of a Resource Recovery Park in Northamptonshire	Northamptonshire Enterprise Ltd	2007

77	Managed Trading Estates – Pilot Study	Envirowise	2007
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
17	Resource Management in the Education Sector	Waste Watch	2004
27	Resource Efficiency KTN Annual Report 2005-2006	The Resource Efficiency Knowledge Transfer Network	2006
68	Market Assessment of Waste Resources	Advantage West Midlands	2008
72	Waste Management and Recycling – Learning and Skills	Learning Skills Development Agency	
Overview of Evidence			
Within Northamptonshire there has been some good work on identifying the skills required specifically around local industry / industrial estates and how the message with respect to the management of waste and resources can be carried to the wider community. If the resource recovery park and visitor centre which is the subject of the research gones ahead, it could be a model for other counties, but it would need constant monitoring to ensure it reaches its full potential in delivering awareness and grater resource efficiency skills. There is a clear understanding that the waste industry is changing, moving away from landfill to more recovery and new waste management methods (influenced by changes in technology and legislation). There is also a recognition that general waste skills and the new skills as they develop must be integrated at all levels. To enable the up-skilling across the industry there is a need to review the methods and bodies delivering the training with the intention of standardising the quality of knowledge delivered across sectors.			

Specialist Research Area	Skills		
Total Evidence Items Reviewed	17		
Total Number of Useful / Relevant Evidence Items	3		
Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
146	CBI Education and Skills Survey 2008	Confederation of British Industry	2008
159	Skills for Sustainable Development (Draft)	Sustainable Development Commission	2008
165	Skills for the West Midlands Environmental Technologies Cluster	ECOTEC for LSC Black Country	2004
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
7	Learning and Skills for Sustainable Development (Workshop)	University of Hertfordshire Environment Team	2005
8	Skills for Sustainability (Workshop)	Professional Practice for Sustainable Development and	2006

		The Science Council	
64	IEMA 2007 Membership Survey	Institute of Environmental Management and Assessment	2007
82	Sector Skills Mapping in the Environmental Technology Sector	Energy and Utility Skills SSC	
94	Employee Skills Survey	Government Skills SSC	2007
96	Building Professional Skills for Government – A Strategy for Development	Government Skills SSC	2008
97	Employers Survey	Government Skills SSC	2007
98	Understanding and Mapping Training Provision in the World of Government	Government Skills SSC	2007
101	Nuclear Skills Passport	Nuclear Skills Academy	
103	Looking Back Moving Forward 2006	Chartered Institute of Marketing	2007
105	Investing in a Low-Carbon Energy Future in the Developing World	World Business Council for Sustainable Development	
161	Skills for Sustainability Report	The Science Council	2006
169	New Solutions to Address the Sustainability Challenge	Chemistry Innovation	2004
170	Roadmap Charts Route to Sustainable Technologies	Chemistry Innovation	2008
Overview of Evidence			
Of the documents reviewed, there is a mix of sector and industry research undertaken over the past four years; however, there is limited relevance to the parameters of the project. Overall the documents state that there is a general shortage of skilled personnel at all levels of employment, with a note that specialist and technical skills are needed.			

Specialist Research Area	Sustainability / Sustainable Development		
Total Evidence Items Reviewed	11		
Total Number of Useful / Relevant Evidence Items	2		
Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
4	Mind the Skills Gap – The Skills We Need for Sustainable Communities	Academy for Sustainable Communities	2007
175	Driving Success	Business and the Environment Programme	
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
34	BRASS Project Description + Working Paper 45 Supporting Skills and Knowledge to Deliver Sustainable Communities	BRASS	2008
47	Finding the right policy mix for sustainable	Imperial College, London -	2002-

	innovation	Department of Environmental Science & Technology	2004
52	Brunel Research in Enterprise, Innovation, Sustainability and Ethics (BRESE) website	Brunel University	
71	Sustainable Communities 08	Govnet Communications	2008
110	Then and Now Celebrating the 20th anniversary of the Brundtland Report	World Business Council for Sustainable Development	
116	The Future of Services to the Public	Institute of Chartered Accountants of England and Wales	
158	Learning the sustainability lesson	Royal Academy of Engineering	2003
160	Teaching Sustainable Development at Oxford	Royal Academy of Engineering	
162	Sustainable Development in Higher Education	Higher Education Academy	2005

Overview of Evidence

Of the documents reviewed, there was a mixture of university and sector research undertaken recently. Some of the non-relevant evidence collected was research or strategy documents that deal more with the methodology of delivering training rather than the specific skills needed for a future LCREE.

Generally where there were references to skills needed, these tended to be generic vague skills rather than specific technical skills. Overall, there appear to be drivers for skills training coming from the next generation as well as academic professionals, although the evidence did not show this consistently. Although LCREE awareness may be low, general sustainable development issues are becoming more mainstream.

Specialist Research Area	Sustainable Procurement
Total Evidence Items Reviewed	4
Total Number of Useful / Relevant Evidence Items	3

Relevant Evidence Items

Ref Number	Title	Organisation	Year
138	Mapping of the Current Sustainable Procurement Activity and Support in the Yorkshire and Humber	For Sustainable Procurement Network by Action Sustainability	Recent
139	Sustainable Procurement Training Needs Analysis (Draft)	For London Boroughs by Action Sustainability and London Remade	Recent
140	Joining the Gaps – Sustainable Procurement – Final Report Summary	For London Centre of Excellence by Action Sustainability	2007

Non - Relevant Evidence Items

Ref Number	Title	Organisation	Year

137	Joining the Gaps in Sustainable Procurement – Literature Review	For Greater London Authority by Action Sustainability	Recent

Overview of Evidence

In terms of research into procurement skills for Low Carbon and Resource Efficient Economies the work done unearthed a limited number of documents (4), all with a focus on sustainable procurement rather than LCREE procurement skills. However, these documents considered many of the features of LCREE procurement and so were considered suitable for review. The documents are all likely to have been produced relatively recently (exact ages not known in all but one case).

Of the relevant documents, 2 were by Action Sustainability with another one by the London Centre of Excellence. All are London Local Authority based but many of the skills findings are considered to be applicable to other Local Authorities and other public and private sectors.

The Training Needs Analysis (document number 139) focused the most attention on skills directly, whilst the other two documents allowed inference of skills to varying degrees. The references to skills in these documents are at a fairly detailed level.

It appears from the research that there is a good level of expertise around what the skills requirements are and that there is at minimum a reasonable level of understanding and awareness of these issues within the Local Authorities. What is not clear is how widespread this knowledge is throughout the country and different sectors.

The main skills and provision priorities highlighted by the research are:

- Integration and mainstreaming of skills and awareness at all levels (provision of training and skills in communication and change management).
- Increasing provision.
- Development of more advanced training.
- Results monitoring and measurement.
- Contract specification.
- Contract and performance management.
- Risk assessment.
- Supplier evaluation.

The literature reviews revealed that the desire to become a leader in sustainable procurement is a driver for acquiring the relevant skills and changing practices. In addition a major obstacle to obtaining skills (within the Local Authorities) is lack of time during which to undertake training.

In addition to the subject areas listed above evidence on 'other' subjects was reviewed. The outcomes of this are summarised below.

Specialist Research Area	Other Research
Total Evidence Items Reviewed	7
Total Number of Useful / Relevant Evidence Items	4

Relevant Evidence Items

Ref Number	Title	Organisation	Year
3	Delivering the Low Carbon Economy –	EEF	2008

	Business Opportunities for UK Manufacturers		
14	Towards Sustainable Energy Use for Transport	UK Energy Research Council	2007
152	Bioscience Skills Gap	SEMTA	2007
171	Resource Efficient Design – Sector Needs Analysis	East Midlands Development Agency	2008
Non - Relevant Evidence Items			
Ref Number	**Title**	**Organisation**	**Year**
16	Social and Environmental Responsibility and the Small Business Owner	Federation of Small Businesses	2007
22	Adapting the UK to Climate Change	Institute of Physics	2008
91	The 80% Challenge	WWF and RSPB	2008

Overall, of the 140 documents reviewed, 63 were found to contain useful information with regards to LCREE skills requirements. The number of potentially relevant documents attests to the levels of interest in this area. However, it is clear from the review that:

- Where skills are mentioned, this is generally in a high level manner which does not often break new ground or further knowledge of skills requirements on this subject.
- There is a reasonable amount of work being done in this area but a lot of similarity and duplication, much of the work covers similar ground.
- There is a widespread recognised need for action in this area and development of skills, but a clear lack of direction as to what the next steps should be. Consistent policy and guidance are highlighted as being important.
- More sources of evidence were found which related to the Low Carbon and Energy aspects of LCREE than those directly related to Resource Efficiency. It is considered that this may be due to a combination of current government priorities with regards to carbon, media publicity raising awareness and energy being a tangible area for cost savings by industry.

A full list of the relevant evidence documents reviewed and the publishing organisations is available in Appendix 7 and summaries of relevant individual documents are available in Appendix 8.

Academic Literature

Purpose and Methodology

Searches were carried out using the following academic indexes:

- ISI Web of Knowledge (This comprises a number of databases, see below).
- Cambridge Scientific Abstracts Illumina.

Searches were also carried out using the online Google Scholar search facility.

The searches were carried out using various combinations of the following key words:

- Low Carbon
- Low Carbon Skills
- Low AND Carbon AND Skills
- Resource Efficiency
- Resource Efficiency Skills
- Resource AND Efficiency AND Skills

ISI Web of Knowledge Sources:

Web of Science

Web of Science consists of five databases containing information gathered from thousands of scholarly journals in the following areas of research.

- Science Citation Index Expanded
- Social Sciences Citation Index
- Arts & Humanities Citation Index
- Index Chemicus
- Current Chemical Reactions

Science Citation Index Expanded

Science Citation Index Expanded provides access to bibliographic information, author abstracts, and cited references from over 6,650 of the world's leading scholarly science and technology journals covering more than 150 disciplines.

Social Sciences Citation Index

Social Sciences Citation Index provides access to bibliographic information, author abstracts, and cited references from over 1,950 of the world's leading scholarly social sciences journals covering more than 50 disciplines. It also includes individually selected, relevant items from approximately 3,300 of the world's leading science and technology journals.

Arts & Humanities Citation Index

Arts & Humanities Citation Index provides access to bibliographic information, author abstracts, and cited references from over 1,150 of the world's leading arts and humanities journals. It also covers individually selected, relevant items from approximately 7,000 journals in the sciences and social sciences.

Current Chemical Reactions

Current Chemical Reactions contains single- and multi-step new synthetic methods taken from leading journals and patents from 39 issuing authorities. The overall reaction flow is provided for each method, along with a detailed and accurate graphical representation of each reaction step. Current Chemical Reactions (1985 - present) contains more than 880,000 reactions. It is updated with 3,000 reactions each month.

Summary of Findings

ISI Web of Knowledge

The carbon searches produced 22 results, none of which had any relevance to the project scope.

The resource searches produced 121 results of which 5 had limited or partial relevance to the LCREE project.

Below are listed summary details of the relevant search results. Full abstract details are available in Appendix 9.

	Paper Title	**Source**
1.	Initiating a Waste Management and Resource Recovery Network: A College, NGO and Corporate Partnership	Conference on Environmentally Conscious Manufacturing
2.	The effects of flexibility in employee skills, employee behaviours, and human resource practices on firm performance	Journal of Management
3.	Sustainability Science and Engineering: The Emergence of a New Metadiscipline	Environmental Science and Technology
4.	Energy efficiency and renewable energy in Russia – Transaction barriers, market intermediation, and capacity	Energy Policy

	building	
5.	Designing The Future - Sustainable Agriculture In The United-States	Agriculture, Ecosystems and Environment

Cambridge Scientific Abstracts Illumina Database
'Carbon' searches of the CSA (Cambridge Scientific Abstracts) Illumina database found 55 results, many of which are duplicates of the web of knowledge search above.

A search of the CSA Illumina database produce 253 hits for "resource AND efficiency AND skills" but no hits for "resource efficiency skills".

One abstract (listed below) was identified with a limited fit with the LCREE – the focus of the abstract is on teaching sustainability to students. Full abstract details are available in Appendix 9.

	Paper Title	**Source**
1.	Teaching Students Sustainability: An Interdisciplinary Design Project for Sophomore Engineering Students	2002 ASEE Annual Conference & Exposition: Vive L'ingenieur!; Montreal; Canada; 16-19 June 2002

A search of the CSA Illumina database produce 253 hits for "resource AND efficiency AND skills" but no hits for "resource efficiency skills".

Google Scholar Search::
The internet search produced one potentially relevant reference:

	Paper Title	**Source**
1.	Skills for a Low Carbon Future and the Need to Train 10,000 New Energy Surveyors	Energy World

Overall Summary
There is a very little evidence of academic research into the demand / need for skills and types of skills related to a Low Carbon Resource Efficient Economy. This is not a real surprise as skills and training are not often considered to be the domain of the Higher Education sector who focus on "high level" skills and the transfer of knowledge as opposed to training.

Carrying out a series of individual skills keyword searches (for example; energy minimisation) was beyond the scope and capability of this research. However, due to the specialised nature of university research it is possible that these searches may yield further results.

Stakeholder Consultation

Purpose and Methodology
Consultation of a range of relevant stakeholders was considered to be an integral part of the research for a number of reasons:

- As the understanding and level of engagement with Low Carbon and Resource Efficiency issues is changing rapidly, it was considered that in some cases written evidence may not reflect the latest developments. The most appropriate way to find out about these developments was through consultation with the relevant organisations.

- To produce well informed and unbiased research it is necessary to evaluate the robustness of the evidence gathered and reviewed in order to draw appropriate findings. Discussion with a selection of stakeholder organisations providing evidence was a necessary part of the evaluation process and allowed us to consider the information gathered in the correct context.
- To raise awareness of LCREE skills issues and open an ongoing dialogue with stakeholders on behalf of Defra.

Consultees were grouped on the basis of organisation types and the type of information sought from them. A consultation questionnaire was developed for each consultee group. This was used to structure telephone discussions with consultees. It ensured consistency of discussions and that relevant information was gathered from each consultee organisation.

Summary of Findings

35 organisations agreed to be interviewed (including 12 priority SSC's). A full list of the organisations interviewed as part of this work is available in Appendix 3. Please note that some additional organisations who were not actually interviewed provided us with feedback on the draft definition and draft skills checklist.

Priority Organisations

Sector Skills Council's

The remit of the 12 SSC's listed below was identified as being significant in terms of achieving low carbon and resource efficient economies:

- Asset Skills – property, housing, cleaning services and facilities management.
- Cogent - chemicals, pharmaceuticals, nuclear, oil and gas, petroleum and polymers.
- Construction Skills.
- Energy and Utility Skills – electricity, gas, waste management and water industries.
- E-Skills – information technology and telecommunications.
- Improve Ltd – food and drink manufacturing and processing.
- Lantra - environmental and land based industries.
- Proskills UK - process and manufacturing in building products, coatings, glass, printing, extractive and mineral processing industries.
- SEMTA - science, engineering and manufacturing technologies.
- Skillfast UK – Fashion and textiles.
- Skills for Logistics – freight logistics and wholesaling industry.
- Summit Skills – building services engineering sector.

Suitable personnel at each priority SSC were interviewed (in most cases policy managers/directors). The main points coming out of the interviews are summarised below.

- **SSC Understanding of LCREE –**

Understanding of the scope of LCREE varied. Some consultees commented that LCREE had not been considered by their organisation - in some of these cases sustainable development was the topic they were more familiar with (and the one which their work was geared towards). Consequently a number of respondents did not have a clear understanding of the whole scope of the subject and related LCREE to one or two specific activities. On the other hand, a select few were able to demonstrate that their understanding encompassed at least the majority of the definitions' scope.

- **LCREE Relevant Research Undertaken by SSC's –**

None of the SSC's had undertaken research which specifically related to LCREE and skills requirements. SSC's undertook research for their SSA's (as well as other pieces of research) which involved looking at skills requirements for their sectors (including demand and training requirements), however LCREE skills and demands were not examined as an individual issue and the coverage of skills requirements tends to be at a high level (see SSA review above).

Several SSC's pointed us to research in related areas/topics (such as Sustainable Development or core skills requirements for the sector) some of which covered aspects of LCREE. However most research did not specifically address skills requirements beyond the high level. Relevant research generally considers the issues of management, business improvement techniques, productivity and competitiveness as sector priorities (these are generic and potentially apply to all sectors) as well as environmental considerations. In exceptional cases research had specified LCREE relevant skills requirements. Some of the SSC's noted that research has identified aspects of LCREE as important areas, but had not taken this any further.

At the time of interview some research work was ongoing or planned for the future. These research projects are highlighted later in this section.

- **Actions Taken in Support of LCREE –**

SSC's differ in the volume and types of actions taken to support LCREE within their sectors. Most SSC's were able to give at least one example of actions they have taken which support the LCREE agenda (albeit often indirectly). A minority of SSC's were not able to provide any examples. Examples of actions that have been taken include:

- Presentations to sector companies in support of renewable technologies.
- Involvement with other SSC's and other organisations in development of regional skills delivery action plans.
- Collaboration with other organisations on research work.
- Promotion of use of sustainability matrix and National Occupational Standards (NOS).
- Compilation of environmental case studies.
- Work to develop Safe and Fuel Efficient Driving scheme in conjunction with Mayor of London's office.
- Provide LCREE support through tools on regulatory issues.
- Development of NOS to ingrain environmental and best practice, support new technologies or LCREE relevant occupations.
- Focus on management and leadership.
- Working on mechanisms for better transfer of knowledge between FE, HE and employers with regards to new technologies (not specifically ones related to LCREE).
- Sustainable development workshops held and a suite of courses in sustainable development developed aimed at supervisors and above (delivered through national construction college).
- Launch of sustainable development DVD on construction site issues.

It can be seen that examples range from research based to, in a minority of cases, very practical actions.

Availability of funding for actions was raised as an issue. One SSC stated that their role was to ensure that the training employers want is funded and they had taken no proactive action. This demand-led emphasis on the work and role of SSC's is likely to affect their potential impact in driving forward this issue. One SSC stated that LCREE had not filtered through to SSA's and action plans yet, this situation is fairly prevalent amongst SSC's (see SSA review for further information). Sections in SSA's cover productivity which often affects LCREE.

- **Levels of Sector Companies Understanding and Awareness –**

Many SSC's stated that larger companies within their sectors are more aware and more likely to have taken action. This is in a large part due to their ability to devote resource to this, including employing staff specifically to work on this. The consensus seems to be that smaller companies are generally too involved in day-to-day survival to concentrate on this. They do not currently need as it is not being demanded by their customers or required by legislation, so it is not a priority.

Some sectors consider that because of the type of sector they are (eg. environmental or energy related), their companies have high levels of awareness (although whether this awareness includes understanding of the full scope of LCREE is sometimes questionable).

In some sectors it is considered that awareness is currently low but growing quickly, especially where the economic benefits are being understood. One SSC stated that it was trying to raise awareness that a lot of the skills exist but need to be applied into different areas. Supply chain pressures are also noted to have influenced levels of awareness – most strongly in customer facing industries. One example was given of a large company who won work on the basis of their emissions reductions and carbon efficiencies.

- **Priority Generic (Cross-Sector) Skills –**

Skills suggestions ranged from very vague to being quite specific. Some suggestions were related to the sectors requirements in general, but not to LCREE specifically - these have not been listed in the examples below.

Examples of current skills requirements highlighted include:

- Management and leadership - including supervisory skills, project management, planning, managing change, line management skills to deploy information and raise awareness, business case skills for selling capital investments.
- Awareness of implications of LCREE.
- Communicating with client base, championing the cause.
- Energy management skills for monitoring and targeting.
- Business activity and environmental monitoring and impact reporting.

Examples of future skills requirements include:

- Carbon footprinting.
- Environmental skills.

- **Priority Sector Specific Skills -**

There were more suggestions related to sector specific skills requirements from the SSC's. Again these ranged from very vague to the quite specific. Some suggestions were related to the sectors requirements in general, but not to LCREE - these have not been listed in the examples below.

Examples of current skills requirements highlighted include:

- Design – understanding material, market dynamics, international working.
- Waste energy and water.
- Building energy assessment, energy use and planning the process, producing energy reports. Design skills and impacts of building modifications.
- Water and electrics cross over skills.
- Technical design skills.
- Waste water management.

- Fleet management and logistics.
- Pallet sharing networking and load sharing.
- Efficient route planning and operation of dark warehouses.
- Energy efficient driving.
- Environmental performance improvement.
- Technology intensive product and service innovation.
- Design of lower impact processes and activities.
- Designing out waste and waste management.

Examples of future skills requirements highlighted include:

- Renewable technologies including planning design and installation.
- Material cleaning and washing techniques.
- Resource management.
- Local sourcing of food/materials and economical transport.
- Skills for operating hi-tech equipment.
- Smart metering, electricity distribution and maintenance.
- Carbon capture.

- **Skills Demand Drivers –**

Demand drivers cited include:

- Economic situation – the down turn of the economy will affect the demand for skills in general.
- Changing specifications for low carbon will influence demand for skills and the demand for new buildings.
- Supply chain pressures.
- Hi-tech and environmental issues.
- Legislation (including environmental).
- Public and consumer demand for green products and services.
- High replacement demand as older staff leave a variety of industries.
- Changing technologies.
- Energy infrastructure upgrading programme.
- Carbon efficiency and planning (future driver).
- Competitiveness.

Legislation, competitiveness and supply chain pressures (where these exist) are generally the most significant factors in driving the demand for skills in general (including LCREE skills).

- **Obstacles to Furthering LCREE Agenda –**

Obstacles cited included:

- Many SSC's commented that they were interested in this topic and one said it didn't know how to further this agenda.
- It is difficult to reach the sole trader and SME market and industries where these are prevalent find it hard to raise awareness among this audience in general.
- Global competition and cost-competitive nature of business. Anything that adds cost will not be implemented.
- Investment sources are difficult to source for small companies and they cannot manage the payback period.
- SSC funding.
- Expertise lacking within SSC.

- LCREE skills are seen as a cost not a benefit.
- Need for senior management commitment.
- Additional changes that are based on regulations incur costs.
- Lack of understanding that a series of small improvements can have an impact and that things do not rely on a large technical solution.
- Costs of training and releasing people from work.
- Overall cost of investing in improved environmental processes.
- High cost of capital investment encourages companies to relocate to plants in countries with less environmental requirements.
- There is already a lot of legislation and getting companies to exceed its requirements is difficult.
- Not enough of a priority – there is a lot to contend with already.
- Recession means costs will be cut, so skills will be less of a priority.

- **Skills Delivery Infrastructure Comments –**

Comments on the suitability of skill delivery infrastructure ranged from those that thought it was broadly suitable to those that indicated there were problems. Significant issues highlighted included lack of focus on higher level skills, the problems of reaching and funding training for those already in employment and the need for flexibility in training provision to fit in with employers needs.

Comments included:

- Massive gap between potential demand and ability to supply training in technologies.
- One sector SSA shows huge gaps in technical skills that are not available within the UK, or within particular regions.
- National shortage of training provision in the energy sector.
- Government focus is on basic skills but it is higher level skills that will be needed.
- Some smaller companies want to get involved in this but don't know how to go about this and access skills and support.
- A lot of renewable installer training is dependant on manufacturers.
- Provision is currently determined by suppliers not the needs of employers, this is exacerbated by the current funding system – employer demand needs to influence provision more looking forward.
- Practical arrangements for provision of training are important, independent providers have been found to be more flexible than the FE sector.
- Plan to set up a sector specific national training system.
- New apprenticeships in facilities management required.
- Work based learning is preferred to academic training.
- Majority of training is informal in-house – delivered by supervisors to new staff.
- Management training tends to be external.
- Companies would prefer funding beyond level 2 and modularised / shorter training rather than full qualifications.
- Current funding model for higher education is not suited for workforce development.
- There is no solution as to how work based learning would be paid for.
- Getting to people in work is the difficult bit.
- FE places for energy training will be a too low in future.
- Already crowded in the skills delivery arena – too many issues to deal with at the moment.
- Access to public money for training (some support vastly increases take up of training).
- Business link has no penetration in our sector sector.

- **Comments on Sector Companies Integration of LCREE Skills –**

Comments on the level of integration of LCREE skills within sector companies included:

- NVQ's and NOS should generally be mainstreamed but tackled as an individual topic at level 4 and above.
- Low carbon economy not currently seen as a high priority. RE is a high priority amongst larger players.
- Difficult to say, but based on local knowledge there is some way to go there.
- Much of the renewables agenda is upskilling based on existing skills.
- Skills needed to be mainstreamed so they are taken into account day-to-day like health and safety.
- Not integral at the moment, but overlies many activities.
- Better integration required between FE, HE and knowledge and technology transfer.

- **Main Gaps in Evidence Base –**

Some SSC's found this difficult to answer as they did not have a complete knowledge of what research had been done. Examples of comments and suggestions for areas where research is required are listed below:

- No real research has been done on LCREE. Current research for general requirements is robust, good understanding of needs and supply.
- Identification of skills across the board and how these will be filled.
- One SSC stated that SSA research is almost 3 years old – none of the SSC's has had enough resources to dig deeper.
- Productivity – lean manufacturing.
- General uptake of LCREE skills and levels of interest.
- Quality of skills delivery.
- Research to forecast future increases in demand.
- SSC is not sufficiently aware of the skills needs or how to address them.
- Research into innovation and new product developments – to support reinforcement and commercialisation of this.
- Research has not been done for Logistics sector LCREE requirements.
- Future technologies – good for companies to know what is coming up in future.
- Need to understand better how the changes in technology and industry changes are going to impact skills needs in future.
- A research project which seeks to find out the opinions of industries - what motivates them as businesses and how they could be won over to the LCREE agenda.
- Business perceptions of environmental issues – how important is this to them? Quantitative research.

Suggestions centred mainly on finding out about new technologies, finding out business perceptions and forecasting future skills demands. Some SSC's stated that no real research had been done on LCREE.

- **Other Comments -**
  - There is a huge potential for employers to demand LCREE skills – benefits need to be promoted to them (one SSC is involved in working with chief executives and managing directors). The push to spark initial interest needs to be provided.
  - We are interested in this topic and would like to work on this in future.
  - Industries that cannot compete on costs have to reposition themselves.

- Need to develop people's awareness of LCREE issues and how management teams can address these issues.
- A focus on the employee to develop skills rather than the employer may encourage uptake.
- Implementation of low carbon measures is hindered by the sectors inability to recruit young people who have higher levels of awareness.
- Businesses are driven by the demands specified by their customers; if LCREE is not important to the customers the businesses will not be competing on the basis of LCREE capability.

Others
The following other organisations were interviewed:

- Carbon Trust.
- East Midlands Development Agency.
- Envirowise.
- Advantage West Midlands.
- Institute of Environmental Management and Assessment.
- National Industrial Symbiosis Programme.
- Learning and Skills Council.

- **Understanding of LCREE –**

These organisations were selected due to their perceived knowledge and involvement in LCREE related issues. As expected, these organisations had good levels of understanding of the meaning of LCREE and the bigger picture. They understood the interlink between Resource Efficiency and Low Carbon issues, for example Envirowise spoke of minimising clients carbon footprints through the use of resource efficiency.

One of the consultees stressed that LCREE should be viewed in the context of sustainability.

- **LCREE Relevant Research Undertaken –**

The organisations consulted had not all undertaken relevant research (many of them are providers of support).

Some research has been undertaken on energy skills, sustainable development skills, environmental content of NOS and training supply gaps as well as involvement in work on social science aspects of industrial behaviour to facilitate exchange of resources.

- **Actions Taken in Support of LCREE –**

The business support organisations are involved in a range of actions to support aspects of LCREE, these include provision of training and assistance as well as production and distribution of guidance materials.

The Regional Development Agencies are supporting LCREE through development of skills action plans for regional implementation and the funding of relevant research and practical programmes.

It is worth noting that the Learning and Skills Councils role is to respond to the demands from government and SSC's which determine which courses they fund, as such they are not able to influence the priorities in the funding of specific courses.

- **Levels of Audience Companies Understanding and Awareness –**

This was found to vary by sector with companies involved in, for example, environmental, energy and waste activities being perceived to have a better understanding. In addition some respondents

backed up the view that larger companies tended to be more aware of these issues. One respondent felt that LCREE was perceived as a threat by companies outside the environmental technologies cluster.

It was felt that at the moment a range of factors are raising awareness such as pressures to manage energy, corporate social responsibility and supply chain requirements. The extent and quality of understanding and training provision in this area was questioned. One consultee felt that although factors were at work raising awareness, most companies did not have a holistic awareness of the issues. Another consultee suggested that what is really needed is a large scale behaviour change across the board to encourage new ways of thinking and integration of LCREE into day-to-day behaviour.

- **Priority Generic (Cross-Sector) Skills –**

Relevant points included:

- Higher level skills – this will be a difficulty because of the drop in STEM (Science, Technology, Engineering and Maths) graduate numbers. A lot of skills are required in terms of developing new assets or modifying existing assets.
- Research skills – there is a lack of research people.
- Ability to prepare a business plan based on whole life costing.
- Carbon accounting – especially for the accountancy profession.
- Level 3-4 engineering and technical skills.
- Risk management.
- Innovation.
- Understanding and awareness of LCREE agenda amongst the design community (to ensure application in day-to-day work).
- Management skills and competency (application of those skills) - businesses should be doing this anyway.
- Environmental Management Systems – these will contribute to LCREE and promote good practice in management.
- Communication skills – for integrating and mainstreaming the LCREE message.
- Measuring impacts – if you can't measure it you can't manage it.
- Embedding environmental and resource efficiency skills and thinking into procurement.

- **Priority Sector Specific Skills -**

Relevant comments include:

- Few courses available for building services engineers. Retrofitting buildings will be a problem in future.
- Fuel consumption reduction in the automotive sector.
- Specialist installation skills, eg. Renewables.
- Policy maker skills and awareness.
- Planning skills for those involved in all those involved or affected by the planning process – eg local authorities, building control.
- Energy industry engineering and technician skills across the board.
- Awareness gap in the skills sector.

- **Skills Demand Drivers –**

Significant drivers included:

- Corporate Social Responsibility - although the quality of actions is sometimes questionable.

- Use of green credentials used as a marketing factor – especially in retail/public facing industries.
- Supply chain pressures.
- Carbon footprinting.
- Emissions monitoring.
- Customer pressure.
- Costs of water and energy likely to impact in future.

One consultee felt that demand had moved on from technology skills to some of those listed above.

- **Obstacles to Furthering LCREE Agenda –**

The consultees cited many different obstacles which are impacting. Examples are listed below:

- Previous work to raise awareness of skills as a priority has not been effective.
- HE and FE are disjointed as skills delivery partners. HE is motivated by research, not teaching.
- LCREE skills demands are not currently realised by employers (latent demand) – as skills delivery is demand driven there is a need to build the evidence base to prove there is a latent demand.
- Need for consultants who deliver support to companies to be able to combine strategic management and technical skills.
- There are not enough skilled people available to embed LCREE within companies.
- Low level of policy maker awareness and government leadership. Government departments should be leading by example, eg by adopting things like whole life costing.
- Getting resources allocated within businesses to do work on LCREE is a difficulty.
- Chicken and egg situation in many markets - the lack of awareness leads to lack of customer demand which leads to a lack of upskilling. For example within the building sector.
- There has been no real and systematic discussion about how to stimulate demand for LCREE. How to do this is unclear.
- Grant scheme for fitting energy equipment are too short term to stimulate demand in the market and encourage employers to upskill.
- No mechanism exists for dissemination of planning best practice examples.
- Avoidance of the inevitable and short-termism is preventing organisations from tackling this.
- Lack of time to dedicate to this.
- This is a holistic issue and the right atmosphere is not being created for the debate.
- Businesses all look for advice in different places so difficult to reach them.
- LCREE is not a specific main Regional Development Agency remit and measurement of their performance doesn't particularly support this.
- Probably a limited number of training providers.

- **Skills Delivery Infrastructure Comments –**

Consultees voiced concerns about whether the right things were being taught, for example many university courses are not delivering appropriate management skills. Although two consultees stated there was no shortage of FE capacity and training capacity in the UK, there were others that expressed concern about the capacity and capability to deliver the required skills.

One consultee thought the system had undergone many changes recently but it broadly works (although acknowledging it was not particularly effective at cross-sector skills delivery) and needs a period of stability to become effective.

One consultee highlighted the low level of availability of vocational courses at the lower levels whilst another described the lack of take up of training offered (due to low levels of awareness) as a market failure.

- **Comments on Audience Companies Integration of LCREE Skills –**

Comments included:

- The focus for LCREE has been on technical solutions as opposed to behaviour change – companies have put in a piece of kit and not really through widely about company impacts.
- Resource Efficiency is not a phrase used by industry, there is currently more awareness of low carbon.
- What makes the difference is an enlightened director level person to push this forward.
- In good organisations actions for LCREE are taking place, but these are not integrated into general management practices on a widespread basis.

- **Main Gaps in Evidence Base –**

One consultee commented that the evidence exists, but the problem is having a clear picture of what evidence is being sought. Conversely another consultee stated that there was not really any evidence that focused specifically on skills requirements beyond the high level and what has been done is vague.

Other consultees suggested the following main gaps:

- Identification of the latent skills demand.
- Investigation of how far down the business size spectrum change is harder to promote?
- Optimum methods for training delivery.
- Behaviour change – what makes employers embed these skills?
- Benchmarking performance of existing companies.

- **Other Comments -**
  - A key issue is how to accelerate the take-up of low carbon goods and services (this will involve manufacturers and HE).
  - The amount of awareness raising which has taken place is enough, this now has to be backed up by knowledge.
  - SSC's should be working on mainstreaming skills – their understanding of the impacts of this varies and it is difficult for them because demand is not really coming from employers.
  - Government actions need to reinforce speeches and policy.
  - Changing the awareness of decision makers is a good approach to promoting LCREE, but there is a need for a bottom up approach too.
  - Company boards should be required to consider LCREE.

Non-Priority Organisations

In reporting the result of the non-priority interviews below only comments that have added to the points made by the priority organisations have been raised below.

Key Skills Providers

The following key skills providers were interviewed:

- Northampton University – SITA Centre for Sustainable Waste Management.
- Rodbaston College.
- Stevenson College.
- University of East Anglia – Low Carbon Innovation Centre.

- Imperial College – Centre for Energy Policy and Technology.
- Chartered Management Institute.

- ***LCREE Research Done –***

A variety of LCREE research was being undertaken by the skills providers, but not all applicable to skills requirements.

- ***Levels of Understanding and Awareness of LCREE within Audiences –***

General points were:

- Renewables installers are not given enough credit for understanding broader LCREE issues.
- There is a low understanding of the Low Carbon economy.
- Awareness of issues is high but businesses in general find the topic overwhelming and are not aware of applicable legislation which is probably the key driver. Many businesses are unaware of what the next step should be for them – skills to act are low.
- Resource Efficiency is not seen as being mainstream like Health and Safety and it needs to be.
- There is a great deal that needs to be done to raise SME awareness so they demand skills.
- There is a high awareness amongst board members and researchers.

- ***Generic LCREE Skills Provision Priorities –***

Skills provision priorities highlighted include:

- Rainwater harvesting.
- Transport skills.
- The foundation of LCREE awareness is needed and this will lead to increased demand for other skills training.
- Specific training in LCREE is required not just degree courses.
- Auditing (energy, water, waste etc.).
- Cost benefit analysis will help mainstreaming.
- Skills for planning, delivery and maintenance of new technologies.
- Environmental cost reduction.
- Carbon footprinting and reporting at board level.
- Strategic thinking.
- High end (graduate level) engineering skills (partly because graduates are being lost to other services sector).

- ***Sector Specific LCREE Skills Provision Priorities –***

Priorities highlighted include:

- Need for renewable design and installation skills due to loss of old skills. Installation courses should be more generic and not just applicable to one manufacturer's products. It is unclear what the next priority renewable will be and this makes it difficult to plan training.
- Design and installation of buildings systems.
- Financial services skills.
- Carbon sequestration.
- Energy sector skills.

- ***Factors Driving LCREE Skills Demand –***

Factors driving demand include:

- Altruistic business measures.
- Tax incentives.
- Climate change – but may be seen as too late to do anything.

- Security of energy supply and raw materials availability.
- Risk management.
- Increasing demand as a result of new market opportunities.
- Companies seeking to go beyond regulatory compliance.
- Future employees will not want to work for polluting employers.

- ***Progress with Mainstreaming LCREE into Teaching and Organisational Working –***

Selected examples of mainstreaming were highlighted (such as modifying a management NVQ to include carbon management, developing an MBA with carbon emphasis and adjustments to plumbing level 3 course) but in general progress was considered to be quite slow.

Problems were identified in understanding the skills required to be taught at lower levels to degree students and in supply versus demand (there is no financial incentive to provide these courses and it is considered that demand is outstripping supply leading to problems mainstreaming). It was also pointed out that sustainable development is covered more in schools then at higher educational levels and stronger demand from younger people is expected in future.

LCREE skills are not implicitly embedded in management provision.

- ***Obstacles to the Provision of LCREE Skills –***

Obstacles cited included:

- Only a very narrow range of training is available at the moment which is driven by demand.
- It is considered that the Sustainable Development industry is still in its infancy – it is not really a single industry but a set of ad hoc initiatives.
- No single SSC is looking at LCREE/sustainable development skills apart from LANTRA and the building trade which is driven by regulations
- Professional courses have LCREE skills modules which have been developed, but these are often optional so take up is limited – if these were compulsory then it would drive greater understanding.
- There are not enough trainers.
- The cost of training is too high smaller companies, subsidisation is needed.
- Lack of stringent legislation and regulation for carbon emissions.
- Concern as to whether employment opportunities for the LCREE graduates exist.
- The current demand is not there and is not clear how to drive it. There is a need to target the right messages to the right levels.
- Need for accreditation of LCREE skills courses to relevant standards.
- High set-up costs for colleges wishing to teach renewables courses.

- ***Skills Delivery Infrastructure Comments –***

It was considered that not all FE colleges that are delivering training have progressed on quality. The college infrastructure is in place and is driven by demand and action from government policy. With regards to waste courses, some institutions are thinking of closing them due to poor take up.

Another comment was that the infrastructure is in place, but there are very few organisations to deliver. To remedy this central government needs to put resources behind developing material and deliverers.

It was felt that a key challenge is to develop multi-disciplinary skilled people working in the area and getting LCREE courses respected academically.

- ***Integration of LCREE Skills within Audiences –***

In general not enough quality integration/mainstreaming is taking place now (although some limited elements of LCREE are being delivered to plumbers). This is not being driven as a priority by the professional bodies. The issues are not mainstreamed into business and policy agenda.

- ***Main Gaps in the Evidence Base –***

One consultee said the perception is that little research has been done in the skills area and what has been done is on high level discussions which are not translated into action.

Suggestions for research which is needed included:

- Behavioural change programmes.
- There is no repository/central database for information.
- Current information is too complicated and needs to be generalised and made more relevant to audiences. There is a need to conduct a mapping exercise to determine key issues for certain sectors/job roles etc.
- Research to make the business case for LCREE.

Professional Bodies / Business Support Agencies

The following organisations were interviewed:

- Chartered Institution of Wastes Management.
- Confederation of British Industry.
- EEF.
- GMB.

- ***Levels of Understanding and Awareness Amongst Members/Audience –***

The viewpoint was expressed that there is a lot of talk but it is not clear if this equates to a proper level of understanding. At a high level all businesses are aware there could be a skills gap but are not sure what to do to fix this. This was not on the radar a few years ago and has moved up the priority list. There is also felt to be more emphasis on skills in general to improve competitiveness and a greater awareness amongst businesses with Climate Change Levy agreements.

- ***Generic LCREE Skills Provision Priorities –***

Those identified include:

- Procurement and selection of materials.
- Financial investment modelling.
- Eco-design.
- Green manufacture.
- Waste re-use.
- Opportunities management.
- Strategic planning/development skills and decision making.
- Leadership.
- Specific LCREE management training – e.g. Decision making for LCREE.
- STEM skills in general.

- ***Sector Specific LCREE Skills Provision Priorities –***

Priorities include:

- Energy efficient construction.
- Minimising energy use in waste processing.

- Facilities management.
- Clean fossil fuel technologies.
- Offshore wind and marine technologies.

- ***Factors Driving LCREE Demand –***

The following factors are considered to be driving demand for LCREE:

- Climate change (in future).
- Climate change adaptation, nuclear new build and offshore wind (in future).
- Competitive edge for companies that have a skilled workforce.
- Government policy drivers such as fiscal measures and support schemes (in future) – companies need long term commitments to know where to spend their money for example in R&D.

- ***Obstacles to Audience/Member Upskilling –***

Obstacles include:

- The waste industry is not seen as a career option.
- Companies have not yet got to grips with where the gaps and risks are.
- Difficulties in getting background and specialist training courses to the existing workforce training – it is also very difficult to get LSC funding for short courses.

- ***Skills Delivery Infrastructure Comments –***

Carbon energy skills are now being integrated into some apprenticeships as of September 2008.

- ***Integration of LCREE Skills Among Audiences/Members –***

There is a perception that this is happening more quickly in recent years for large energy intensive companies.

- ***Main Gaps in Evidence Base –***

Suggestions include:

- Nuclear power generation sector skills – regulatory and technical.
- Investigation of how fiscal and regulatory measures impact on the ROI/IFF for investment decision making (especially amongst smaller companies).

- ***Other Comments -***

If the construction industry is to comply with government targets they need to take action now. But this is hampered because it is not clear which renewables will be demanded in future – so companies are unsure as to which skills to train their employees in? Unsure whether the demand is clear enough to enable colleges to run appropriate courses.

Other

The following other organisations were interviewed:

- Action Sustainability.
- Institute for Public Policy Research.
- London Energy Partnership.
- Sustainable Development Commission.
- UK Energy Research Centre.
- Waste and Resources Action Programme.

- ***Levels of Understanding and Awareness –***

Comments included:

- SME's can't afford business support and skills development.
- Sustainability of procurement is not well understood in companies or procurement departments.
- There are high levels of awareness but not widespread ability to set out in detail what needs to be done.
- This is a mixed picture – there is lots of innovation going on but this is very piecemeal.
- A lot of confusion exists over the word sustainable – it is misused a lot. There is a need to keep true to sustainable development principles.
- This is a key skill for larger organisations but SME's are not yet being influenced – there is a need to reach them through the supply chain.

- ***Generic LCREE Skills Requirements –***

In some ways it is too early to be talking about skills as the fundamental priority issue is raising awareness and changing the way businesses think and behave.

Sustainable Procurement skills improvement involves – understanding impacts as well as consideration of aims and scope/extent of what they are trying to achieve at a strategic level. Also prioritising the business requirements of the supply chain (risks, security of supply, markets etc.) and contract management approaches (specification or performance management).

Performance assessment skills are also required.

- ***Obstacles to Mainstreaming LCREE –***

Obstacles suggested are:

- Skills are not core to business planning and models. This needs to be addressed partly through legislation and partly through the supply side (universities).
- Long term consistence with policy drivers is needed.
- Organisations will not invest in skills unless the business case is strong.
- There is an awareness gap in that businesses do not yet understand that this is an important set of drivers.
- A co-ordinated approach to awareness raising is needed.
- Existing culture in the energy sector is an obstacle to development of LCREE skills – because traditionally this sector has focussed on maintaining reliability of supply at the lowest cost.
- Low cost culture and lack of policy maker skills in enabling deployment.
- Budget cuts tend to lead to less staff training and it difficult to get training which is outside of your specialism.

- ***Skills Delivery Infrastructure Comments –***

In the employer driven world of skills delivery evidence is needed that employers want this. At what point should you conclude that there is a market failure and intervention is required?

- ***Main Gaps in the Evidence Base –***

There is a Gap in looking at how to relate carbon targets to the numbers of employers needed to take action.

The picture is not clear at the moment. Some tentative models have been developed but a framework for tying this together would be useful. A leadership framework which relates this research work (on the key factors for achievement of sustainability) to the context of government

policies would be good. There is work to do at the top end of the skills checklist – relating the lower tier skills to the top priorities.

How to use the delivery systems in place to generate these skills – delivery is a key issue that needs addressing.

There is little available evidence that would prompt people to see the links and train in this.

- ***Other Comments –***

This is about a large transition which involves 3 things: thinking longer term, thinking more broadly and thinking more inclusively. Organisations go through three stages; denial to compliance to opportunity. The people with decision making power need to kick-start the process, then others will get involved. Leading by example is also an important part of this.

A policy level organisation is needed specifically to look at skills for a Low Carbon and Resource Efficient Economy. It will also be important to ensure that Resource Efficiency is not lost in the emphasis of LCREE.

Changing understanding and ways of thinking is about coaching in the first instance rather than training staff.

Research Planned or In Progress

Through consultation, it became clear that a range of work relevant to LCREE is either planned or in progress. Brief details of these studies are outlined below.

Planned Research Work/Work in Progress

	Research Topic	Organisation	Notes
1	Greening Management.	Chartered Institute of Management	This piece of work is intended to commence during 2008.
2	Skills for Renewable Generation.	Emfec leading with Renewables East, Pro Enviro, East Midlands Development Agency.	Steering group for research has been formed. Next meeting at End May 2008.
3	Climate Change Adaptation and Mitigation.	Institute of Public Policy Research	To be commissioned soon.
4	Brass Working Paper 45 – Supporting Skills and Knowledge to Deliver Sustainable Communities.	Sustainable Communities (BRASS)	Due for completion Sep 08.
5	Skills and the Capacity to Deliver on the Waste Strategy 2007.	Institution of Mechanical Engineers, Institution of Civil Engineers, Chartered Institution of Waste Management, Constructing Excellence	Being scoped now. Likely to commence Sep 08.
6	Skills Associated with Adapting the UK to Climate Change.	Institute of Mechanical Engineers	Would like to do this work but currently no funding.
7	Skills Needs and Provision in the Food and Drink Manufacturing Sector.	National Skills Academy for Food and Drink Manufacturing	Environmental sustainability skills forms a specific heading under this research but it is part of the bigger skills picture. NE research due by 14th May. NW research due end May/June. Carried out by research organizations. Working with companies to identify their sustainability skills needs then mapping these to regional provision.
8	Skills Research for Sustainability.	National Skills Academy for Food and Drink Manufacturing	Had a proposal into Defra to do this work but not done because Defra wanted it by end March 08.
9	Future Skills Needs in the Government Sector.	Government Skills Sector Skills Council	Due for completion Mid May. She will send me a copy. Is expecting that sustainability will be an emerging demand from those in the sector.
10	Future waste industry skill needs to identify course requirements.	University of Huddersfield	Working with university of Newcastle, but work has only just started.
11	Functional and Occupational Mapping of Environmental Job Roles.	Institute of Environmental Management and Assessment for	Currently being carried out. This piece of work follows work already completed which reviewed the

		Lantra	environmental content of National Occupational Standards/
12	Mapping of Availability of Environmental Training and Sustainable Development Provision and Take- Up.	Lantra, with Job Centre Plus and Learning and Skills Council	Will commence this year. ESF funding.
13	Sustainable Development Skills.	East Midlands Development Agency	Currently being undertaken.
14	Sector Activity Review of Technologies, Training Requirements and Demand.	Summit Skills	In final edit stage. ESF funding.
15	Construction Skills 2020 Vision Forecast.	Construction Skills	Commenced late 2007. Includes forecasting of technologies for zero carbon. Due for publication May 2008.
16	Skills for Environmental Technologies.	West Midlands Regional Observatory	In the process of being commissioned.
17	Climate Change Adaptation of Businesses.	Pro Enviro for East Midlands Development Agency	This work incorporates research into business requirements for climate change adaptation. Due for completion at end March 2009.

Stakeholder Advisory Group

In addition an informal Stakeholder Advisory Group has met to provide comments on this work. Full details of the groups members and the outcomes of this discussion are available in Appendix 10.

Conclusions

Low Carbon and Resource Efficient Economies Definition

The definition served the purpose of defining the scope of the project and development and use of this definition generated a limited amount of debate.

A number of the consultees are exacerbated by the general tendency for the language of Sustainable Development, Low Carbon, Green, Eco and Climate Change Adaptation to be used interchangeably and believe there is a lack of clarity in the economy as a whole. Consistent language and policy direction is needed in future research and future actions.

To make the definition clearer and more user friendly for future use, there may be a case to amend the definition by emphasising embedded carbon, carbon and greenhouse gas emissions.

The merits of inclusion of targets and strategies for carbon emissions reduction are debateable. Some consultees felt this would clarify what is being aimed for in terms of achievements of the economy. However, targets and strategies are subject to change which would cause the definition itself to become dated and potentially less relevant. For this reason, it is recommended that careful consideration is given to the use and purpose of future LCREE definitions before including targets and strategies.

An important point was raised about how far a LCREE should aim by one of the consultees. Should a low carbon economy aim to just break the link between carbon emissions and growth (so the two are not related) or, should it actually aim to reverse this link (so increased growth actually results in decreasing carbon emissions). It is likely that resolution of this issue will be influenced by government policy and the intentions of future work. It is recommended that this issue is considered before future use and development of the LCREE definition.

Draft Skills Checklist

The draft checklist served its purpose by clarifying the scope of LCREE skills and stimulating discussion of LCREE skills requirements. A wide range of comments regarding the scope and content of the draft checklist were received during the course of the research. The comments are naturally influenced by the level of understanding and viewpoints and interests of the consultees. Some of the consultees did not fully appreciate the scope of LCREE as defined within other topics such as sustainability and some thought the work should be about sustainability. At the beginning of the project it was agreed that the scope associated with sustainable development and sustainability was to wide to be covered by this specific project. These viewpoints led to some suggestions which are not considered strictly relevant to LCREE (such as flood planning and biodiversity).

The checklist did not attempt to place a value or indicate the relative importance of the skills within it. However, some of the comments received were about the lack of relative emphasis/priority given to particular skills (especially with regards to awareness raising and delivery skills). Because of this consideration should be given to reviewing the checklist structure for future work.

The checklist was intended to apply to all sectors and contain all types of skills. Because of this, it does not really differentiate between sector specific and cross-sector skills. It may be worth considering this for the purposes of future work.

A range of good suggestions were received in relation to the existing skills areas relating to the desire to expand the content and level of detail in Tier 3 and adding additional skills and emphasis around the social, communication and delivery skills which are considered crucial in achieving LCREE.

Suggested new skills areas include; land management and production, repair skills, carbon skills and IT. In the case of land management and production there is a clear case for an additional Tier 1 level. Careful consideration should be given to the other suggested new skills areas in terms of creation of new Tier 1's versus their incorporation into existing skills areas within the list.

Understanding and Awareness

The conclusions within this section incorporate the response to the following research question:

- ***What is the current level of understanding, awareness and demand for the skill requirements for a low carbon resource efficient economy?***

- Understanding and awareness is a crucial issue. This refers to a holistic in-depth understanding of the issues involved in LCREE and impacted by it. Understanding and awareness at appropriate depths is necessary to affect the way organisations think and operate with regard to LCREE in a day-to-day context. This must be in place to stimulate demand for LCREE skills and more effective skills implementation.
- A key issue affecting understanding and awareness is the interchangeable use of terms such as sustainable development, green, eco, environmental – each term means different things to different people and there is a lack of clarity in the economy as a whole.
- Written evidence on a range of LCREE and associated topics indicated lower than desirable levels of in-depth understanding and a lack of progress beyond the high level.
- Understanding and awareness was seen to vary amongst sectors and with company size. Different pressures are acting on the different sectors raising awareness and promoting the requirement to develop understanding. Sectors which are involved in the environmental or energy markets are generally considered to have higher levels of knowledge, understanding and awareness in addition to some companies in the retail and public facing sectors (due to customer demand).
- Company size is a factor which seems to have influence – larger companies are considered to have more resources in terms of time, money and staff to dedicate to this. Smaller companies are harder to reach – causing difficulties in influencing and raising awareness in sectors where there are high proportions of SME's and sole traders.
- Sector Skills Councils are considered crucial organisations in influencing the development of skills by businesses. However, the level of understanding and awareness within the SSC's varied and comparatively little was being done by many SSC's in terms of mainstreaming LCREE within their work. This is likely to be influenced by some of the following factors; a lack of understanding of the importance of the issues to their sector, their relevance in day-to-day operations, lack of clarity as to how to move forward with this agenda, insufficient resources to devote to this or lack of demand for this emanating from employers. SSC's were seen to have slightly higher levels of knowledge on associated topics such as sustainable development, green, environmental etc.. It is worth noting that whilst not often reflected in SSA's to a great extent, interviews revealed a selection of actions that were being taken by some SSC's which indicate recent progression in this area.
- There are issues around the level of understanding and awareness present in organisations. Whilst in many sectors there are high levels of initial awareness on some aspects of LCREE, it is

debateable how in-depth and holistic this understanding is. For example there are low levels of understanding of the meaning of a low carbon economy (relating this to embedded energy) or that management skills are a crucial aspect of LCREE.

- There was evidence that consultees thought awareness levels were growing quickly. However, the key issue is utilising this growth in awareness to develop understanding and a practical suite of actions/way forward for the companies and sectors concerned. There is a visible lack of knowledge about how to move forward and actually implement LCREE improvements and manage suitable upskilling.
- Awareness and understanding is higher for aspects of LCREE which are recognised to have cost benefits – e.g. energy and waste. This is not the same as having a holistic view of LCREE.
- Supply chain pressures are cascading down to raise awareness.
- There is limited evidence that companies in some sectors are beginning to become aware of the competitive advantage and marketing benefits LCREE can bring.
- It is important to view LCREE in the context of sustainability and recognise how it contributes to the achievement of this.

Priority Skills

One important point that came out of the research is that a lot of the skills which will be required by a LCREE are not new skills, simply skills that already exist whose availability needs to be increased or which need to be applied in new situations or with LCREE specifically in mind. There is a need to identify these transferable skills and mechanisms for their transfer.

Generic

- Evidence for the importance of a wide range of generic (cross-sector) skills was gathered during this research work. These included skills which organisations would not necessarily associate with LCREE such as leadership, management, communication and financial as well as the more traditionally identified skills such as those in energy, water and waste.
- With regards to the leadership and management skills highlighted there was an emphasis on the skills required to further this agenda effectively such as communicating the LCREE message within organisations, strategic business planning with LCREE in mind, life cycle analysis, managing change, financial investment modelling and management with LCREE in mind. It was observed that these skills are ones that effective organisations should already posses, it is a case of applying these appropriately day-to-day within an LCREE ethos. These skills apply equally to all types of organisations whether public or private.
- Science, Technology, Engineering and Mathematics skills were cited as being important. Although this is a general requirement due to the general shortages of these skills.
- Other significant generic skills cited are; sustainable procurement skills, monitoring and measuring skills, carbon accounting, performance reporting, EMS, risk management, whole life costing, cost benefit and analysis and innovation and commercialisation skills.
- The need for delivery of generic skills does not match with the sector specific approach to skills delivery which is currently in place, indicating a requirement for improved cross sectoral collaboration and cooperation.

Sector Specific

- A large range of sector specific skills was cited during the research. The question of skills targeting (i.e. who needs which skills and at what levels) was raised – effective provision should target skills appropriately to those who require them.
- Employers are not always clear on what their skills requirements are.

- Renewables – planning, design and installation skills were highlighted as important.
- Energy skills across the board were raised including skills for renewables, clean fossil fuel technologies and new distribution network skills.
- Other skills highlighted include; planning skills, skills in building services engineering and financial skills.

Integration of Skills

The conclusions within this section incorporate the response to the following research question:

- How do skills for a low-carbon, resource efficient economy relate to existing skills priorities for organisations, such as leadership and management?

- Integration of LCREE skills into all training taken by companies is the key to mainstreaming LCREE understanding, knowledge, skills and thinking. Several consultees mentioned that these skills have to become core to organisational function, in much the same way that health and safety skills have.
- The written evidence reviewed does not demonstrate a high level of integration of LCREE skills needs into current organisation priorities.
- LCREE has traditionally been seen as a skill set that is separate to the work of the company. As such, technological fixes were often favoured in the past as one-off actions which did not lead to integration within an organisation's main priorities.
- Integration of some LCREE skills into qualifications and National Occupational Standards has started to take place in a limited capacity, but there is still a long way to go. This indicates that companies involved in training are not being exposed to LCREE skills as part of this, making it necessary for companies who want this training to source it separately – a situation which does not promote integration into the day-to-day work of the organisation and its skills priorities.
- A key factor highlighted as increasing integration of LCREE and associated skills into organisational priorities is an enlightened and aware director who will push these skills issues forwards. In addition, levels of understanding and awareness amongst staff will impact on the ability to integrate LCREE skills requirements and practices into organisational priorities.
- In many good organisations LCREE actions are taking place but they are not necessarily being integrated into general management practices of these organisations on a widespread basis.

Skills Demand Drivers and Obstacles

The ***conclusions in this section incorporate the responses to the following research questions:***

- ***What preliminary conclusions can be drawn in terms of existing demand and expected demand in the next 10-20 years?***
- ***What are the main drivers for these skills (e.g. new or anticipated legislation, market demand)?***

Drivers

- It is considered that at the moment levels of demand for LCREE skills are lower then could be expected. This is because a significant proportion of the total potential demand for LCREE skills is latent. Currently organisations do not have the level of to fully realise why LCREE will be important for their businesses. Only when these links and a clear business case are made will businesses demand LCREE training. This leaves us in a 'chicken and egg' situation –

understanding and awareness are the key to stimulating demand for skills but in a demand led skills delivery system (such as the one in place in England), an expression of demand is required from the organisations for the skills delivery sector (especially SSC's) to respond to.

- There has been no systematic discussion about how to stimulate demand for LCREE and consequently the optimum way to do this is unclear, leaving a significant proportion of latent demand unrealised.
- The general consensus was that most organisations will be driven to take action if it is required by legislation or if there is a clear business case (such as cost savings) to justify it. The clear business case is not currently being seen.
- Supply chain pressures were commonly cited as a driver of increasing importance and a good way to cascade LCREE awareness and actions through to smaller companies which are generally less likely to implement LCREE actions.
- A range of other drivers were cited including; cost savings and competitiveness, consumer demand (although this was more prevalent in public facing industries), Corporate Social Responsibility, increasing costs of energy, climate change, access to new market opportunities, altruistic reasons and tax incentives.
- It is expected that with the types of drivers currently operating on the market, levels of demand will rise in future. However, latent demand is still very significant and the large increases in demand that will be required to move organisations successfully towards Low Carbon and Resource Efficient Economies will only happen if a high proportion of currently latent demand is realised.

Obstacles

- The main obstacles to organisations realising demand and seeking skills training include; lack of resources (time, staff and money), lack of access to the necessary skills/expertise, lack of senior management commitment, LCREE seen as a cost not a benefit and forthcoming economic pressures (during recessions training budgets are often cut).
- One important obstacle was the low levels of policy maker awareness and leadership – these lead to a short-term approach from policy makers and decision makers within government, the public sector, the skills provision sector and businesses. Organisations find it difficult to plan ahead because they do not know what the future policy drivers will be.
- Another important obstacle was the need for suitable mechanisms for reaching and upskilling those already in the workforce.
- LCREE skills are not being comprehensively promoted by professional bodies that influence the perception of their members' skills requirements.

National Capacity and Capability to Meet Skills Needs

The conclusions within this section incorporate the response to the following research question:

- ***What conclusions can be draw in terms of current skills availability, skills provision and capability?***
- ***What conclusions can be drawn on future skills needs (quantitative and qualitative), including in relation to national capacity and capability?***

- Opinions as to whether the capacity and capability to meet skills needs is available varied. Some consultees considered capacity and capability to be sufficient (especially in light of depressed levels of actual demand) whilst others indicated that there were issues in catering

to existing demand (although this is likely to be more prevalent in some subjects than others).

- It is considered unlikely that current levels of skills training capacity will be sufficient to meet demands in the event of increased conversion of latent potential demand to actual demand.
- It was also highlighted that there may be a shortage of trainers in the marketplace – a factor which will significantly impact on delivery.
- Skills brokerage (and subsequent delivery) is reliant on well informed business advisors under the Business Support Simplification Programme. Not all business advisors are sufficiently knowledgeable about LCREE to identify issues and broker relevant support/training. Business advisors should receive specific LCREE training. In addition, this is a major mechanism for reaching the workforce already in place, yet there are sectors which do not use Business Link services as they are not perceived as relevant to their needs.
- With around three quarters of the 2020 workforce having already left compulsory education, new types of higher education provision need to be created to complement traditional models, including more flexible courses designed and co-funded by employers. There must be an effective way of reaching this group with appropriate qualifications and policies that support re-skilling and upskilling in a modular way. Current skills delivery infrastructure is not well suited to reaching and upskilling those already in the workforce. Those already in work require shorter specialist and background courses/modules and vocational training material which are often not available (or available in sizeable quantities). Funding mechanisms are geared to delivery of longer term qualifications and do not support these shorter courses. In addition the practical methods of delivery are important to successful upskilling – with the private sector more flexible and able to respond to employers requirements better (e.g. on-site training).
- The nature of LCREE means that many of the skills required are generic (cross-sector) skills. Delivery of these does not match well to the current sector specific approach. This makes it even more important that SSC's integrate LCREE into their core activities.
- The skills delivery system and funding has been focussed on lower level skills. This does not maximise support of the LCREE agenda as LCREE skills have been cited as mainly being level 3 and above as well as at higher levels.
- Funding arrangements in the Higher Education sector are dependant on research performance as opposed to teaching performance resulting in miss-matches in the content of high level courses. In addition, an appropriate focus on overarching management skills required for LCREE is not present in most higher level STEM courses.

Evidence Base

The conclusions within this section incorporate the response to the following research question:

- ***What are the main gaps in the evidence base?***

- Research is being conducted into many aspects of LCREE, but not LCREE as a whole. Evidence is more likely to be focussed around issues such as sustainable development (which has a broader remit), low carbon, green and environmental.
- Most research is at a high level with only a vague focus on more in-depth specific skills requirements. In some cases research is repetitive and does not lead to any new insights. This indicates a lack of clarity in the research mission and an inability to progress to the next level (specifying skills requirements and actual actions to promote LCREE and its skills requirements).

- There was a lot more evidence available on the low carbon and energy issues and far less on the resource efficiency issues.
- A number of gaps in the evidence base were identified. These centred around work specific to LCREE (as opposed to environmental, green etc..) and are mainly around factors affecting delivery, demand and take-up of LCREE. These are detailed in the recommendations below.

Recommendations

Following analysis of available evidence and stakeholder feedback the following priority gaps in the evidence base have been identified.

Further Work

Recommendations for further research work arising from this study are:

- ***Latent demand*** – further development of the evidence supporting it and quantification of potential demand.
- ***Methods for stimulating LCREE demand*** – the work shows this will be a crucial first step before skills delivery will be successful. Investigation and assessment of a range of methods for stimulating LCREE demand would be sensible to inform any future campaigns to raise demand.
- ***Employer perception –*** a lot has been done on employer perception, but not to find out their opinions on LCREE specifically. Telephone interviews or a series of workshops/discussions to be carried out in order to gather employers' evidence. This would benefit the development of awareness raising campaigns and training courses and start to raise awareness amongst consultees of LCREE issues and their importance.
- ***Case studies, performance and benchmarking –*** examples of good performance and best practice as well as the benefits this has brought (clarifying the business case) need to be collated and disseminated to promote uptake of LCREE skills and behaviour amongst organisations
- ***Identification of sector specific LCREE skills requirements*** – in more depth than existing research and could include consideration of how these will be filled**.** Mapping of sectors and job role skills requirements. Priority for some sectors.
- ***Transferable skills*** – many LCREE skills exist and are transferable to new sectors and into currently available skill sets. Identification of these skills and investigation of mechanisms for transferral or upskilling.
- ***Further Investigation of the relationship between behaviour change and LCREE skills -*** implementation of LCREE is about more than just upskilling – it is about application of knowledge and thinking differently. There is a gap in the knowledge of what the key factors are in influencing organisations to change, what makes them embed LCREE skills and how influencing factors vary with company size and sector.
- ***Waste and resource efficiency research -*** not a lot is available, especially with relevance to skills requirements**.**
- ***Optimum training delivery methods –*** to identify training delivery methods fit for a range of up-skilling purposes**.**
- ***Future technologies for LCREE*** - to gain a greater understanding of where the key skill demands will be.
- ***Development of leadership framework for LCREE*** – there are a range of leadership and management skills and behaviours which it will be crucial to embed in all organisations in order to achieve and function within a LCREE. Development of a model for how these should be developed within organisations to ensure LCREE and longer term LCREE considerations become a fundamental part of management and leadership going forwards.
- ***Design skills –*** definition of sector specific requirements and increasing consideration of LCREE in design.

Other Recommendations

The following are based on the outcomes of the written evidence review and stakeholder consultation:

- LCREE considerations should be integrated across the whole of the skills delivery system.
- ***Further consideration of how SSCs, the new CES and exsiting NSAs can collaborate -*** to ensure that where there is latent demand it is proactively anticipated and mechanisms are put in place to deliver the appropriate skills.
- ***Pilot study investigating optimum methods of generic skills delivery –*** difficulties have been reported for employers trying to access training which is delivered in ways that are convenient for their business requirements. This practical pilot would trial and analyse a number of methods of skills delivery to produce guidance on the best and most effective practices for skills deliverers.
- Consideration should be given to suitable methods of empowering SSC's to influence the agenda with regards to LCREE (in line with government priorities) and / or to methodologies for an awareness raising campaign to raise awareness at employer level.
- Creating change in the current policies where SSC's respond only to demand lead skills needs. LCREE skills should be incorporated into majority, if not all the Sector Skill Agreements facilitating creation of sector based National Occupational Standards which will accelerate the development and delivery of sectoral skills in LCREE.

Following assessment of the evidence and stakeholder feedback Pro Enviro recommend the following which are not related to specific gaps in the evidence base, but which would support the effective promotion of the LCREE agenda:

- Policy making within government should consider LCREE issues and implications. LCREE considerations should be integrated into the core work of all departments in order to 'future-proof' and provide consistency to policies.
- To avoid confusion it is recommended that government promote LCREE or another consistent definition depending on the aims of government policy. The definition chosen should be consistent with government policy.
- Government policy and direction should be formalised so a consistent approach is used. Government is encouraged to lead by example to ensure that the skills implications are factored into to policy decisions.
- A strong, consistent focus should be placed on targeting organisation directors and key decision-makers with regards to LCREE and the use of supply chain pressures to embed LCREE in targeted sectors. This should be core to government contact with this group.
- Working with the professional bodies that influence the perception of their members' skills requirements to promote better understanding of LCREE and provision of LCREE skills.
- Greater clarity on the skills for climate change adaptation and how these relate to skill requirements for LCREE.

Disclaimer

The content, statements and views within this report do not necessarily represent the views of Defra or other Government Departments or Agencies.

Appendix One – High Level Document Review

Securing the Future – Delivering the UK Sustainable Development Strategy

The UK sustainable development strategy "Securing the Future" stresses the interdependency of the social, economic and environmental dimensions of sustainability and emphasises the UK's international responsibilities. It sets out guiding principles agreed by the UK Government, Scottish Executive, Welsh Assembly Government and the Northern Ireland Administration.

These are:

- Living within environmental limits.
- Ensuring a strong, healthy and just society.
- Achieving a sustainable economy.
- Promoting good governance.
- Using sound science responsibly.

There are also four priority areas for immediate action contained within the strategy:

- Sustainable Consumption and Production.
- Climate Change and Energy.
- Natural Resource Protection and Environmental Enhancement.
- Sustainable Communities.

Summary

Securing the Future is the key strategy document for the UK Government and was published in March 2005. The UK strategy for sustainable development aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations.

The strategy contains:

- a new integrated vision building on the 1999 strategy – with stronger international and societal dimensions
- five principles – with a more explicit focus on environmental limits
- four agreed priorities – sustainable consumption and production, climate change, natural resource protection and sustainable communities, and
- a new indicator set, which is more outcome focused, with commitments to look at new indicators such as on wellbeing.

Skills

Although Securing the Future focuses on the wider scope of Sustainable Development and not simply the skills required for a low carbon resource efficient economy it does help highlight a number of key issues of skill requirements and how they will be provided.

- The Community Action 2020 is meant to act as a catalyst for community action helping people to get involved by providing skills training.
- Creation of the Professional Skills In Government programme and embedding sustainable development into the curriculum of the National School of Government.
- Firm Foundations: the Government's framework for community capacity building' (Home Office, 2004) identified that there is a skills gap within local communities.
- Sustainable Development to be built into National Occupational Standards.
- To maintain a more competitive economy, to compete internationally and build ourselves sustainable communities, we need to improve the knowledge and skills base of everyone, including professionals and others in the workplace.

- Several reports have identified an economy-wide gap in skills needed to deliver more sustainable consumption and production. This is being tackled through the Department for Education and Skills' Sustainable Development Action Plan.
- The Code for Sustainable Buildings will establish new voluntary standards for resource efficiency.
- The Code for Sustainable Buildings will establish stretching voluntary standards for resource efficiency on key issues such as energy, water, waste and materials.

The Government will focus on measures to enable and encourage behaviour change, measures to engage people, and ways in which the Government can lead by example. Where these are not sufficient to change entrenched habits, we will also look for ways to catalyse changes.

Key commitments include:

- a new programme of community engagement – Community Action 2020 – Together We Can – to act as a catalyst for community action helping people to get involved by providing skills training, improved access to funding and mentors
- a deliberative forum to look at what it would take to help people live more sustainable lifestyles
- piloting open and innovative ways to allow stakeholders to influence decisions about the kind of projects which would deliver the goals of this strategy
- new commitments to support education and training in sustainable development, and
- evaluations of key environmental taxes to help build a more comprehensive picture of the effectiveness of such taxes and inform further reviews, including that of the Climate Change Programme.

"One Planet Economy": Sustainable Consumption And Production

Increasing prosperity, in the UK and across the world, has allowed many people to enjoy the benefits of goods and services which were once available to just a few. We have also made progress in cleaning up some of the worst industrial pollution. Nevertheless, the environmental impacts of our consumption and production patterns remain severe, and inefficient use of resources is a drag on the UK economy and businesses. In addition, internationally we need to promote the mutual supportiveness of trade liberalisation, environmental protection and sustainable development to help developing countries.

We need a major shift to deliver new products and services with lower environmental impacts across their lifecycle, and new business models which meet this challenge while boosting competitiveness. And we need to build on people's growing awareness of social and environmental concerns, and the importance of their roles as citizens and consumers.

Our strategy for doing this involves:

- strengthening UK and international measures to improve the environmental performance of products and services, including improved product design
- a continued drive to improve resource efficiency and reduce waste and harmful emissions across business sectors, aided by the Business Resource Efficiency and Waste (BREW) programme
- a new push to influence consumption patterns, including proposals for new advice for consumers
- new commitments on sustainable procurement in the public sector to make the UK a leader within the EU by 2009
- support for innovation to bring through new products, materials and services
- stronger partnerships with key business sectors such as the food, tourism and construction industries, and
- a review of our waste strategy, with increased emphasis on reducing waste at source and making use of it as a resource.

Confronting The Greatest Threat: Climate Change And Energy

The UK government is committed to reducing the country's greenhouse gas emissions. In its 2003 Energy White Paper, the Government put the goal of moving to a low carbon economy at the heart of its energy strategy, and set out a long term goal of reducing carbon dioxide emissions by some 60 per cent by about 2050, with real progress to be shown by 2020.

In addition, we have a target under the Kyoto Protocol to reduce greenhouse gas emissions by 12.5 per cent below base year levels by 2008-12, and a more ambitious national goal of reducing carbon dioxide emissions by 20 per cent below 1990 levels by 2010. Our Climate Change Programme sets out policies and measures to help achieve these goals. The UK is on track to meet its Kyoto target – a significant achievement. However, more needs to be done to achieve our national 2010 goal. Through the current review of the UK Climate Change Programme the Government is committed to evaluating the existing programme measures and aims to publish a revised programme in summer 2005.

Major international and domestic developments which are already in the pipeline include:

- putting climate change as a top priority for both the UK's G8 and European Union presidencies in 2005
- discussion at an international level on further engagement of all parties to the United
- Nations Framework Convention on Climate Change on future action to reduce greenhouse gas emissions, and adaptation strategies
- launch of the Climate Change Communications Initiative with funding of at least £12 million over the period 2005-08, to tackle public attitudes to, and understanding of, climate change, and what we can each do to help reduce our personal contribution to climate change
- delivering against our commitments in 'Energy Efficiency: The Government's Plan for Action'
- a consultation on the draft code for sustainable buildings during 2005, with national rollout planned to begin in 2006
- launch of the Government's pilot carbon offsetting scheme for air travel in 2005
- pressing for the inclusion of intra-EU air services in the EU emissions trading scheme from 2008 or as soon as possible thereafter; this will be a priority for the UK Presidency of the EU in 2005, and
- publication of a climate change adaptation policy framework during 2005.

A Future Without Regrets: Protecting Our Natural Resources And Enhancing The Environment

Natural resources are vital to our existence and to the development of communities throughout the world.

The issues we face are the need for better understanding of environmental limits, the need for environmental enhancement where the environment is most degraded, the need to ensure a decent environment for everyone, and the need for a more integrated policy framework to deliver this.

Key commitments in the strategy include:

- producing an integrated policy approach for protecting and enhancing natural resources with stakeholders in 2005
- researching environmental limits and environmental inequalities
- taking account of natural systems as a whole, through the use of an ecosystems approach

- bringing together all the UK Government's policy frameworks, targets and strategies for natural resources
- modernising the delivery framework through the creation of new agencies to manage the marine and terrestrial environments
- launching Environmental Stewardship to incentivise farmers to deliver environmental benefits
- addressing problems of degraded resources and environmental inequalities by enhancing the role of the Environment Agency, the creation of the Integrated Agency, and by strategic partnership work nationally and locally between Defra and the Department of Health and their agencies
- working with international partners to reduce the rate of biodiversity loss worldwide, and
- encouraging partner countries globally to integrate principles of sustainable development into poverty reduction and development processes, assisting developing countries in negotiation and implementation of Multilateral Environmental Agreements, and supporting multilateral institutions such as the UN Environment Programme.

From Local To Global: Creating Sustainable Communities And A Fairer World

The Government will promote joined-up solutions to locally identified problems, working in partnership to tackle economic, social and environmental issues.

At the local level there will be a package of measures to realise the vision of sustainable communities across England, in both urban and rural areas, which will catalyse the delivery of sustainable development.

At the national level, the strategy sets out the framework for changing people's lives through improvements in public services and providing opportunity for all.

At the global level, we look at how we will apply the principles of good governance, democracy and partnership and how to work effectively to meet locally identified priorities so that this country helps meet Millennium Development Goals.

Key commitments include:

- joining up effectively at the local level around the vision of sustainable communities with Sustainable Community Strategies and Local Area Agreements, linked to planning through Local Development Frameworks
- placing sustainable development at the heart of the land use planning system and at the core of new planning guidance
- enabling people to participate fully by providing new neighbourhood structures and funding to allow people to have a say in the way their neighbourhoods are run
- new powers for local authorities under the Clean Neighbourhoods and Environment Bill
- meeting the new national target to improve the local environment, focused on the most deprived neighbourhoods
- providing better information to people on their local environment
- creating opportunities locally for people to improve their local environment, health, education, job prospects, and housing
- helping to improve international environmental governance including through continued support for the Partnership for Principle 10, and
- working with other donors to increase global levels of official development assistance, including through the International Finance Facility.

Ensuring It Happens

We want to ensure that this strategy is converted into action. We are proposing additional measures, which we believe will prove powerful catalysts for improved delivery:

- strengthening the Sustainable Development Commission and asking it to report on the Government's progress on sustainable development
- mainstreaming sustainable development in the Civil Service through the Professional Skills In Government programme and embedding sustainable development into the curriculum of the National School of Government, to be launched in the first half of 2005
- establishing an Academy for Sustainable Communities and launching a new 'How To' programme to promote the take up and use of new and existing powers to transform the local environment
- working with the Audit Commission to strengthen the Comprehensive Performance Assessment of local authorities to take more account of sustainable development and the local environment
- all central Government departments and their executive agencies will produce focused sustainable development action plans based on this strategy by December 2005
- reviewing the effectiveness of arrangements to deliver sustainable development at the regional level
- a new Sustainable Development Programme as part of the UK's Global Opportunities Fund, complemented by additional Defra funding to help deliver commitments from the World Summit on Sustainable Development, and
- monitoring more effectively delivery of the UK's international sustainable development priorities.

From Here to Sustainability – The LSC Strategy for Sustainable Development

Education is considered to play a crucial part in the future mainstreaming of sustainability. As such integration of skills delivery with sustainable development will be essential. The LSC's Strategy for Sustainable Development – From Here to Sustainability (2005) outlines its vision that 'the learning and skills sector will proactively commit and contribute to sustainable development through its management of resources, the learning opportunities it delivers and its engagement with communities'.

The Stern Review

The Stern Review was commissioned by the Chancellor of the Exchequer as a contribution to assessing the evidence and building understanding of the economics of climate change.

The Review examines the evidence on the economic impacts of climate change itself, and explores the economics of stabilising greenhouse gases in the atmosphere. The second half of the Review considers the complex policy challenges involved in managing the transition to a low-carbon economy and in ensuring that societies can adapt to the consequences of climate change.

Although not specifically a skills review, the final document identifies the need to provide skills and to ensure that adequate training and support is provided to develop the required skills.

The review included the following points;

- The development and deployment of a wide range of low-carbon technologies is essential in achieving the deep cuts in emissions that are needed.
- The low carbon energy technology markets could grow to be worth hundreds of billions of dollars each year, and employment in these sectors will expand accordingly.
- The Government will ensure that an understanding of how to apply sustainable development principles is a key part of policy skills for the future.

- The Academy for Sustainable Communities will work with partners to promote a new agenda for sustainable communities, increase the availability of generic skills and widen and improve access to sustainable communities skills.
- It is important to redirect energy-sector research, development and investment towards low-carbon technologies.
- It is important to avoid getting 'locked into' long-lived high carbon technologies, and to invest early in low carbon alternatives.
- A major R&D effort on energy storage and storage systems will be crucial for the achievement of a low-carbon energy system. This is important for progress in transport, and for expanding the use of low-carbon technologies,
- Policies to remove the barriers to behavioural change are a critical element.
- A shared understanding of the nature of climate change and its consequences should be fostered through evidence, education, persuasion and discussion.
- Government has an important role in directly funding skills and basic knowledge creation for science and technology it may be difficult to expand research capacity very quickly as the skilled researchers may not be available.
- Capacity constraints may arise because of a shortage in a required resource. For example, there may be a shortage of skilled labour to install a new technology.
- Training architects, designers and construction technicians on the principles and application of 'sustainable' design and efficient technologies, and on relevant policy frameworks develops market capacity to supply efficient buildings.
- Modelling for this review suggests that the output of low-carbon technologies in the energy sector will need to expand nearly 20-fold over the next 40-50 years to stabilise emissions, requiring new generations of engineers and scientists to work on energy-technology development and use.

The Egan Report on Skills for Sustainable Communities

The Egan Report considered the evidence for generic skills and people shortages. A number of previous studies point to shortages of generic skills amongst built environment professionals, and there is evidence of people shortages in some core occupations (e.g. civil and structural engineers, town planners, transport planners). Both of these shortages could hamper the ability to deliver the Sustainable Communities Plan. The Egan Report did not make any direct references to the needs of a low carbon resource efficient economy but include many recommendations on the need for generic skills to improve the skill set of people engaged with the built environment with regard to the creation of sustainable communities.

Action is needed both to encourage more people to enter core occupations, and to upskill and provide information to all three of the groups identified in the report. But the breadth of these occupations and their different training and accreditation processes make it difficult for existing providers and institutions to deliver the requisite skills to everyone involved. To address this issue, things need to be done differently.

Egan firmly believes that attempting to upskill professionals in isolation will not produce sustainable communities. Instead success will lie in changing the behaviour, attitudes and knowledge of everyone involved, many of whom may not have realised in the past that they had anything to do with each other, or with sustainable communities. There is a desire to see planners interacting with tenant associations, highways engineers teaming up with urban designers, and central government officials who plan hospitals and schools working with those who will be maintaining the surrounding streets and buildings in ten years time. There is no quick fix – sustainable communities are a holistic long-

term objective requiring a holistic approach to skills to deliver the outcome we are seeking and this requires an appropriate delivery method to achieve this upskilling.

The report recommends;

- that Government should work with education providers, professional institutions, employers, Sector Skills Councils and Regional Centres of Excellence to ensure that an introduction to the generic skills forms part of existing formal training courses for built environment professions; and that cross-sector working is introduced at an early stage;
- that access to information about sustainable communities needs to be made available to a wide audience to enable them to contribute to delivering such communities;
- that all new proposals for major building developments should meet recognised design quality guidelines or standards where they exist – for example, the Construction Industry Council's Design Quality Indicators, and BREEAM EcoHomes.

Improving young people's understanding of the importance of the sustainable communities agenda can be helpful in initiating them into the complex decision making processes around planning, delivering and maintaining sustainable communities, and through this understanding they are more likely to want to 'participate'. So awareness raising amongst school pupils should be seen as in investment in the future of sustainable communities.

Employers and professional institutions will need to consider a wide variety of ways of delivering the requisite generic and, specialist/technical skills. This implies building on and extending existing work to improve access to training through flexible entry requirements, accrediting prior learning, and distance learning. It also includes consideration of on-line learning, delivering courses in modules which can fit around other life commitments, in-service training, and informal learning opportunities.

Securing the Regions Future: Strengthening Delivery of Sustainable Development in the English Regions

This report sets out the ways in which the Government will strengthen the delivery of sustainable development in the English regions in response to the Sustainable Development Commission's review of sustainable development in the English regions and its 16 recommendations. The government aims to work with regional bodies across the regions to promote the sustainable development agenda. This agenda encompasses the need for low carbon and resource efficient skills.

The report sets out 20 recommendations to increase the regions' contribution to delivering sustainable development. The key elements of this approach are:

- Using the sustainable development principles and priorities to underpin the refreshed or updated high-level regional strategies.
- Creating a strengthened role for regional sustainable development roundtables as 'champion bodies'.
- Embedding sustainable development within the work of Government Offices and across their organisations so as to become exemplars in the regions.
- Supporting the role of Regional Assemblies in delivering sustainable development through all their functions.
- Working with Regional Development Agencies to help them deliver economic productivity, which delivers sustainable development at the same time - and to ensure that this contribution is fully reflected in Regional Development Agency assessments.
- Maximising the contribution which city-regions, sub-regions and inter-regional strategies can make to delivering sustainable development through innovative ways of working at these levels.

Energy White Paper 2003 – Our Energy Future – Creating a Low Carbon Economy

In its 2003 Energy White Paper, the Government put the goal of moving to a low carbon economy at the heart of its energy strategy, and set out a long term goal of reducing carbon dioxide emissions by some 60 per cent by about 2050, with real progress to be shown by 2020. The document identified the need for early, well-planned action to provide a framework within which businesses and the economy generally, including the jobs and skills base, can adjust to the need for change.

The white paper envisaged that the "new" sector skills network would work with the energy industry to develop the skills that industry needs. It also identified the need to improve skills through better education for young people and greater training opportunities for those already in the workforce

With regard to specific skills the white paper suggested that the skills problems are widespread:

- nearly a third of staff in offshore oil companies are over 45. 20% of companies provided no regular staff training - nearly 40% for smaller companies;
- even without new build the nuclear fuel cycle, power generation and environmental restoration sectors are likely to need around 19,000 graduates and skilled trades people over the next 15 years to replace retirements and satisfy demand in environmental restoration;
- the Gas and Water Industry National Training Organisation (GWINTO) has predicted that there could be a major shortage of skilled
- gas installers in the coming years; and
- key skills in companies building major infrastructure such as power stations and refineries are currently concentrated in the over-50s.

Many employers invest in training but finding time and resources can be difficult, particularly for smaller companies. The Manufacturing Strategy emphasised the importance of a skilled workforce to a productive and competitive economy - not only technical skills but also leadership and management skills.

This strategy was followed by the Energy White Paper - Meeting the Energy Challenge in May 2007.

Energy White Paper - Meeting the Energy Challenge - May 2007

The 2007 Energy White Paper identified that the move to a secure and low carbon economy requires the development of technologies, products and processes to reduce the carbon emissions from energy. There is a need to harness cleaner sources of energy, such as wind, waves and tides, and find ways to decarbonise fossil fuels, including through more efficient production and use. There is also a need for skilled people to develop, install and operate these technologies. Without these developments we will be unable to meet our carbon reduction goals and we will have fewer sources of energy to rely on within our energy mix.

The White Paper proffers the argument the skills outlook is challenging and that we must ensure, not only a transfer of skills, but of know-how and experience, to a new generation of workers. In addition, we must develop new skills sets and competencies to deliver and operate the low carbon economy, and maintain the skills we need to deliver secure energy supplies.

Success in the low carbon economy will require not only the right conditions for the large scale investment needed but also the skills and experience in the workforce to deliver that investment and

ensure that the infrastructure is effectively and safely run. The Government asked the Sector Skills Councils to report on skills gaps in the energy sector and action being taken to address them.

The White Paper places responsibility with the Regional Development Agencies to support the development of projects (such as anaerobic digestion plants), by supporting the development of energy supply chains and skills, and by ensuring regeneration projects meet high standards of carbon efficiency.

In summary, the 2007 White Paper states that the Government and industry are already investing in low carbon energy technologies and we will continue to work together to overcome the barriers to development and deployment. The development and deployment of new technologies requires effective infrastructure, well-targeted funding, and the skills to bring forward a low carbon energy future.

Commission on Environmental Markets and Economic Performance Report – November 2007

The Commission on Environmental Markets and Economic Performance (CEMEP) was established by the UK Government in the light of the Stern Review on the Economics of Climate Change.

This Report sets out the actions that Commissioners believe should be taken by Government, business and others to drive investment and innovation in environmental markets in the UK, and in so doing seize the substantial opportunities for wealth and job creation.

The Goal

By making the UK one of the best locations in the world to develop and introduce low-carbon and resource-efficient products, processes, services and business models, the country can attract the investment today that will help create tomorrow's prosperity and jobs, as well as contributing to a cleaner environment. These benefits can be achieved without a need to 'pick winners' or predict future market leaders, and whether or not the businesses involved are UK-owned.

The Challenge

Achieving this goal will require a policy framework that drives investment and enterprise in environmental markets in the UK and provides more effective support for the development and commercialisation of environmental innovations.

The policies required are not cost free. There will be a trade-off between short-term costs and the potentially huge but uncertain longer term economic benefits in the form of higher growth and greater job creation than might have been achieved otherwise. This raises a set of practical and policy choices for governments.

But the policy framework needs to be developed further. Commissioners believe policies can too easily be framed by cost-benefit considerations that are too short-term. There needs to be greater understanding and institutional support across Government for taking longer-term costs and benefits into account and explicitly focusing some policy measures on harnessing market dynamics and innovation in meeting environmental goals.

The report is focussed around 4 main areas:

- Analysis.
- The Policy Response.
- The Business Response.
- Implementation.

The Policy Response
Policy needs to be designed to enable business to respond in the most cost-effective way but also to maximise the opportunities for wealth creation.
1. **Environmental Policy.** Measures such as putting a credible long-term price on carbon, better environmental regulations and removing barriers to commercialisation are needed to provide the appropriate signals to the economy.
2. **Innovation Policy: Market 'Pull'.** Market 'pull' instruments are required to support the larger scale deployment of emerging innovations by helping to create 'lead markets', which – in the environmental field – do not generally exist in the absence of policy intervention.
3. **Innovation Policy: Supply 'Push'.** These policies need to be underpinned by effective investment in the technologies and skills that will help develop competencies in the UK, and around which the new industries of the future will emerge.

In many areas, policy is set at European Union level and above, so this approach needs to be taken forward within a strong international context. Policy making at this level will help reduce concerns about impact on the UK's international competitiveness, and increases the scale and attractiveness of the market opportunities created.

The Business Response
1. **Business** – market opportunities in environmental goods and services and the wider economy, actions businesses can take themselves and business actions facilitatated by government.
2. **Employees** – skills and employment, employee led initiatives.
3. **Investors**
4. **Consumers**

The report and the subsequent Government response recognised the key role that skills play in a successful transition to a LCREE.

Implementation
In this Report, Commissioners make the case for additional policies to support innovation directly and for explicitly joining up innovation policies with environmental policies. They also highlight the need to find ways to value innovation properly in public finance. CEMEP recognises this cannot be achieved overnight. The agenda covers many Government Departments and agencies and valuing innovation is fraught with practical difficulties. **Capacity building** and training may be needed for officials. However, CEMEP is also clear that making progress will depend on commitment from the highest levels in Government and clear **ownership** of this agenda. Government should consider whether existing structures and organisation can provide this.

Commissioners also recognise that all **stakeholders** have a role to play, and urge all to consider how they can contribute to the implementation of this Report.

The commission made the following recommendations:
1. Government should set credible, long-term environmental goals, consistent with business investment cycles. One means of achieving this is through building national consensus by opening decision making to wider society. 'Credible' and 'consensus' need not mean unambitious. Where a pressing environmental case can be made, goals should be set in areas other than climate change, such as products and materials. The newly established Products and Materials Unit within Defra should facilitate this.

2. Government, working with EU partners as necessary, should urgently consider options to reduce the uncertainty in carbon prices under the EU Emissions Trading Scheme, or at least its impact on business, and so increase the incentives to invest and innovate to cut carbon emissions.
3. Government should explore the scope for making greater use of progressively updated or 'dynamic' performance standards to drive improvements in the resource efficiency of products, particularly at the EU level.
4. Government should ensure that it sets out and adheres to well-defined timetables for the implementation of environmental legislation. Examples of where this would be relevant are implementation of the Energy Using Products (EuP) Directive, and the proposals in England's Waste Strategy 2007 to consider landfill bans for certain materials (should these be taken forward).
5. Government should commission a study of how the long-term needs and opportunities from innovation can be incorporated into cost-benefit analysis guidance, with a view to assessing longer term impacts on economic performance routinely in environmental policy appraisal.
6. Government Departments' and regulatory agencies' science and innovation strategies should not focus only on the use of science to support policy, but should address their role in inducing and rewarding private sector innovation that furthers the Government's environmental objectives.
7. Government, business and the relevant bodies should review the product approvals regime in the construction sector to better understand the barriers to introducing innovative, sustainable products. Measures should be identified to overcome these barriers and, where appropriate, applied more widely.
8. Government should review the duties of the economic regulators in the energy and water sectors to give greater prominence to the importance of environmental innovation in meeting sustainability goals, and back this up with guidance as to how a more complex set of duties might be interpreted.
9. Government should facilitate the scaling-up and replication of the Forward Commitment Procurement (FCP) model in the public sector by:
• identifying where better, more cost effective solutions are needed to achieve environmental policy objectives;
• developing the public sector's capability to engage effectively with the market using FCP, including by establishing a 'Challenge' scheme; and
• adopting the FCP model for the 'Zero Waste Places' initiative.
10. Government should establish 'Environmental Innovation Zones' where local area partnerships are empowered to use a range of policy measures to bring forward innovative solutions to deliver unmet environmental goals. This should be seen as the first in a series of progressive steps to transforming market sectors and creating economic opportunities on a wider scale. Successful examples should be replicated and participants encouraged to collaborate, where appropriate, to create economies of scale.
11. To improve the development and uptake of renewable and low-carbon energy technologies in the UK, Government should use targeted sectoral deployment support measures more widely, with careful attention to the choice of instrument for different stages of technology maturity.
12. To leverage best overall value for money from the funds available, existing capabilities and new initiatives in RD&D across the public sector and industry should be better coordinated. Synergies should be sought between different strands of innovation support, including linking RD&D support to procurement opportunities.
13. An 'Options Approach' should be taken to RD&D support, whereby:
• a diverse portfolio of emerging technologies is supported as consistently as possible beyond early-stage R&D and through the development lifecycle; but
• progress is reviewed at the end of each development stage, and support withdrawn for underperforming technologies.
14. Government should develop a strategic capability to prioritise its RD&D support for innovation in environmental markets, using transparent criteria to target those technologies with the greatest environmental and economic benefits.

15. To create market opportunities by improving the eco-efficiency of their operational performance and developing environmentally improved products and services, business should:
• address the whole life cycle of products, to enable all environmental impacts from 'cradle to grave' to be identified and reduced;
• investigate the scope for 'cradle to cradle' or 'closed-loop' production, where recycled materials become the feedstock for new products, and spreading new practices through the supply chain;
• assess how to re-engineer processes to cut costs while reducing pollution and resource consumption and avoiding environmental risk;
• investigate the scope for re-designing or re-manufacturing goods, incorporating environmental factors from the beginning of the design process; and
• consider how to create higher profits while reducing resource (including energy) consumption, by selling added-value services rather than more products.

16. Government should consider the need for a longer-term, better-resourced system to advise business on resource efficiency, with more emphasis on upstream measures and dissemination. This should inform the Government's ongoing Business Support Simplification Programme.

17. Government and industry should work together to improve the provision of training and professional development for supply chain management and public and private procurement professionals, to enable them to better manage the environmental implications of their supply chains.

18. Government, business, trade unions and other stakeholders should jointly develop, agree and adopt standardised protocols for measurement and reporting of carbon and other impacts, such as use of material resources and water. These should provide clear and simple, yet robust and credible, information to allow business and consumers to behave in a more resource-efficient way, and should be applied at intermediate stages as well as the end of supply chains.

19. Government, along with business, should sponsor a study of how reliable an indicator the carbon footprint is for resource use and environmental consequences more broadly, and which aspects it fails to reflect.

20. To better understand where employment opportunities and skills needs are emerging in environmental markets, all stakeholders have a responsibility and a role to play.
Government should map the various fora where these issues are already under discussion to help identify whether existing bodies are sufficient to take the agenda forward.
Following the Energy White Paper request to Sector Skills Councils (SSCs) to report on skills gaps in the energy sector, Government should invite the UK Commission for Employment & Skills to review with SSCs the implications for employment and skills of the move to a sustainable, low-carbon and resource efficient economy, and to make recommendations to Government.

21. Trade Unions should continue to press for companies to commit to and work for socially and environmentally responsible values. They should provide the necessary support frameworks for their members to lead and participate in workplace initiatives (such as training on resource efficiency) that will generate environmental improvements and increased employee loyalty and satisfaction.

22. To facilitate investor scrutiny of environmental markets, Government should consider integrating agreed standards of disclosure into corporate reporting guidance, and should encourage the establishment of voluntary benchmarks and consistent methods for corporate, pension fund and charity environmental disclosure.

23. Policies on the introduction of smart metering should create a clear and credible market requirement against which business can invest in the cost-effective deployment of technology. In the water sector, for example, a clear commitment to the introduction of flexible tariffs would achieve this.

24. All interested parties, including Government, business, investors, employees and consumers, should consider how they can contribute to the implementation of CEMEP's recommendations.
This cross-cutting agenda must be driven forward across Government, and Government should consider whether existing structures and organisation can achieve this. It should also put in place

capacity-building measures, such as training at the National School of Government, to increase awareness among officials of the links between environment, competitiveness and innovation.

The Energy Markets Outlook Report – Published October 2007

The Energy Markets Outlook report provides energy market information on security of supply, looking forward over a fifteen-year time span. The intention is to help develop a shared understanding of the longer-term outlook for energy supply and demand, and to help understand emerging risks that could affect security of supply.

Malcolm Wicks said: "Security of energy supply is one of the fundamental challenges this country faces. We need to ensure that the market delivers enough energy supply in five years time, in ten years time and in fifteen years time.

Decisions are being taken, the market is delivering investment, but we can't let our guard down.

Underpinning this is the need to move as quickly as reasonably possible towards a low-carbon economy. The sooner the world tackles climate change the better, both economically and environmentally. The best way of reducing emissions from energy is to use less. But whatever the exact composition of the future energy mix is, it must clearly involve a far greater role for renewable energy."

The report highlights key signals to the market, including:

- Significant medium-term opportunities for the construction of new electricity generation capacity in response to expected demand and plant closures. This is consistent with the conclusion set out in the Energy White Paper that around 20 to 25 gigawatts (GW) of new generation will be required by 2020. Companies have already announced over 14 GW of new generation.
- Delivery of new gas capacity and planned new infrastructure should more than compensate for reduction in indigenous production in the medium term, although whether the infrastructure is actually used to deliver gas will depend on the market price. Further investment will be needed to avoid market tightness around the middle of the next decade and in subsequent years. Alongside pipeline supplies, the global Liquefied Natural Gas market provides an opportunity to access additional sources of gas on a more flexible basis.
- The future use of other fuels - coal, oil and nuclear fuels - is unlikely to be limited by resource availability. There may be scope for additional indigenous coal production.
- There is a continued need for skills and resources in the engineering and construction sectors in order for new infrastructure to be provided. Delays caused by the planning system also have a major impact on the deliverability of new infrastructure and the Governments proposals for planning reform are intended to address this.
- Increases in the price of carbon should encourage investment in new, low-carbon generating capacity in the long term. In the short term, however, uncertainty about the future of the carbon market may cause delays in investment in new generating capacity. This could potentially be one cause of temporary market tightness in the years ahead, if this uncertainty is sustained.
- Greater deployment of renewables will have an important role to play in cutting carbon emissions. Maintaining security of supply while expanding the use of renewable energy sources is achievable, given the UKs significant primary renewable resources, although this will involve some additional costs.

Prosperity for All in the Global Economy : The Leitch Review of Skills - 2006

The Chancellor of the Exchequer and the Secretary of State for Education and Skills commissioned the Leitch Review in 2004 to examine the UK's optimal skills mix in order to maximise economic growth, productivity and social justice. In addition, the Review was asked by the Chancellor in Budget 2006 to consider how best to integrate employment and skills services.

What do we mean by skills?

Skills are capabilities and expertise in a particular occupation or activity. There are a large number of different types of skills and they can be split into a number of different categories. Basic skills, such as literacy and numeracy, and generic skills, such as team working and communication, are applicable in most jobs. Specific skills tend to be less transferable between occupations. Most occupations use a mix of different types of skills. The most common measures of skills are qualifications. On the job training in the workplace is a vital source of skills development and career progression. The Review recognises the importance of looking at these wider definitions of skills. For individuals, they provide portability in the labour market, allowing them to demonstrate the skills they have aquired. For employers, they provide valuable signals when recruiting new workers and also motivate employees to complete their training. Qualifications form a major part of employer recruitment strategies, especially screening candidates prior to interview. As a result, the majority of individuals prefer studying towards a qualificationa and over one half of employers say they would like to support their employees to gain qualifications through staff training. Qualifications can be grouped into five different levels: full level 2 equates to 5 good GCSEs or their vocational equivalents, full level 3 to two or more A Levels and level 4 and above to degree level qualifications. Levels of literacy and numeracy tend to be based on surveys or on the proportion of the workforce with English or Maths qualifications.

The global economy is changing rapidly, with emerging economies such as India and China growing dramatically, altering UK competitiveness. The population is ageing, technological change and global migration flows are increasing. There is a direct correlation between skills, productivity and employment. Unless the UK can build on reforms to schools, colleges and universities and make its skills base one of its strengths, UK businesses will find it increasingly difficult to compete. As a result of low skills, the UK risks increasing inequality, deprivation and child poverty, and risks a generation cut off permanently from labour market opportunity. The best form of welfare is to ensure that people can adapt to change. Skills were once *a* key lever for prosperity and fairness. Skills are now increasingly *the* key lever. A radical step-change is necessary.

The UK's productivity – how much workers produce – has improved in recent years. Despite this, productivity in the UK still lags behind that of comparator nations: the average French worker produces 20 per cent more per hour than the average UK worker, the average German worker 13 per cent more and the average US worker 18 per cent more. Skills are a key lever within our control to improve productivity in the workplace – one fifth or more of the UK's productivity gap with countries such as France and Germany results from the UK's relatively poor skills. Differences in management practices between the USA and the UK, for example, explain 10 to 15 per cent of the productivity gap in manufacturing between the two countries. This indicates that both skills provision and management are important elements in increasing productivity.

Productivity is increasingly driven by skills. The ability of firms to succeed in the face of growing international competition depends increasingly on the skilled labour force they can draw from. Skilled workers are better able to adapt to new technologies and market opportunities. Higher levels of skills drive innovation, facilitate investment and improve leadership and management. For innovation to be effectively implemented, businesses must be able to draw on a flexible, skilled workforce.

To achieve world class prosperity and fairness in the new global economy, the UK must achieve world class skills. Without world class skills, UK businesses will find it increasingly difficult to

compete and innovate. The employment opportunities of the lowest skilled will continue to decline, risking a lost generation, cut off permanently from labour market opportunity.

The UK must become a world leader in skills. Skills is the most important lever within our control to create wealth and to reduce social deprivation.

Skills projections for 2020

History tells us that no one can predict with any accuracy future occupational needs. The Review is clear that skill demands will increase at every single level. Better skills will be needed at higher levels to drive leadership, management and innovation – these are key drivers of productivity growth. Intermediate skills must be improved to implement investment and innovation. Basic skills are essential for people to be able to adapt to change. People lacking basic skills will be most at risk of exclusion in a global economy.

Improving the skills of young people, while essential, cannot be the sole solution to achieving world class skills. Improvements in attainment of young people can only deliver a small part of what is necessary because they comprise a small proportion of the overall workforce. Demographic change means that there will be smaller numbers of young people flowing into the workforce towards 2020.

More than 70 per cent of the 2020 working age population are already over the age of 16. As the global economy changes and working lives lengthen with population ageing, adults will increasingly need to update their skills in the workforce. There is a pressing need to raise the rates of skills improvements among adults – the UK cannot reach a world class ambition by 2020 without this.

The Government and Devolved Administrations have extremely demanding targets already in place to improve skills across the UK, for young people and adults and across all skill levels. These will be difficult to achieve and must not be taken for granted. Even if these targets are met, the Review has found that the UK will still fail to significantly improve its relative position by 2020, lagging behind key comparator nations with deficits across all skill levels.

This continuing shortfall will have profound implications for the UK economy and society, constraining prosperity, business ability to compete, and individual pay and job prospects. To succeed in the new global economy, the UK must raise its sights and aim for world class skills. This will require a new shared national mission, moving beyond the old distinction between voluntarism and compulsion, forging a new compact between the Government, employers, trades unions and individuals.

A Compelling Vision for the UK

The Review recommends that the UK commit to becoming a world leader in skills by 2020, benchmarked against the upper quartile of the OECD. This means doubling attainment at most levels. Stretching objectives for 2020 include:

• 95 per cent of adults to achieve the basic skills of functional literacy and numeracy, an increase from levels of 85 per cent literacy and 79 per cent numeracy in 2005;

• exceeding 90 per cent of adults qualified to at least Level 2, an increase from 69 per cent in 2005. A commitment to go further and achieve 95 per cent as soon as possible;

• shifting the balance of intermediate skills from Level 2 to Level 3. Improving the esteem, quantity and quality of intermediate skills. This means 1.9 million additional Level 3 attainments over the period and boosting the number of Apprentices to 500,000 a year;

• exceeding 40 per cent of adults qualified to Level 4 and above, up from 29 per cent in 2005, with a commitment to continue progression.

Principles

The following principles underpin delivery of a raised ambition:

• **shared responsibility.** Employers, individuals and the Government must increase action and investment. Employers and individuals should contribute most where they derive the greatest private returns. Government investment must focus on market failures, ensuring a basic platform of skills for all, targeting help where it is needed most;

• **focus on economically valuable skills.** Skill developments must provide real returns for individuals, employers and society. Wherever possible, skills should be portable to deliver mobility in the labour market for individuals and employers;

• **demand-led skills.** The skills system must meet the needs of individuals and employers. Vocational skills must be demand-led rather than centrally planned;

• **adapt and respond.** No one can accurately predict future demand for particular skill types. The framework must adapt and respond to future market needs; and

• **build on existing structures.** Don't always chop and change. Instead, improve performance of current structures through simplification and rationalisation,

• **stronger performance management and clearer remits.** Continuity is important.

The Prize for the UK

The prize for achieving this ambition is great – a more prosperous and fairer society. The Review estimates a possible net benefit of at least £80 billion over 30 years. This would come from a boost in the productivity growth rate of up to 15 per cent and an increase in the employment growth rate by around 10 per cent. Social deprivation, poverty and inequality will diminish.

Remit

The Review's remit is to focus on adult skills. This is because 70 per cent of the 2020 working age population have already left compulsory education and the flow of young people will reduce. However, the Review also recognises how vital effective education for young people is to the new ambition. School standards have improved over the past decade, with more young people than ever achieving five good GCSEs. And yet, more than one in six young people leave school unable to read, write and add up properly. The proportion of young people staying in education past 16 is below OECD average. The Review emphasises how critical reforms to GCSEs are to improve functional literacy and numeracy. The new 14-19 Diplomas must succeed. Once the Government is on track to successfully deliver Diplomas, demonstrated by rising participation at age 17, it should implement a change in the law, so that all young people must remain in full or part-time education or workplace training up to the age of 18.

Main Recommendations

• **increase adult skills across all levels.** Progress towards world class is best measured by the number of people increasing skills attainment. The raised ambitions will require additional investment by the State, employers and individuals. The Government is committed to increasing the share of GDP for education and skills. Additional annual investment in skills up to Level 3 will need to rise to £1.5-2 billion by 2020. Increased investment is required in higher education, but costings are difficult to project accurately;

• **route all public funding for adult vocational skills in England, apart from community learning, through Train to Gain and Learner Accounts by 2010.**

• **strengthen employer voice.** Rationalise existing bodies, strengthen the collective voice and better articulate employer views on skills by creating a new Commission for Employment and Skills, reporting to central Government and the devolved administrations. The Commission will manage employer influence on skills, within a national framework of individual rights and responsibilities;

• **increase employer engagement and investment in skills.** Reform, relicense and empower Sector Skills Councils (SSC). Deliver more economically valuable skills by only allowing public funding

for vocational qualifications where the content has been approved by SSCs. Expand skills brokerage services for both small and large employers;
• **launch a new 'Pledge' for employers to voluntarily commit to train all eligible employees up to Level 2 in the workplace.** In 2010, review progress of employer delivery. If the improvement rate is insufficient, introduce a statutory entitlement to workplace training at Level 2 in consultation with employers and unions;
• **increase employer investment in Level 3 and 4 qualifications in the workplace.** Extend Train to Gain to higher levels. Dramatically increase Apprenticeship volumes. Improve engagement between employers and universities. Increase cofunded workplace degrees. Increase focus on Level 5 and above skills;
• **increase people's aspirations and awareness of the value of skills to them and their families.** Create high profile, sustained awareness programmes. Rationalise existing fragmented 'information silos' and develop a new universal adult careers service; and
• **create a new integrated employment and skills service, based upon existing structures, to increase sustainable employment and progression.** Launch a new programme to improve basic skills for those out of work, embedding this support for disadvantaged people and repeat claimants. Develop a network of employer led Employment and Skills Boards, building on current models, to influence delivery.

Impact
These recommendations will have a strong and enduring impact across all sectors of society. For example:
• all individuals will have a greater awareness of the value of skills development and easier access to the opportunities available;
• workless people will have a better chance to find a job through effective diagnosis of their skills needs and greater support as they make the transition into sustainable work;
• low-skilled workers will have more chances to gain a full Level 2 qualification and basic skills in the workplace through Train to Gain, and more control over flexible, rewarding learning through their Learner Account;
• skilled workers will have more opportunities to develop their careers in the workplace, through Apprenticeships, degrees and management and leadership programmes;
• small firms will have easier access to relevant training for their employees. Management skills, competitiveness and productivity will improve;
• employers will have more influence over skills strategy within a simplified system, greater incentives to invest in skills across all levels; advice through expanded skills brokerage and increased assistance for workplace training; and
• skills deficiencies will reduce. Upskilling and portable, economically valuable qualifications throughout the entire workforce will ensure improved labour supply.

World Class Skills : Implementing the Leitch Review of Skills in England - 2007

In order to sustain and improve our position in the global economy, the Government has committed itself to the ambition of becoming a world leader in skills by 2020.

The 2020 ambition is very stretching. For England, it means by 2020 we would need:
- 95 per cent of adults to have the basic skills of functional literacy and numeracy3, up from 85 per cent literacy and 79 per cent numeracy in 2005;
- More than 90 per cent of adults to have gained at least a level 2 qualification (equivalent to 5 GCSEs at A*-C grade), up from 69 per cent in 2005; with a commitment to achieve 95 per cent as soon as possible;

- to shift the balance of intermediate skills from level 2 to level 3 (equivalent to 2 A levels), with 1.9 million more people achieving level 3 by 2020;
- to deliver England's share of the UK ambition to have 500,000 people a year in Apprenticeships; and,
- More than 40 per cent of all adults to have a higher education qualification (at level 44 and above) up from 29 per cent in 2005; with a commitment to achieving world-class levels.

While the new cross-cutting Public Service Agreements for skills and employment will be announced in the autumn, our current thinking is that by 2011 we should aim for:

- participation in full-time education amongst 16-18 years olds to rise to 84 per cent;
- 89 per cent of adults to be qualified to at least level 1 literacy, and 81 per cent to be qualified to at least entry level 3 numeracy;
- 79 per cent of adults to be qualified to at least full level 2; and 56 per cent of adults to be qualified to at least full level 3.

By 2014, we will aim for 36 per cent of adults to be qualified to level 4 and above.

Following the spending review settlement relevant to the Department for Innovation, Universities and Skills (DIUS) that was announced in the Budget 2007, we are substantially increasing the proportion of public funding for adult training that is 'demand led'.

In return for this increased level of investment, we will expect individuals and employers to take much more responsibility for improving their own skill sets and qualifications.

Supporting individuals to improve their skills and progress at work

We have to motivate many more adults to want to improve their skills and education. In order to do this, we will have to clearly show individuals the link between getting economically valuable skills, and getting good jobs and progressing in their chosen career. We will also work to remove any barriers related to a person's age, race, gender or class, that may be preventing them from having fair and equal access to more training and education opportunities.

DIUS and DWP will work together to create a joined-up employment and skills system. We will merge the information and advice services of learndirect and nextstep providers into a new universal adult careers service in England, working in partnership with Jobcentre Plus. The new careers service will ensure that everyone is able to access the help they need to take stock of where they are in achieving their goals and ambitions, and to get the support they need to advance themselves and achieve their full potential.

Flexible training for individuals will be offered in a way that can be combined with their job search and continued alongside work. Train to Gain brokerage and employer training funds will play an important part in supporting this objective.

We will pilot the new concept of 'Skills Accounts', which will give individuals greater ownership and choice over their learning, motivating them to gain skills and achieve qualifications, enter work and progress in employment.

We will bring forward new legislation to strengthen the current funding entitlement for adults to free training in basic literacy and numeracy skills, and to achieve their first full level 2 qualifications. This arrangement would not create any new obligations on employers, since the case for new legislation around workplace training will be reviewed in 2010.

Employers leading the way on skills

Treating employers and individual learners as the customers of the skills system is central to the idea of a demand-led approach. Through the measures set out in this plan, we will give employers the opportunity to exert real leverage and decision-making over both the content and delivery of skills and employment programmes. That will help us to build employer confidence in the qualifications and learning programmes provided by universities, colleges and training providers, and it will open the door to increased employer investment in skills. We will use employer satisfaction data to monitor whether the skills delivered contribute to improved business performance.

We will work with the Devolved Administrations to create a new UK Commission for Employment and Skills that will operate across the UK, and strengthen the employer voice at the heart of the system. We expect the UK Commission to be fully operational in 2008.

The UK Commission will provide a vigorous, expert, and external challenge to the employment and skills system at all levels, to ensure that it is delivering the services that employers and individuals need. It will also report to Government in 2010 on whether a statutory entitlement on training is appropriate, and whether further institutional change is required to deliver a better integrated employment and skills service.

In England, the UK Commission will advise Government on skills and employment strategy and targets; assess our progress towards achieving our world-class ambition; ensure that employment and skills services are integrated to meet the needs of individuals and employers; and oversee the performance and reform of the SSCs.

In England, the remit of the SSCs will be more sharply focused on: raising employer ambition and investment in skills at all levels; articulating the future skill needs of their sector; and ensuring that the supply of skills and qualifications is driven by employers.

Through their SSCs employers have the opportunity to play a leading role in the reform and development of vocational qualifications for their sector. Only those vocational qualifications which meet the standards set by the SSCs will be put onto the Qualifications and Credit Framework.

We will consider whether it would be beneficial to introduce new enabling legislation to make it easier for SSCs to introduce levy schemes where they consider that these would help improve skills and productivity in their sector, where a clear majority of employers in the sector support them, and where impact assessments are positive.

We will make it easier for employers to have their own in-house training programmes accredited through the Qualifications and Credit Framework.

We will continue to encourage more HE institutions to collaborate with employers to develop programmes and delivery methods that meet their higher level skills needs.

The Higher Education Funding Council for England (HEFCE), which is supporting a range of projects in HE institutions to develop employer engagement, will fund an additional 5,000 student places in 2008-09, co-funded with employers. We expect the HEFCE's work in this area to substantially expand in subsequent years.

In return, we want employers to increase their investment in skills, training and qualifications at all levels.

We want employers to be more demanding, and to clearly articulate what their skills needs and priorities are, in order to support business development. We also want them to engage with and challenge the learning and skills providers at all levels, to achieve high standards in the design and delivery of training.

Investing in National Skills Academies (NSAs), for example, offers employers an opportunity to directly influence the content and delivery of skills training for their sector, through further and higher education. We are on course to have 12 National Skills Academies in place by 2008. Longer term, we hope to have at least one Academy for each major sector of the economy.

A new partnership for the workplace

We want to encourage all employers in England to take responsibility for the skills of their workforce, by making a Skills Pledge to support their employees to become more skilled and better qualified, with Government help.

The Skills Pledge is a public, voluntary commitment that we launched in June 2007. Any organisation that signs up to the Skills Pledge undertakes to support their staff to get basic literacy and numeracy skills, and also to work towards achieving their first full level 2 qualification in an area that will be valuable to the employer. This is the core requirement for the pledge, but many organisations will want to extend their commitment to a higher level of training and skills beyond this.

Employers making the Skills Pledge will be able to access Government support to deliver their Pledge commitment through the Train to Gain service, including the support of an independent skills broker to help them assess their training needs and source the right provision for them, and free literacy, numeracy and first full level 2 training for their staff.

In 2010, we will review whether this voluntary approach is working sufficiently well, or whether the time has come to introduce a statutory entitlement to workplace training in England.

Train to Gain currently offers a skills brokerage service for employers, with full public funding for literacy and numeracy programmes and first full level 2 qualifications. But we intend Train to Gain to become a much broader service that will help employers of all sizes and in all sectors to improve the skills of all their employees, as a route to raising the performance of their businesses. It must also help employers and employees in disadvantaged communities, as well as those in more prosperous areas. Given the enormous potential benefits to their businesses, employers will be expected to pay towards the costs of this wider training effort.

Trade unions also have an important part to play in achieving our skills ambitions. There are now more than 18,000 trained Union Learning Representatives (ULRs) working across the country to encourage more people to participate in training. These ULRs are proving to be particularly effective in targeting people with low skills, or low confidence in their own ability to learn and benefit from training.

We will encourage Union Learning Representatives to work with employers to make the Skills Pledge, to draw up action plans for delivering the Pledge, and to help more employers and employees to access Train to Gain brokerage and funds for training.

We will also encourage unions and employers to work together to improve skills in individual workplaces, building on the achievements of the new union-sponsored training programme, Unionlearn. And, through the consultation on Business Support Simplification, we will look at

whether skills brokerage and business support brokerage should be combined into one seamless service from April 2009.

Equipping young people with the skills they need for work and life

The major focus of the Leitch Review was is on training and skills for adults. This is because 70 per cent of the 2020 workforce is already beyond the age of compulsory education. But our long term skills needs will only be met if we also ensure that young people have a better start than previous generations, and are equipped with the skills, competencies, understanding and attributes they need to succeed in a modern, sustainable economy.

In England, we have a major programme underway to reform education and training for 14-19 year olds. This programme includes rolling out new Diplomas in a number of broad occupational areas that have been developed with the SSCs.

We are making basic English, maths and ICT skills the cornerstone of young people's education, integrating them into Diplomas, Apprenticeships and GCSE English, maths and ICT, as well as creating a stand-alone qualification.

We have consulted on proposals to raise the participation age to 18, so that all young people would be required to continue in education or training until the age of 18. We will shortly be publishing a report of the consultation and have announced our intention to introduce legislation to implement these proposals.

We have also made a commitment to boost the number of Apprentices in England, and to ensure that all suitably-qualified young people will have access to an Apprenticeship. In 2007, the number of Apprentices has risen to 250,000. We want to build on this success by introducing a new entitlement to free training for those aged 19-25, in order to help more people in this target group to achieve their first full level 3 qualification. For many people in this group, an Advanced Apprenticeship will be the most appropriate programme. The Train to Gain brokerage service will help employers access the Apprenticeships scheme.

Following the recent Machinery of Government changes, sponsorship of the further education and higher education sectors now sits with the new Department for Innovation, Universities and Skills (DIUS). The DIUS will work in partnership with the Department for Children, Schools and Families (DCSF) to secure effective delivery of 14-19 reforms.

More detailed extracts from the high level documents are available below.

the National School of Government,	
The Home Office review of capacity building found that communities often do not have the skills or confidence to get involved and often do not have the support they need within easy reach. Better co-ordination is also needed within the voluntary and community sector and between national and local levels. Government's priorities for action in light of the review are set out in 'Firm Foundations: the Government's framework for community capacity building' (Home Office, 2004).	28
Including sustainable development in National Occupational Standards and accredited units which set out the skills and principles of practice for community development work.	30
Formal education has a crucial role to play in both raising awareness among young people of sustainable development, giving them the skills they need to put sustainable development into practice in later life; but also in forming good habits at an early age On behalf of the Government, the Department for Education and Skills (DfES) aims to ensure that sustainable development is embedded in the core education agenda across all education and skills sectors. A Sustainable Development Action Plan for Education and Skills, was launched in September 2003. There is an opportunity for schools to develop the skills of sustainable living not just through the curriculum, but through the examples that teachers set on a daily basis, and through pupils' direct experience of living and studying within the school environment.	37
The strategies, which are being developed following extensive processes of consultation, aim to encourage institutions within the college and university sectors to embed sustainable development within their teaching and learning, their management and leadership, and their engagement with the wider community.	38
To maintain a more competitive economy, to compete internationally and build ourselves sustainable communities, we need to improve the knowledge and skills base of everyone, including professionals and others in the workplace. Later parts of the strategy set out how we are planning to upgrade public sector skills for sustainable development, help business with corporate social responsibility and develop a strategy for sustainable development in the workplace, but we need to make "sustainability literacy" a core competency for professional graduates.	39
The Government's 2003 innovation review identified the environment as a key driver for future innovation. Improved, lower impact products and services need to be developed. Some will be specific environmental goods and services, such as technologies to minimise pollutants or promote resource efficiency, or renewable energy sources.	44
However, more action is needed if sustainable production is to be mainstreamed in business practice. For example, we need to understand better why business does not always take up opportunities for resource efficiency or to respond to environmental pressures. We need to encourage process re-design, lean manufacturing and ways to use waste from one business as a resource for another, and to integrate sustainable development into all business support programmes.	50
Several reports have identified an economy-wide gap in skills needed to deliver more sustainable consumption and production. This is being tackled through the Department for Education and Skills' Sustainable Development Action Plan. The Government has established a CSR Academy to support development of skills for corporate responsibility, and is working with professional bodies to integrate sustainable development competencies into their standards.	58
The Code for Sustainable Buildings (see Chapter 4) will establish new voluntary standards for resource efficiency. In addition, the Government will continue to demonstrate what	60

can be achieved by good design and management through our Millennium Communities programme. Through our work with the Housing Forum, English Partnerships, and others, the Government will continue to actively promote the use of good quality Modern Methods of Construction which can offer resource efficiency through reducing waste, better levels of productivity, energy efficiency, and improved health and safety.	
The design and use of transport is an important element of encouraging more Sustainable Consumption and Production. Chapter 4 outlines many actions on transport that will equally contribute to Sustainable Consumption and Production. For example, the Powering Future Vehicles Strategy work on clean, low-carbon vehicles and fuels, and the activities of the Low Carbon Vehicle Partnership.	61
Reducing greenhouse gas emissions. We will support this through measures including promoting energy efficiency and renewables.	69
The Government set out its strategy to address the challenges facing our energy system in 2003: 'Our energy future: creating a low carbon economy'. The White Paper provides a long-term framework for developing policies to ensure that UK has access to sustainable, reliable and affordable energy, through competitive markets.	79
The Government will take this forward with the intention that 10 per cent of all of its vehicles will be low carbon by 2012.	85
The Sustainable Development Commission is researching the techniques, costs, benefits and support mechanisms necessary to improve the resource efficiency of the existing building stock. The Government is developing with industry a Code for Sustainable Buildings. This will establish stretching voluntary standards for resource efficiency on key issues such as energy, water, waste and materials, which could collectively deliver significant carbon savings. The Code will encourage builders to go beyond the letter of the regulations and minimise resource use from the start, and will be updated as technology develops. The Code is being developed to apply to all new buildings, with the focus initially on new housing stock. In due course the Government's aim is to apply the Code also to major refurbishments of existing housing stock. An initial outline of the Code was produced at the end of January 2005.	87
The Government will ensure that an understanding of how to apply sustainable development principles is a key part of policy skills for the future and that all policies are properly appraised against the new principles of sustainable development.	154
Following the recommendation contained in Sir John Egan's Review 'Skills for Sustainable Communities' (2004), the Government has announced the establishment of a new Academy for Sustainable Communities. The Academy will work with partners to promote a new agenda for sustainable communities, increase the availability of generic skills and widen and improve access to sustainable communities skills. The Academy's programme will include the development of learning opportunities for the core occupations identified in the Egan Review, including those for Local Strategic Partnerships.	161
Stern Review Executive Summary	
Putting an appropriate price on carbon – explicitly through tax or trading, or implicitly through regulation – means that people are faced with the full social cost of their actions. This will lead individuals and businesses to switch away from high-carbon goods and services, and to invest in low-carbon alternatives.	18
The second element of climate-change policy is technology policy, covering the full spectrum from research and development, to demonstration and early stage deployment. The development and deployment of a wide range of low-carbon technologies is essential	19

in achieving the deep cuts in emissions that are needed. The private sector plays the major role in R&D and technology diffusion, but closer collaboration between government and industry will further stimulate the development of a broad portfolio of low carbon technologies and reduce costs. Many low-carbon technologies are currently more expensive than the fossil-fuel alternatives. But experience shows that the costs of technologies fall with scale and experience.	
Stern Review Conclusions	
Action on climate change will also create significant business opportunities, as new markets are created in low-carbon energy technologies and other low-carbon goods and services. These markets could grow to be worth hundreds of billions of dollars each year, and employment in these sectors will expand accordingly.	8
Emissions trading: Expanding and linking the growing number of emissions trading schemes around the world is a powerful way to promote cost-effective reductions in emissions and to bring forward action in developing countries: strong targets in rich countries could drive flows amounting to tens of billions of dollars each year to support the transition to low-carbon development paths.	9
The Stern Review	
Increasing scarcity of fossil fuels alone will not stop emissions growth in time. The stocks of hydrocarbons that are profitable to extract (under current policies) are more than enough to take the world to levels of CO_2 concentrations well beyond 750ppm, with very dangerous consequences for climate-change impacts. Indeed, with business as usual, energy users are likely to switch towards more carbon-intensive coal, oil shales and synfuels, tending to increase rates of emissions growth. It is important to redirect energy-sector research, development and investment away from these sources towards low-carbon technologies.	169
Energy systems are subject to very significant inertia. It is important to avoid getting 'locked into' long-lived high carbon technologies, and to invest early in low carbon alternatives.	193
Range of low-carbon technologies is already available, although many are currently more expensive than fossil-fuel equivalents. Cleaner and more efficient power, heat and transport technologies are needed to make radical emission cuts in the medium to long term. Their future costs are uncertain, but experience with other technologies has helped to develop an understanding of the key risks. The evidence indicates that efficiency is likely to increase and average costs to fall with scale and experience.	211
A range of options is currently available for decarbonising energy use in electricity generation, transport and industry, all of which are amenable to significant further development. These include:- • On and offshore wind. • Wave and tidal energy projects. • Solar energy (thermal and photovoltaic). • Carbon capture and storage for electricity generation (provided the risk of leakage is minimised) – Box 9.2 sets out the state of this relatively new technology, and what is known about costs. • The production of hydrogen for heat and transport fuels.	221

• Nuclear power, if the waste disposal and proliferation issues are dealt with. A new generation of reactors is being built in India, Russia and East Asia. Reactors have either been commissioned or are close to being commissioned in France, Finland and the USA. • Hydroelectric power, though environmental issues need to be considered and new sites will become increasingly scarce. The power output/storage ratio will also need to increase, to reduce the typical area inundated and increase the capacity of schemes to meet peak loads. • Expansion of bioenergy for use in the power, transport, buildings and industry sectors from afforestation, crops, and organic wastes. • Decentralised power generation, including micro-generation, combined heat and power (dCHP) using natural gas or biomass in the first instance, and hydrogen derived from low-carbon sources in the long term. • Fuel cells with hydrogen as a fuel for transport (with hydrogen produced by a low-carbon method). • Hybrid- and electric-vehicle technology (with electricity generated by a low-carbon method).	
Energy Storage. With the exception of biofuels, and hydrogen and batteries using low carbon energy sources, all the low carbon technologies are concerned with the instantaneous generation of electricity or heat. A major R&D effort on energy storage and storage systems will be crucial for the achievement of a low-carbon energy system. This is important for progress in transport, and for expanding the use of low-carbon technologies.	227
A low-carbon economy with manageable costs is possible, but will require a portfolio of technologies to be developed.	240
The rate of uptake of efficiency measures is often slow, largely because of the existence of market barriers and failures. These include hidden and transaction costs such as the cost of the time needed to plan new investments; a lack of information about the available options; capital constraints; misaligned incentives; together with behavioural and organisational factors affecting economic rationality in decision-making.	220
Policies to remove the barriers to behavioural change are a third critical element. Opportunities for cost-effective mitigation options are not always taken up, because of a lack of information, the complexity of the choices available, or the upfront cost. Policies on regulation, information and financing are therefore important. And a shared understanding of the nature of climate change and its consequences should be fostered through evidence, education, persuasion and discussion.	308
Government has an important role in directly funding skills and basic knowledge creation for science and technology it may be difficult to expand research capacity very quickly as the skilled researchers may not be available.	362
Capacity constraints may arise because of a shortage in a required resource. For example, there may be a shortage of skilled labour to install a new technology.	370
In the buildings sector, for example, large numbers of poor quality and inefficient buildings are constructed despite the existence of a range of cost effective technologies and design techniques. Training architects, designers and construction technicians on the principles and application of 'sustainable' design and efficient technologies, and on relevant policy frameworks develops market capacity to supply efficient buildings. However, coordinating different elements of the construction industries is a key barrier.	388
Governments also fund the education and training of scientists and engineers. Modelling for this review suggests that the output of low-carbon technologies in the energy sector will need to expand nearly 20-fold over the next 40-50 years to stabilise emissions, requiring new generations of engineers and scientists to work on energy-technology development and use.	362

Individual preferences play a key role, both in shaping behaviour and demand for goods and services affecting the environment, as well as in underpinning political action. Public policy on climate change should seek to change notions of what responsible behaviour means, and promote the willingness to co-operate. Education and promotion of clear discourse on the potential risks, costs and benefits together with leadership by the governments, businesses, investors, communities and individuals on the potential for action is critical.	398
The Egan Review – Skills for Sustainable Communities	
When the Deputy Prime Minister invited me to undertake a Skills Review, the focus was very much on the professional, built environment skills necessary to deliver sustainable communities. Professional skills are vitally important, but simply upgrading these in isolation will not, I believe, deliver the outcomes the Government is seeking – communities in which people want to live and work, and which are sustainable for future generations.	4
We recommend that Government works with the Sustainable Buildings Task Group to develop further our proposal for a sustainable communities code/benchmarking, that will give clear information about the environmental and quality standards that sustainable communities should achieve, and how these translate into practical building standards. Government should also look at ways of incentivising progress, with the longer term aim of meeting developments that achieve carbon emissions and waste minimisation standards consistent with a sustainable one planet level within, say eight years.	11
We considered the evidence for generic skills and people shortages in the core group. A number of studies point to shortages of generic skills amongst built environment professionals, and there is evidence of people shortages in some core occupations (e.g. civil and structural engineers, town planners, transport planners). Both could hamper our ability to deliver the Sustainable Communities Plan.	10
We recommend that the Government should work with professional institutions, local authorities, education institutions, Sector Skills Councils and Regional Centres of Excellence to develop professional campaigns that will raise the profile of core occupations and understanding of their role in sustainable communities and in turn encourage entrants into these occupations.	14
For some core occupations, specifically built environment professionals, the generic skills, behaviours and knowledge need to sit alongside existing specialist or technical skills such as planning, architecture, design, and surveying. We have not undertaken an audit of professional training because we do not believe that this is where the fundamental difficulties lie. We concur with the findings of the Urban Task Force which concluded that "the teaching in basic professional technical skills is excellent. The main problem is a lack of cross disciplinary learning with a strong vocational element". This view is underlined by recent work carried out by Oxford Brookes University on the skills base in the planning system. It concluded from the available literature that "currently planners are well equipped with discipline skills they need to undertake their work, but that it is the wider areas of key/transferable and professional/management skills where the needs and shortages occur, i.e. skills which can be acquired through initial education, but which also require experience". There is broad agreement in other studies that it is the generic rather than technical skills that are in short supply. KPMG/Urban Catalyst's work for ODPM and English Partnerships reached similar conclusions in respect of regeneration professionals, as did the stakeholder interviews carried out by Ernst and Young for this Review. Many of the respondents to our public consultation confirmed these views.	58

These findings suggested to us that the process of defining educational needs by the professions has delivered specialists who may have good technical skills but who have a less good understanding of generic skills and of what makes communities sustainable. We know some schools and professional bodies are already addressing the generic skills element of training courses, but want to see this becoming widespread. We are clear that there has to be a mechanism for introducing generic skills alongside the technical skills into the training of professionals (Chapter Four) and that specialist training has to be re-focussed on delivery of the final output – sustainable communities. This has implications for the way in which training courses are specified and accredited, that will need to be pursued with professional institutions and educational providers.	59
We recommend that employers of those in core occupations (local authorities, government, private sector consultancies and developers etc) should work with the key professional institutions, Sector Skills Councils, and other skills bodies to develop occupational benchmarks for core occupations (or enhance existing benchmarks where these exist) that reflect their sustainable communities role. The feasibility of an on-line benchmarking and assessment tool should be considered.	71
Securing the Regions' Futures	
The Way Ahead highlights, as one of the South West's great strengths and key economic assets, its quality of natural and built environment. As part of its ongoing development it is preparing a sustainable development toolkit consisting of best practice on, amongst other things, urban design, sustainable construction and low carbon usage, for use in the region.	49
For England it is also proposed that one of the priority areas for action would be sustainable development. This will allow funding to be provided to encourage innovation in the use of the environment as an economic driver, help business mitigate and adapt to climate change and promote increased energy and resource efficiency.	23
Our Energy Future – Creating a Low Carbon Economy	
We can get to a 60% cut in emissions by 2050 in a number of ways. But leaving action until the last minute is not a serious option. If we do not begin now, more dramatic, more disruptive and more expensive change will be needed later on. We need early, well-planned action to provide a framework within which businesses and the economy generally, including the jobs and skills base, can adjust to the need for change. This will for example allow business to plan to act in the course of normal capital replacement cycles. It will also encourage new technologies to come forward to help to meet the challenges we face.	8
We will continue our commitment to competitive energy markets and use market-based instruments to deliver our wider energy policy goals. And we will work with business to help them prepare for the low carbon economy of the future and to seize the opportunities that it provides. Through our new sector skills network we will work with the energy industry to develop the skills that industry needs.	15
To deliver these goals in the energy system we need to address what the Government has identified as the key drivers of productivity. These are: • to strengthen the competition regime to encourage firms to innovate and minimise costs and to deliver better quality goods and services to customers; to promote enterprise to help new and established businesses to start up, develop and grow; • to improve skills through better education for young people and greater training opportunities for those already in the workforce; • to support science, research and innovation to utilise the potential of new technologies and to develop new ways of working; and	95

• to encourage investment to improve the stock of physical capital.	
We need to address skills development, training and an ageing workforce in the energy industries. The problems are widespread: • nearly a third of staff in offshore oil companies are over 45 and only 6% under. 20% of companies provided no regular staff training - nearly 40% for smaller companies; • even without new build the nuclear fuel cycle, power generation and environmental restoration sectors are likely to need around 19,000 graduates and skilled trades people over the next 15 years to replace retirements and satisfy demand in environmental restoration; • the Gas and Water Industry National Training Organisation (GWINTO) has predicted that there could be a major shortage of skilled gas installers in the coming years; and • key skills in companies building major infrastructure such as power stations and refineries are currently concentrated in the over-50s. Many employers invest in training but finding time and resources can be difficult, particularly for smaller companies. Our Manufacturing Strategy emphasised the importance of a skilled workforce to a productive and competitive economy - not only technical skills but also leadership and management skills. It also highlighted the need for a demand-led approach, combining government investment, access to best practice support and increased support for the science base. This implies close co-ordination across the industry, in particular between employers and education and training providers and also through supply chains (especially where seasonal shifts in workloads are a factor).	99
We recognise the interrelationship between skills, research and innovation: skills tend to drive innovation; in turn innovation creates more demand for new and established skills. A healthy research base is crucial to nurturing the skills needed to manage the effective application of emerging new energy technologies. Not all research training in our universities will produce radical new technologies but the skills and expertise developed will equip people for the vital task of implementing and maintaining new energy infrastructure. It also includes the developing SSCs for the Process and Manufacturing sector and the Science, Technology and Engineering Training Alliance (SEMTA), which will address some energy-related areas. Upgrading skills will be vital for effective delivery of the step change in energy efficiency, particularly in the household sector, which is our goal. We therefore welcome the proposed creation of an Energy Utility SSC and look forward to working through such an SSC, provided it achieves licensed status, to develop new ways to enhance the skills and training of employees in the energy efficiency industries.	101
The Electricity Training Association is commissioning a Skills Foresight Project to identify the skills requirements of the renewables industry to 2010; and GWINTO has made proposals to address shortages of gas installers including a pilot project with EAGA to deliver around 400 qualified central heating installers.	102
Energy White Paper - Meeting the Energy Challenge - May 2007	
We also want to mobilise the enthusiasm and potential of individuals and communities to generate their own energy locally, through solar panels and wind turbines for example. We are therefore bringing forward a range of measures to support more distributed forms of energy.	5
Our move to a secure and low carbon economy requires the development of technologies, products and processes to reduce the carbon emissions from energy. We need to harness cleaner sources of energy, such as wind, waves and tides, and find ways to	216 -

decarbonise fossil fuels, including through more efficient production and use. We also need skilled people to develop, install and operate these technologies. Without these developments we will be unable to meet our carbon reduction goals and we will have fewer sources of energy to rely on within our energy mix.	
All agree that the skills outlook is challenging and that we must ensure, not only a transfer of skills, but of know-how and experience, to a new generation of workers. In addition, we must develop new skills sets and competencies to deliver and operate the low carbon economy, and maintain the skills we need to deliver secure energy supplies.	233
Meeting the challenges of energy security and climate change will require strong international co-operation as a priority, both in taking forward the EU energy strategy and more widely. At home, it will require action by the Government, business and individuals. It is the Government's role to create the right conditions and incentives so that everyone can play their part. Success will require not only the right conditions for the large scale investment we need but also the skills and experience in our workforce to deliver that investment and ensure that our vital infrastructure is effectively and safely run. We are asking the Sector Skills Councils to report on skills gaps in the energy sector and action being taken to address them.	26
The Microgeneration Strategy aims to help development of microgeneration technologies, in the following ways: • a map of funding available for microgeneration R&D has been published on the DTI website to point companies to major funding sources in the UK; • a route-map of all technologies is being developed by DTI and industry to address the specific challenges faced by each individual technology; • DTI is working with the Sector Skills Councils to ensure the skills base develops to support the levels of demand in manufacturing, installing and maintaining microgeneration technologies; • the Microgeneration Strategy recognises the importance of educating children in energy efficiency through their schools. Schools can access funding through the Low Carbon Buildings Programme; and • working with industry to move away from grants-based funding to a more sustainable model.	95
RDAs will also support the development of DE projects (such as anaerobic digestion plants) for example, by supporting the development of energy supply chains and skills, and by ensuring regeneration projects meet high standards of carbon efficiency.	103
If nuclear power is to be viable, the market needs to respond to interest from firms in developing new nuclear power stations by increasing its ability to meet rising demand. The long lead times for nuclear power stations allow time for industry to plan ahead through such measures as placing early contracts well in advance to secure slots in manufacturers' order books for the production of certain components, and for training and recruitment. Such moves could reduce the risks that industry will suffer from shortages of skills and a lack of capacity in the supply chain.	203
The Government and industry are already investing in low carbon energy technologies and we will continue to work together to overcome the barriers to development and deployment. The development and deployment of new technologies requires effective infrastructure, well-targeted funding, and the skills to bring forward a low carbon energy future.	216

Appendix Two – Comments on LCREE Definition

The following are examples of the types of comments received on the LCREE definition:

- The definition makes sense.
- Needs to emphasise more the embedded carbon factors (ie. all resource use, materials, water etc… have a carbon impact).
- The definition discusses carbon per unit of output – this can make is seem less relevant to service sectors.
- Is there a difference between low carbon and resource efficient?
- Actions that are good for carbon are not always good for the environment as a whole.
- Requirement to consider carbon emissions and greenhouse gases.
- Technically the Energy White Paper said a Low Carbon Economy was 60% on 1990 but this is very old hat now. Any Low Carbon Economy would need to be at 80-90% now.
- Would have expected something in the definition about the 2020 and 2050 targets. Is this definition supporting or going further than the legal targets?
- There is no demand that can pull us along any trajectory to this outcome other than crisis.
- It is fine to refer to Sustainable Development within the definition but it is pretty meaningless to refer to the Brundtland definition.
- A low carbon economy should not just break the link between carbon emissions and growth. It should reverse it.
- A low carbon economy means an economy that has transformed so its emissions of greenhouse gases are stabilised at levels sustainable in the long term and which avoid significant climate change. This focuses on the end-state and includes a long term sustainable level of greenhouse gas emissions rather than just using specific numerical targets (which are likely to change as scientific understanding increases).
- IPCC 4th assessment scenario definitions:
    - Zero-Carbon Economy: No net global CO_2 emissions due to human activity – to limit climate change to 1-3 degrees by 2100 we need a zero-carbon global economy.
    - Low-Carbon Economy: 15Gt CO_2 emitted globally each year – to limit climate change to 2-5 degrees by 2100 we need a low-carbon global economy.
- The definition needs to pick up the suppliers and manufacturers of low carbon technologies.
- Clarify whether referring to greenhouse gas or carbon in the definition.
- 5th paragraph is confusing.
- The land management and agriculture sector thinks in terms of increased sustainability as opposed to increased productivity.
- Description is a bit unfocused as it bundles together the desired outcome, the actions that might contribute to that outcome, whether we even want that outcome and what else we might wish to achieve instead of the outcome. The use of phrases such as 'minimises carbon emissions' or 'utilises carbon resources in an efficient way' are rather ambiguous and have arbitrary standards.
- The use of LCREE is confusing. Should use sustainable economy.
- Definition of LCREE should refer to the 2005 strategy.
- The fact that some of the skills required are generic with cross sector importance is a key point which is backed up by research. The key is utilisation of these skills in new contexts. There is a school of thought that says all learning and developmental activities should have an element of LCREE considerations within them.

Appendix Three – List of Organisations Consulted

	Organisation	Evidence	Interview
	Priority Organisations		
Sector Skills Council's			
1.	Asset Skills	X	X
2.	Cogent	X	X
3.	Construction Skills	X	X
4.	Energy and Utility Skills	X	X
5.	E-Skills	X	X
6.	Improve Ltd	X	X
7.	Lantra	X	X
8.	Proskills UK	X	X
9.	SEMTA	X	X
10.	Skillfast UK	X	X
11.	Skills for Logistics	X	X
12.	Summit Skills	X	X
Other Organisations			
13.	Carbon Trust	X	X
14.	East Midlands Regional Development Agency	X	X
15.	Envirowise	X	X
16.	Institute of Environmental Management and Assessment	X	X
17.	National Industrial Symbiosis Programme	X	X
18.	National LSC	X	X
19.	Advantage West Midlands	X	X
	Other Organisations		
Non-Priority SSC's			
20.	Automotive Skills	X	
21.	Creative and Cultural Skills	X	
22.	Financial Services Skills Council	X	
23.	Go Skills	X	
24.	Government Skills	X	
25.	Lifelong Learning UK	X	
26.	People 1st	X	
27.	Skills Active	X	
28.	Skills for Care and Development	X	
29.	Skills for Health	X	
30.	Skills for Justice	X	
31.	Skillset	X	
32.	Skillsmart Retail	X	
Key Skills Providers			
33.	Anglia Ruskin University	X	
34.	Chartered Management Institute	X	X

	Organisation	Evidence	Interview
35.	Imperial College – Centre for Energy Policy and Technology	X	X
36.	London South Bank University	X	
37.	Northampton University – SITA Centre for Sustainable Waste Management	X	X
38.	Open University – Energy and Environmental Research Unit	X	
39.	Rodbaston College		X
40.	Stevenson College		X
41.	University of East Anglia – Low Carbon Innovation Centre	X	X
42.	University of Manchester	X	
Government Departments			
43.	Department for Business Enterprise and Regulatory Reform	X	
44.	Department for Children Schools and Families	X	
45.	Department for Communities and Local Government	X	
46.	Department for Environment Food and Rural Affairs	X	
47.	Department for Innovation and Skills	X	
48.	Department for Work and Pensions	X	
Professional Bodies / Business Support Agencies			
49.	Chartered Institute of Marketing	X	
50.	Chartered Institute of Personnel and Development	X	
51.	Chartered Institution of Wastes Management	X	X
52.	Confederation of British Industry	X	X
53.	Design Council	X	
54.	EEF	X	X
55.	Energy Institute	X	
56.	Environmental Industries Commission	X	
57.	GMB		X
58.	Institute of Asset Management	X	
59.	Institute of Chartered Accountants of England and Wales	X	
60.	Institution of Mechanical Engineers	X	
61.	Royal Institute of Chartered Surveyors	X	
62.	Royal Society of Chemistry	X	
63.	The Royal Academy of Engineering	X	
64.	Trade Union Congress	X	
National Skills Academies			
65.	Fashion Retail Academy	X	
66.	National Skills Academy for Construction	X	
67.	National Skills Academy for Financial Services	X	
68.	National Skills Academy for Food and Drink Manufacturing	X	

	Organisation	Evidence	Interview
69.	National Skills Academy for Manufacturing	X	
70.	Nuclear Skills Academy	X	
71.	Process Industries Academy	X	
Other			
72.	Academy for Sustainable Communities	X	
73.	Action Sustainability	X	X
74.	All Regional Development Agencies	X	
75.	Building Research Establishment	X	
76.	Business Council for Sustainable Development	X	
77.	Centre for Sustainable Design	X	
78.	Chemistry Innovation KTN	X	
79.	Demos	X	
80.	East Midlands Centre for Constructing the Built Environment	X	
81.	Environment Council	X	
82.	Federation of Small Businesses	X	
83.	Forum for the Future	X	
84.	HEFCE	X	
85.	Higher Education Academy	X	
86.	Institute for Employment Studies	X	
87.	Institute for Public Policy Research	X	X
88.	Institute of Directors	X	
89.	London Energy Partnership	X	X
90.	Resource Efficiency Knowledge Transfer Network	X	
91.	Society for the Environment	X	
92.	Sustainable Communities (BRASS)	X	
93.	Sustainable Development Commission	X	X
94.	Technology Strategy Board	X	
95.	The Energy Savings Trust	X	
96.	UK Energy Research Centre	X	X
97.	Waste and Resources Action Programme	X	X
98.	West Midlands Regional Observatory	X	

Appendix Four – LCREE Draft Skills Checklist

	Tier 1	Tier 2	Tier 3
1	Design Skills	Eco-Design	Design for Disassembly, Design For Recyclability, Design for the Environment, Design for Effective Energy Use, Legislation and Regulatory Compliance
		Green Manufacturing	Legislation and Regulatory Compliance, Integration of Process Waste
		Materials Specification	
		Life Cycle Assessment/Costing	
2	Waste Skills	Waste Quantification and Monitoring	Waste Production Calculations, Mass Balance, Waste Audit
		Waste Process Studies	Material/Substance Flow Analysis, Resource Utilisation Mapping, Life Cycle Assessment
		Waste Management Systems	Objective Setting, Legislative and Regulatory Compliance, Collection Systems, Segregation, Waste Cycle Management, 3R Implementation (Reduce, Reuse, Recycle), Hazardous Waste Management, Landfill Requirements, Communications/Implementation Campaigns
		Waste Minimisation	Industrial Symbiosis, Integration of Process Waste
		Waste Technologies	Recycling, Waste to Energy
3	Energy Skills	Energy Minimisation	Energy Reduction Programmes, Heat Recover and Re-Use, Energy Efficient Technologies, Energy Efficient Practices, Communications/Implementation Campaigns, Enhanced Capital Allowance Technologies and Scheme
		Energy Management Systems	Objective Setting, Legislative and Regulatory Compliance, Energy Base Loads and Variable Loads, Energy Audit, Energy Review, Communications/Implementation Campaigns
		Energy Quantification and Monitoring	Monitoring Targeting and Reporting, Use of Half Hourly Data, Use of Sub Meters, Computer Based Data Logging and Energy Management Systems, Energy Data Manipulation Software Systems
		Energy Costs and Trading	Energy Markets and Pricing, Carbon Trading Schemes, Climate Change Levy Agreements, Energy Price Trends, Enhanced Capital Allowances, Peak Oil and Impact on Energy Supplies and Prices
		Renewable Energy Technologies	Solar, Wind, Biomass, CHP, Photovoltaic, Ground Source Heat Pump, Air Source Heat Pump, Hydro, Hydrogen, Fuel Cell, Integration into Energy Supply
		Non-Renewable Technologies	Nuclear, Incineration with Energy Recovery, Clean Fossil Fuel Technologies, Carbon Sequestration, Waste to Energy
4	Water Skills	Water Minimisation and Re-Use	Grey Water, Water Harvesting, Waste Water Recovery, Recycling, Cascading, Waste Water Recovery, Effluent Treatment, Sludge/Slurry Dewatering, Leak Detection

		Water Management Systems	Objective Setting, Legislative and Regulatory Compliance, Water Audit, Water Consumption Review, Communications/Implementation Campaigns
		Water Quantification and Monitoring	Sub-Metering, Data Collection, Water Use Calculations
5	**Buildings Skills**	Building Energy Management	Monitoring Targeting and Reporting, Use of Half Hourly Data, Use of Sub Meters, Computer Based Data Logging and Energy Management Systems, Energy Data Manipulation Software Systems, Building Energy Assessment
		Integration of Renewable Energy	Photovoltaic, Solar, Wind Turbines, Combined Heat and Power, Fuel Cell
		Energy Efficient Construction	Insulation (Cavity Wall, Loft, Paperwork), Regulatory Compliance (Part L), Passive Heating, Building Regulations
		Facilities Management	Building Energy Management Systems, Management and Maintenance of Water, Waste Management
		Calculating Building Energy Efficiency and Carbon Ratings	U Value Calculations, Building Energy Assessment, Carbon Rating
6	**Transport Skills**	Transport Impact Minimisation Technologies	Hybrid Vehicles, Biodiesel, Electric Vehicles, Fuel Efficient Vehicles
		Transport Impact Minimisation Processes	Alternative Transport Strategies, Communication/Implementation Campaigns, Car Sharing Schemes, Public Transport Planning, Public Transport Implementation, Cycle Network Planning, Cycle Network Implementation, Transport Modelling
		Transport Management in Business	Transport Modelling, Route Planning and Management, Distribution and Collection Systems
7	**Materials Skills**	Sourcing	Sources of Low Energy Materials, Sources of Low Mileage Materials, Recyclates (Secondary Materials), Energy Efficient Raw Material Extraction, Industrial Symbiosis, Transport Mileage
		Procurement and Selection	Use and Properties of Low Energy Materials. Use and Properties of Recyclates, Industrial Symbiosis, Low Carbon and Resource Efficient Procurement, Cost Impact of Climate Change on Material Procurement
		Material Use and Impact Quantification	Material Usage Calculations, Life Cycle Assessment and Costing
		Management Systems	Material Use Planning, Material Flow Process Design and Implementation, Energy Efficient Process Design and Implementation
		Impact and Use Minimisation	Life Cycle Assessment and Costing, Energy Efficient Process Implementation, Material Flows Analysis
8	**Financial Skills**	Investment Models	Energy Technologies Investment Models, Carbon Derivatives Investment Models, Calculation of Payback/Return on Investment
		New/Alternative Financial Models	Carbon Trading, EU Emissions Trading Scheme, UK Emissions Trading Scheme, Enhanced Capital Allowances,

		Quantification of Climate Change Impacts	Impact Assessment of Climate Change of Business Finances, Impact of Climate Change on Materials Availability and Cost, Carbon Neutrality and Associated Cost/Opportunities (Costs of Doing Nothing), Risk/Opportunity Assessment Models for Adaptation and Mitigation, Insurance Risks/Opportunities of a Low Carbon Economy
		Principles of Low Carbon and Resource Efficient Economies	Polluter Pays Principle, Externalities,
		Tools of Low Carbon and Resource Efficient Economies	Climate Change Levy Agreements, Enhanced Capital Allowance, Cost Benefit Analysis, Low Carbon and Resource Efficient Procurement
9	**Management Skills**	Impact Assessment	Energy Use Calculations, Water Use Calculations, Waste Production Calculations, Carbon Footprinting Calculations, Emissions Measurement
		Business Planning	RE Planning, Low Carbon Planning, Integration of RE and Low Carbon into Business Planning Cycles, Climate Change Risks, Climate Change Adaptation and Mitigation Responses (As Part of Business Risk Management), Understanding Low Carbon and Resource Efficiency Skills Requirements and Long Term Planning
		Awareness Raising	Communication/Implementation Campaigns
		Opportunities Management	Identification of Low Carbon and Resource Efficiency Opportunities, Cost Benefit Analysis
		Risk Management	Identification of Low Carbon and Resource Scarcity Risks, Cost Benefit Analysis
		Day to Day Management	Low Carbon and Resource Efficient Procurement, Integration of Low Carbon and Resource Efficiency Skills, Due Diligence, Management Systems, Low Carbon and Resource Efficiency Skills Requirements for Recruitment
10	**Policy and Planning Skills**	Built Environment Master Planning and Implementation	Low Carbon Spatial Planning, Zero Waste Planning, Resource Efficient Planning, Low Carbon and Resource Efficient Urban Design, Building Regulations, Public Transport Planning and Implementation, Cycle Network Planning and Implementation
		Strategy Development	Impact Assessment and Modelling, Principles of Low Carbon and Resource Efficiency
		Strategy Implementation	Understanding of Skills Needs for HR Managers, Low Carbon and Resource Efficient Material Sourcing and Procurement, Awareness Raising/Communications Skills

Appendix Five: Comments on Draft Skills Checklist

The following are anonymous examples of comments received on the Draft Skills Checklist:

General Comments

- There was nothing on the skills checklist that was a surprise.
- Very thorough.
- Sustainable development was missing from the checklist.
- Looked fairly comprehensive, nothing to add.
- Sensible approach and comprehensive.
- Social justice issues are missing.
- Skills lists don't work, we are not at the stage for skills lists yet.

Comments on Existing Skills Areas

Energy:

- Waste to energy covers a multitude of skills.
- Renewable Energy Technologies – may want to distinguish between upstream (large scale generation connected to the grid) and downstream (microgeneration for local use only). Biogas-CHP.
- Energy – Non Renewable Technologies – flue gas desulphurisation. Also skills needed to monitor and operate transmission and distribution systems.
- Energy price forecasting/prediction.
- Auditing and verification.
- Avoidance or reducing need as distinct from minimisation.
- Carbon skills (fit into other categories too) – avoidance, minimisation, substitution, capture.
- Energy storage including batteries, supercapacitors etc… Tied closely with renewable energy use.
- Non renewable technologies – waste to energy incorporates anaerobic digestion, gasification, and other advanced waste to energy technologies. District heating networks.
- Use of nuclear power will have the following skills implications; developing and licensing of new plant, construction of key components (specialised engineering), operation of new plants. Regulatory and technical skills.
- Lack of general power generation and networking/grid connection skills.
- Specification of renewables for building work (and in construction skills area too).

Waste:

- Use of waste as a raw material and industrial symbiosis (with the co-operation skills this entails).
- Water, hazardous waste, recycling, PPC, packaging design are all cross sector skills.
- Waste Technologies – Reuse and remanufacture, waste to energy incorporates anaerobic digestion, gasification, other advanced waste to energy technologies.

Buildings and Construction:

- Retrofitting for LCREE as opposed to new build skills.
- Renewables planning and specification.

Management Skills:

- Have to incorporate project management skills and the ability to put together a business plan for funding. It is the meeting place between the energy manager and the finance manager skills that is important.
- Energy price forecasting/prediction.

- Innovation skills – design, converting design into enterprise, commercialisation of ideas, entrepreneurial skills.
- Risk Management.
- Life Cycle Analysis (LCA) - skills set looks broadly right but very important need for people in this area to see a problem from all angles – trade offs and cost benefit analysis. LCA lets you do this but a less formal mechanism is needed- this incorporates having sufficient knowledge of the main environmental impact areas so that one doesn't focus exclusively on one's area of specialism. Couldn't see an obvious entry to this on the checklist.
- Behaviour change skills are not reflected strongly enough; e.g. Consultation, stakeholder engagement, media management etc…
- Delivery skills – Egan skills (generic) negotiation, management of change, leadership, visioning. To have a LCREE need to get the delivery right.
- Understanding of sustainable development principles and challenges, looking beyond immediate discipline, involvement of stakeholders, creative and holistic problem solving, cradle to grave approach, long term and global implications considered, risk based, proportionate solutions, embraces change, lead by example.
- Awareness of legal requirements and compliance – interface with EMS.
- Environmental decision making.
- Specific management training for LCREE.
- Management is not the right word – should be leadership and strategy.
- Combine financial and management into a new 'Business Development Skills Tier 1'.
- Comprehensive list but missing social science skills – behavioural skills, PR/Marketing skills.

Policy and Planning:
- Life Cycle Analysis.
- Built Environment Tier – should incorporate forward planning and development control. Should also include spatial aspects of technologies.
- Lacks policy maker and strategic skills.
- Add outreach/communication as individual skills.

Transport:
- Social science issues on transport – change in travel options.

Materials:
- The skills needed to produce renewable materials from crop sources. Crops use CO_2 to grow and as such reduce the carbon intensity of the economy. The development of these products will require crop production skills, crop research, chemical engineering, materials science etc.. to grow suitable new crops and transform them into new products. See also comment below on land management and agriculture.

Design:
- Eco-Design – standards for manufacture and re-use, design for low-carbon emissions.
- Materials Specification – specification methodologies and standards.
- LCA/Costing – methodologies for calculating embedded as well as operational carbon.
- Product design for repair.

Finance:
- Skills for understanding the financing of energy/low carbon technologies – how fiscal and regulatory measures impact on the ROI/IRR for investment decision making. Energy procurement skills.

Comments on Potential Additional Skills Areas

Land Management and Production (incorporating Agriculture and Food):

- The skills needed to produce renewable materials from crop sources. Crops use CO_2 to grow and as such reduce the carbon intensity of the economy. The development of these products will require crop production skills, crop research, chemical engineering, materials science etc.. to grow suitable new crops and transform them into new products.
- Agricultural skills for lower carbon.
- Natural cycles and biodiversity.
- Land treatment, land contamination and nature conservation are missing.

IT Skills:

- Eg computer based data logging etc..

Repair Skills:

- Needed if we are to move away from a throwaway culture. Moving towards a repair culture would also require that products are designed to be repaired (see also design skills area comments).

Technology Skills:

- Awareness of technologies and how to deploy them.

Carbon skills:

- Different from energy skills.
- Carbon emissions and greenhouse gases.

Comments on Approach:

- Why base this around skills, why not base it on the type of person needed? Eg legislators, investors, buyers etc… The type of person will define the skills set.
- All the skills are supply push skills – what about skills to affect demand through designers (of all kinds?).
- Skills could fall into things like carbon avoidance, minimisation, substitution, capture etc…
- Individual skills not always specified.

Appendix Six – Review of Sector Skills Agreements

Priority Sector Skills Councils

Asset Skills - The Sector Skills Council for Property, Facilities Management, Housing, and Cleaning Industries

Drivers include; resource management, energy prices, legislation, technology requirements.
Sustainability and regeneration focuses on making the most of today without causing detrimental effects on the future. It is about making changes in the way companies operate and consume resources in such a manner, which is beneficial for industries and consumers alike. The challenge for the Asset Skills sector is to prolong and rejuvenate operating environments. For example, the regeneration of neighbourhoods can help limit the cyclical motion of housing and re-housing and dealing with the same problems surrounding benefits and payments again and again.
By helping the residents help themselves, a lot of the processes and procedures will not need to be duplicated, allowing resources to be spent on other priorities. This application of sustainability can be imitated across the Asset Skills sector

Cogent SSC – The Sector Skills Council for the Chemicals and Pharmaceuticals, Oil and Gas, Nuclear, Petroleum and Polymer Industries

National objectives are to:

- Reduce the sector's skills gaps and shortages and anticipate future needs in the Cogent industries.
- Improve productivity and business performance through specific strategic actions, based on analysis of sectoral priorities.
- Increase opportunities to develop the productivity of the sector's workforce.
- Improve learning supply, including the development of apprenticeships, higher education and of national occupational standards.

Cogent now presents a clear and powerful voice, enabling sector employers to influence Government policy development and shape the outputs of training and education providers.

The advent of bio fuels and increased demand for renewables are creating the need for areas of new skills development. Of equal importance to all industries within the Cogent footprint is the demand for continuous improvement in environmental performance. Environmental solutions currently being examined involve technology development, process development and application.

Each industry has specific environmental drivers, presenting the industry with key environmental targets to improve energy and reduce emissions, and reduce waste disposal and water usage. For the oil and gas industries, the key environmental drivers are decommissioning, reducing marine discharges and atmospheric emissions. In the Nuclear industries decommissioning and waste management are the main environmental challenges.

The continual need to reduce the environmental impact of our industries requires future learning provision to take account of these key drivers. Research and development is needed at the highest levels to enable innovative solutions to be developed. Within manufacturing organisations qualifications such as Business Improvement Techniques can be used to reduce the waste and environmental impact of processing. There is also a requirement across the footprint for the development of level 4/5 skills provision focusing on compliance management, to ensure environmental legislation and targets are met.

No reference to low carbon or resource efficiency in SSA or proposed Action Plan

Construction Skills – The Sector Skills Council for Construction
Five significant drivers
• The economy
• The pressure from clients to improve performance
• Innovation and new technology
• Sustainability
• Legislation

The impact of the Government's new UK Sustainable Development Strategy, the government's role as a client and other major initiatives are all driving the industry to build in a more sustainable way. The Government's own drive for sustainable development is slowly taking hold in the minds of the consumer, the requirements of clients and the practices of some of the larger industry players.

Making sustainability a reality will require everyone in the supply chain to know what their role is and to have the skills and knowledge to do it. The sustainability agenda in itself is a driving force for technological change and innovation. The development of new products and processes now take into account environmental impact, durability and performance, in addition to the more established concerns of aesthetics, workability and cost.

In early 2004, CITB-ConstructionSkills commissioned some initial research to identify key drivers, barriers, practice and change required for sustainable development to take a firm hold in construction. There are structural barriers to change. However, sustainability is enforced by legislation and the industry will be forced to act.

No mention of low carbon, resource efficiency, greenhouse, energy efficiency,

Energy & Utility Skills – The Sector Skills Council for Energy, Gas, Waste Management and Water industries
Five major priorities, with sixteen sector programmes:
1. Government Policy – essentially, influencing government policy on skills issues.
2. Regulation – recognition by the economic regulators of the need for strategic investment in skills.
3. Competence – e.g. competency frameworks, management and leadership.
4. Skills Provision – ranging from basic/ essential skills to workforce development via Higher Education Institutions.
5. Sector Recruitment and Attractiveness – e.g. schools, diversity.

Ongoing drives for efficiencies and environmental protection drives skills requirements ie. improving technical skills/competence. Low carbon technologies are mentioned in three regional proposals. Renewable energy also included, however limited references to environment overall.

E-skills – The Sector Skills Council for IT
4 strategic objectives.

1. Improving the attractiveness of IT careers:
To attract the necessary quantity, quality and diversity of people into IT careers, this SSA sets out to:
- Transform the attitudes of girls towards IT-related careers;
- Improve careers guidance and establish work in IT as an aspirational career choice for high achievers.

2. Preparing the future workforce:

To ensure that the IT-related curriculum in schools, colleges and universities prepares students for successful employment, this SSA sets out to:

- Improve the relevance of learning in preparation for IT professional careers, including developing new degree options;
- Prepare future business managers with the skills to thrive in the e-economy;
- Enable all students at all stages to improve their skills in the use of IT.

3. Developing adults and the existing workforce:
To realise the potential of the workforce to exploit new technologies for improved business performance and productivity, this SSA sets out to:

- Create effective Continuing Professional Development opportunities for IT professionals, with particular focus on smaller companies;
- Address the skills needed for business managers – especially of smaller companies – to realise the benefits of IT;
- Equip people with the increasingly sophisticated skills needed to use IT effectively in their day-to-day work.

4. Addressing infrastructure matters:
To place the voice of employers at the centre of skills infrastructure matters, this SSA sets out to:

- Ensure the UK's IT qualifications structure and approach to recognising achievement is fit for purpose and meets employer needs;
- Ensure that all policy and action on IT-related skills is underpinned by authoritative insight and market intelligence.

No references to LCREE or environment

Improve – The Sector Skills Council for Food and Drinks sector
Changing market conditions. A number of non-skills related developments will have an impact on the sector over the coming years, as they have had an influence in the past. The combined impact of the demands from the major retailers and more diverse consumer demand, aligned with global sourcing of raw materials, tighter requirements for waste management and the need to control energy use and carbon emissions mean a more complex environment for managers.

Proposed solution that includes training of ISO14000 skills, working with groups like Carbon Trust, WRAP, Envirowise, DEFRA etc to ensure appropriate skills included. Various regions have included environmental skills as key priorities

Lantra - The Sector Skills Council for Environmental and Land-based sector
12 key strands for workforce development in the sector

Improving business performance
1. Engage employers in skills and business development
2. Better managers; better businesses
3. Promote lifelong learning to increase professionalism, productivity and profit

Developing and recognising the skills of the workforce
4. Recognise and increase the skills of the entire workforce
5. Realise the full potential of migrants in the workforce
6. Value fully the contribution of volunteers
7. Ensure a sustainable, high quality network of learning providers

Raising the quality of entrants to the sector
8. Facilitate entry into employment
9. Make the land-based sector a positive career choice for all

Influencing governments and their agencies for the benefit of the sector
10. Help shape governments' policies for the benefit of the sector
11. Maximise public investment in skills and business development for the sector
12. Provide a rigorous evidence base on which to make policy and investment decisions

Action plan includes proposal to develop environmental diplomas/environmental management, technical skills.

Change factors include:
- Changes in business practice (include climate change)
- New approaches to land management and regional regeneration (changes in land use, water framework directive)
- Environmental enhancement (waste management, legislation changes, resource management/costs)

Proskills - The Sector Skills Council for Building Products, Coatings, Extractives, Furniture, Glass, Paper and Printing Industries
Environmental concerns also impact upon the coatings industry where the drive for more environmentally-friendly paints, varnishes and other coatings has created the need for a high-tech approach to almost all new products.
Increasing amount of environmental legislation to be complied with.
Energy usage.
Quarrying of stone has environmental concerns/impacts.
Coatings industry has been at forefront of efforts to identify environmentally friendly substances, materials and applications.
Effects of various inks and varnishes have been a focus of much development work while the need for recycling of paper has now become an established part of the UK efforts at sustainable paper production and use.

The glass industry experiences the usual pressures of any industrial process that uses exotic minerals and chemicals, and one that makes great use of recycled product, but it also has to place more emphasis than most on its use of energy. The industry is constantly working to reduce that usage and to find ways of producing more efficiently with less.

No specific reference to LCREE skills gaps or shortages

SEMTA - The Sector Skills Council for Science, Engineering and Manufacturing Technologies
Automotive sector - A key force driving technological change is environmental regulation – environmental legislation to reduce emissions and increase fuel efficiency, increase safety requirements and better, more attractive recycling.

Aerospace sector – increased environmental regulation on air pollution and noise.

Skillfast – The Sector Skills Council for Fashion and Textiles
Nothing mentioned within summary document.

SSA Action plan for laundry and dry cleaning – environmental legislation compliance.

SSA Action plan for footwear and leather – environmental legislation compliance, sourcing high quality raw materials, environmentally friendly processes.

SSA Action plan for technical textiles and man-made fibres – effective procurement of energy and raw materials.

Skills for Logistics – The Sector Skills Council for Moving, Storing or Handling Goods
Six issues:

- Image of the Logistics Sector
- Diversity
- Basic Skills
- Skills gaps
- Recognition of the business case for 'training'
- Quality of training supply

No mention of LCREE skills – just numeracy and literacy.

Nothing found within regional action plans.

Summit Skills - The Sector Skills Council for Building Services Engineering
Five 'skills priorities':

- Image and Competence: promoting a positive image of the sector
- Communication and Information: creating a knowledge centre for all sector skills development needs
- Training Provision: ensuring pro-active, highly quality and relevant training
- Funding: flexibility in funding to meet fast changing needs
- Management & Leadership: supporting the sector to plan and develop profitable and competitive businesses

The solutions include for Renewables & Environmental Technologies: develop and implement national occupational standards for current and emerging environmental technologies to embrace craft and professional occupations. Ensure environmental technologies are fully integrated within other activities such as the careers strategy and apprenticeship training frameworks.

Non-Priority Sector Skills Councils

Creative and Cultural Skills – The Sector Skills Council for Advertising, Crafts, Cultural Heritage, Design, Music, Performing, Literary and Visual Arts
Drivers include:

- Globalisation
- Environmental change
- Governmental policy

Emerging Skills needs include; Management, Leadership, Information & Digital Technology, Business Skills, Professionalism, Negotiation, Marketing and PR.

The 9 core issues identified as affecting the Creative and Cultural sector do not specifically refer to LCREE skills.

Financial Services Skills – The Sector Skills Council for Finance
No SSA or Action Plans available for review.

Go Skills – The Sector Skills Council for Passenger Transport Industries
Although there is nothing mentioned specifically within the SSA, there are non-LCREE specific priorities within some of the regional plans. Plans include environmental protection, energy and resources, exemplar in environmental technologies and the efficient use of resources (East Midlands) and encouraging prudent use of resources and minimising waste, tackling the causes of climate change (Wales).

Government Skills – The Sector Skills Council for Central Government
Skills Strategy 2008 has been developed, but recommendations predominantly deal with mechanisms for skills development e.g. delivery, programmes, integration, qualification development, rather than specific types of skills needed within sector.

No LCREE mentioned within report.

IMI Automotive – The Sector Skills Council for Retail Automotive Industries
SSA developed but relates to 2006. Stage 5 completed and Action Plans developed for regions.

Five main skills categories were identified/reviewed in Stages 1-3 in five broad groups

- Management and Leadership skills.
- Employability skills.
- Basic skills.
- Generic skills.
- Technical skills

SSA not available for review. Only North West Action Plan has any mention of environment – improving the workplace to improve environmental efficiency.

Lifelong Learning UK – The Sector Skills Council for Life Long Learning
Very limited information available on website – no SSA found, but Sector Qualification Strategy available. Of this, Phase 3 is due to be implemented Oct 2007 – Jul 2008. It is stated that this is responsive to changes in the working environment and able to underpin development of qualifications.

No other information available.

People 1st – The Sector Skills Council for the Hospitality, Leisure, Travel and Tourism Industries
Five targets:
- Productivity.
- Customer Service.
- Retention.
- Employer Business engagement.
- Achieving the 2020 skills mix.

There is a ten point plan to address the priorities, however none of these link into LCREE.

Skills for Care and Development – The Sector Skills Council for Social Care, Children and Young People's Workforces Sector
Stage 1 & 2 completed. Changes are being driven by societal and regulatory needs, eg changing expectations of users.

Generic skills needs include:
- Literacy, language & numeracy.
- Communication, interpersonal & relationship skills.
- ICT skills.
- Entrepreneurial skills.
- Leadership & management skills.
- Commissioning and procurement skills.

No mention of LCREE.

Skills for Health – The Sector Skills Council for UK health sector
Stage 5 completed. SSA states that there are four drivers:
- Aging population.
- Growth in chronic disease/long term illness.
- Increasing hospital Emergency admissions.
- Changing financial regimes.
- Six strategic objectives have been developed.

No mention of LCREE.

Skills for Justice – The Sector Skills Council for justice sector
Stage 5 completed.

Specific issues included:
- Multi-agency working.
- Management and leadership skills.
- ICT and computing.
- Race and diversity.

Ten proposed solutions are provided

SkillsActive – The Sector Skills Council for the active leisure and learning industry
No SSA for England. Regional Plans have limited references to environment including climate change.

Skillset – The Sector Skills Council for creative media
No reference to LCREE in sub-sector skills strategies.

Skillsmart Retail – The Sector Skills Council for retail
Specific issues include:

- Store management (multiple retailers).
- Store management (independents).
- Sales occupations in multiple and independent stores.
- Attracting the necessary labour supply.

No mention of LCREE.

Appendix Seven – Evidence List

Doc Ref	Document Name	Organisation	Summary	Relevant
1	Securing the Future – Delivering the UK Sustainable Development Strategy	HM Government	High Level	Y
2	The Stern Review	HM Treasury	High Level	Y
3	Delivering the Low-Carbon Economy – Business Opportunities for UK Manufacturers	EEF in partnership with Deloitte	Other	Y
4	Mind the Skills Gap – The Skills We Need for Sustainable Communities	Academy for Sustainable Communities	Sustainability/Sustainable Development	Y
5	Skills for a Low Carbon London – Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London	London Energy Partnership (Greater London Authority)	Energy and Engineering	Y
6	Prosperity for All in the Global Economy (Leitch Review of Skills)	HM Treasury	High Level	Y
7	Learning and Skills for Sustainable Development (Workshop)	University of Hertfordshire Environment Team	Skills	N
8	Skills for Sustainability (Workshop)	Professional Practice for Sustainable Development and The Science Council	Skills	N
9	A Green Profession? RICS Members and the Sustainability Agenda	Royal Institution of Chartered Surveyors	Construction, Built Environment and Planning	Y
10	Background Paper on Green Jobs	United Nations Environment Programme (UNEP)	Green Jobs/Employment	Y
11	Green Jobs: Towards Sustainable Work in a Low Carbon World (Preliminary Paper)	UNEP, ILO, ITUC – Green Jobs Initiative	Green Jobs/Employment	Y
12	Professions in Partnership for Sustainability – Evaluation Report	Forum for the Future	Green Jobs/Employment	N
13	Energy Skills Discussion Paper	Pro Enviro for East Midlands Development Agency	Energy and Engineering	Y
14	Towards Sustainable Energy Use for Transport	UK Energy Research Council	Other	Y

15	A Competitive Response to Climate Change	Institute of Directors	Management and Leadership	N
16	Social and Environmental Responsibility and the Small Business Owner	Federation of Small Businesses	Other	N
17	Resource Management in the Education Sector	Waste Watch	Resource Efficiency and Waste	N
18	Investigation into High-Level Skills Shortages in the Energy Sector	Energy Research Partnership	Energy and Engineering	Y
19	Key Issues & Technologies for UK Innovation	Energy Research Partnership	Energy and Engineering	Y
20	Energy Efficiency Training & Awareness - Post Completion Project Report Form	East Midlands Centre for Constructing the Built Environment	Energy and Engineering	Y
21	East Midlands Construction Resource Efficiency Club 24 Month Report	East Midlands Centre for Constructing the Built Environment	Construction, Built Environment and Planning	N
22	Adapting the UK to Climate Change	Institute of Physics	Other	N
23	Renewable Electricity Generation Technologies	Institute of Physics	Energy and Engineering	Y
24	Renewable Electricity Generation Technologies Evidence 1	Institute of Physics – Innovation, Universities, Science and Skills Select Committee	Energy and Engineering	N
25	Renewable Electricity Generation Technologies Evidence 2	E.On UK – Innovation, Universities, Science and Skills Select Committee	Energy and Engineering	N
26	Skill Needs in the Energy Industry	Energy Institute	Energy and Engineering	N
27	Resource Efficiency KTN Annual Report 2005-2006	The Resource Efficiency Knowledge Transfer Network	Resource Efficiency and Waste	N
28	Realising Value from Online Learning in Management Development	Chartered Management Institute	Management and Leadership	N
29	Management Futures Report	Chartered Management Institute	Management and Leadership	N

30	Design 4 Life CPD for Design Professionals Multimedia Workshop Series	East Midlands Centre for constructing the Built Environment	Design	N
31	Educating engineers for the 21st Century "The Henley Report"	The Royal Academy of Engineering	Energy and Engineering	N
32	Engineering UK(2005) Report	The Engineering & Technology Board	Energy and Engineering	N
33	Skills Report 2003 (Renewable Energy) + ETA Results at a Glance	Electricity Training Association	Energy and Engineering	N
34	BRASS Project Description + Working Paper 45 Supporting Skills and Knowledge to Deliver Sustainable Communities	BRASS	Sustainability/Sustainable Development	N
35	LEP Skills Research Summary Report	London Energy Partnership	Energy and Engineering	Y
36	Renewable Supply chain – Gap Analysis	DTI	Energy and Engineering	Y
37	High Tech: Low Carbon The Role of Technology in Tackling Climate Change	Intellect	IT	N
38	Technology Counts IT & Telecoms Insights 2008	e-skills uk	IT	Y
39	IAP ICT ENV Draft Aggregated	Information Age Partnership	IT	N
40	Occupational and Functional Map – Renewable Energy Sector	E&U Skills	Energy and Engineering	Y
41	Microgeneration Report	Welsh Assembly	Energy and Engineering	Y
43	Maastricht Economic and Social Research and Training Centre on Innovation and Technology Website	United Nations University	IT	N
47	Finding the Right Policy Mix for Sustainable Innovation	Department of Environmental Science & Technology, Imperial College, London	Sustainability/Sustainable Development	N
48	Sustainability in the built environment skills matrix (see also 145)	Joint - Three sector skills councils.	Construction, Built Environment and Planning	Y

49	Skills Shortages and Recruitment Agency Behaviours	Association for Consultancy and Engineering (ACE)	Management and Leadership	N
50	Carbonlite Programme Leaflet	Association for Environment Conscious Building	Construction, Built Environment and Planning	N
52	Brunel Research in Enterprise, Innovation, Sustainability and Ethics (BRESE) website	Brunel University	Sustainability/Sustainable Development	N
53	Department of the Built Environment Website	Anglia Ruskin University	Construction, Built Environment and Planning	N
54	Occupational and Functional Mapping of the Renewable Energy Sector	Energy and Utility Skills	Energy and Engineering	N
55	The Feasibility of a Resource Recovery Park in Northamptonshire	Northamptonshire Enterprise Ltd (Urban Mines)	Resource Efficiency and Waste	Y
56	Shape the Agenda	Chartered Institute of Marketing	Management and Leadership	N
57	The Business of Climate Change – Creating a Low Carbon Britain?	The Institute of Chartered Accountants	Management and Leadership	N
58	Climate Change and Employment	European Commission	Green Jobs/Employment	Y
59	European Commission DG Environment	European Commission	Green Jobs/Employment	N
60	Effect of Energy Markets Regulation onto EU's Technology Portfolio	IPTS, European Commission	Energy and Engineering	N
61	Environment and Employment	European Commission	Green Jobs/Employment	N
63	From Here to Sustainability – LSC Strategy for Sustainable Development	LSC	High Level	Y
64	IEMA 2007 Membership Survey	IEMA	Skills	N
65	Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London – Phase 1	London Energy Partnership	Energy and Engineering	Y
66	Skills Gaps in the Energy Efficiency and Renewable Energy Sector in London – Phase 2	London Energy Partnership	Energy and Engineering	Y
67	Low Carb Lane	Designs of the Time 2007	Construction, Built Environment and Planning	N
68	Market Assessment of Waste Resources	Advantage West Midlands	Resource Efficiency and Waste	N

70	Securing the Regions Futures	Defra	High Level	Y
71	Sustainable Communities 08	Govnet communications	Sustainability/Sustainable Development	N
72	Waste Management and Recycling – Learning and Skills	Learning Skills Development Agency	Resource Efficiency and Waste	N
73	Assessment of Microgeneration for Renewables Skills Requirements	Summit and E&U Skills for Welsh Assembly Government	Energy and Engineering	Y
74	Feasibility Study for the Establishment of a Centre of Excellence For Installers	North West Development Agency	Energy and Engineering	N
75	Renewables Labour Market Information Report (summary and full)	Cross Sector Renewables Working Group	Energy and Engineering	Y
76	The Egan Review – Skills for Sustainable Communities	Office of the Deputy prime Minister	High Level	Y
77	Managed Trading Estates – Pilot Study	Envirowise	Resource Efficiency and Waste	Y
78	Clean Design	Emda	Design	Y
79	Exploring the Skills Requirements of the UK Renewable Power Industry	E&U Skills	Energy and Engineering	N
80	East of England Skills for Energy	Department of Trade and Industry (DTI), Learning and Skills Council Norfolk, Cogent, ECTIB, Energy & Utility Skills and SEMTA	Energy and Engineering	N
82	Sector Skills Mapping in the Environmental Technology Sector	Energy & Utility Skills	Skills	N
87	Brownfield Scoping	English Partnerships	Construction, Built Environment and Planning	N
88	Draft Brownfield Skills Strategy	English Partnerships	Construction, Built Environment and Planning	Y
89	Brownfield Skills Evidence Base	English Partnerships	Construction, Built Environment and Planning	Y
90	Regeneration Research Study	English Partnerships	Construction, Built Environment and Planning	N

91	The 80% Challenge	WWF and RSPB	Other	Y
92	Our Energy Future - Creating a Low Carbon Economy	Dti	High Level	Y
93	Energy White Paper - Meeting the Energy Challenge	Dti	High Level	Y
94	Employee Skills Survey	Government Skills SSC	Skills	N
96	Building Professional Skills for Government – A Strategy for Development	Government Skills SSC?	Skills	N
97	Employers Survey	Government Skills SSC	Skills	N
98	Understanding and Mapping Training Provision in the World of Government	Government Skills SSC	Skills	N
100	Commission on Environmental Markets and Economic Performance	DEFRA, DIUS, BERR	High Level	Y
101	Nuclear Skills Passport	Nuclear Skills Academy	Skills	N
103	Looking Back Moving Forward 2006	Chartered Institute of Marketing	Skills	N
104	Business Leadership Towards A Low Carbon Economy	Chartered Institute of Marketing	Management and Leadership	Y
105	Investing in a Low-Carbon Energy Future in the Developing World	World Business Council for Sustainable Development	Skills	N
106	Powering a Sustainable Future - Policies and measures to make it happen	World Business Council for Sustainable Development	Energy and Engineering	Y
108	Promoting Small and Medium Enterprises for Sustainable Development	World Business Council for Sustainable Development	Management and Leadership	N
109	Walking the Talk on Energy and Climate	World Business Council for Sustainable Development	Energy and Engineering	N

110	Then and Now Celebrating the 20th Anniversary of the Brundtland Report	World Business Council for Sustainable Development	Sustainability/Sustainable Development	N
111	Chronos - From Personal Values to Corporate Action	World Business Council for Sustainable Development	Management and Leadership	Y
112	Corporate Responsibility and the Modern Business Leader	Institute of Chartered Accountants of England and Wales	Management and Leadership	N
114	Sustainability - The Role of Accountants	Institute of Chartered Accountants of England and Wales	Finance	Y
115	An Overview of Corporate Social Responsibility	Institute of Chartered Accountants of England and Wales	Management and Leadership	N
116	The Future of Services to the Public	Institute of Chartered Accountants of England and Wales	Sustainability/Sustainable Development	N
117	Environmental Management Accounting	Institute of Chartered Accountants of England and Wales	Finance	Y
118	CITB-ConstructionSkills Build to Last Reviewing Sustainable Construction	National skills academy for Construction	Construction, Built Environment and Planning	Y
119	Climate Change and the European Countryside: Impacts on Land Management and Response Strategies (Scientific Report of the CLIO Project 2006)	CLA/UEA	Agriculture and Land Management	Y
120	Climate Change and the Rural Economy	CLA	Agriculture and Land Management	Y
121	The Carbon Emissions Generated In All That We Consume	The Carbon Trust	Design	N
122	DEFRA – Strategy for Non Food Crops and Uses Action Plan – Summary of Actions	DEFRA	Agriculture and Land Management	N
123	Skills Audit of Horticultural R&D	National Horticultural Forum	Agriculture and Land Management	Y

124	Review of Bioenergy Research – A report for BBSRC Strategy Board	BBSRC	Agriculture and Land Management	Y
125	Review of BBSRC-Funded Research Relevant to Crop Science	BBSRC	Agriculture and Land Management	Y
127	Microsoft response to Developing the Future 2007	Microsoft	IT	N
128	SusCon Low Carbon Skills in Construction	SusCon	Construction, Built Environment and Planning	Y
129	Energy Efficiency	Institute of Physics	Energy and Engineering	N
130	Response to Energy Review Consultation	British Nuclear Energy Society	Energy and Engineering	N
131	Skills Gap Analysis	National Skills Academy for Construction - CITB-ConstructionSkills	Construction, Built Environment and Planning	Y
132	Employer Attitudes and Motivations to Learning and Training Wave 3 Presentation	National Skills Academy for Construction - CITB-ConstructionSkills	Construction, Built Environment and Planning	Y
133	Employer Attitudes and Motivations to Learning and Training Wave 6 Presentation	National Skills Academy for Construction - CITB-ConstructionSkills	Construction, Built Environment and Planning	Y
134	Climate Change and the European Countryside: Impacts on Land Management and Response Strategies (Summary of the CLIO Project 2006)	Various	Agriculture and Land Management	Y
136	Nuclear Operational Plan	National Skills Academy for Nuclear	Energy and Engineering	N
137	Joining the Gaps in Sustainable Procurement – Literature Review (draft)	For GLA by Action Sustainability	Sustainable Procurement	N
138	Mapping of Current Sustainable Procurement Activity and Support in Yorkshire and Humber (draft)	For Sustainable Procurement Network by Action Sustainability	Sustainable Procurement	Y
139	Sustainable Procurement Training Needs Analysis (draft)	Action Sustainability and London Remade for London Boroughs	Sustainable Procurement	Y

140	Joining the Gaps – Sustainable Procurement Final Report Summary	Action Sustainability for London Centre of Excellence	Sustainable Procurement	Y
141	Great Skills Debate - Regeneration England	University of Manchester	Construction, Built Environment and Planning	Y
142	Creativity, Networks and Openness	University of Manchester	Construction, Built Environment and Planning	N
143	Joining Up Participation in Environmental Planning	Environment Agency Northwest & Manchester City Council	Construction, Built Environment and Planning	Y
144	Moving Closer… Identifying skills gaps and developing solutions: UK-wide	Summit Skills	Energy and Engineering	Y
145	Sustainability Skills Matrix for the Built Environment Functions (se also 48)	London Energy Partnership	Construction, Built Environment and Planning	Y
146	CBI Education and Skills Survey 2008	Confederation of British Industry	Skills	Y
149	Evidence to House of Commons Science and Technology Committee Enquiry – Carbon Capture and Storage Technology	University of Sussex Energy Group	Energy and Engineering	N
150	HM Treasury Consultation – Carbon Capture and Storage: A Consultation on Barriers to Commercial Deployment	University of Sussex Energy Group	Energy and Engineering	N
151a	Affecting Consumer Behaviour on Energy Demand – Executive Summary	University of Sussex Energy Group for EDF Energy	Energy and Engineering	N
151b	Affecting Consumer Behaviour on Energy Demand – Final Report	University of Sussex Energy Group for EDF Energy	Energy and Engineering	N
152	Bioscience Skills Gap	SEMTA	Other	Y
154	The Future of Engineering Research	Royal Academy of Engineering	Energy and Engineering	N
155	Planning for a Sustainable Future – White paper	Institution of Civil Engineers	Energy and Engineering	N
156	Skills for the Built Environment	Institution of Civil Engineers	Construction, Built Environment and Planning	Y
157	The State of the Nation	Institution of Civil Engineers	Energy and Engineering	Y

158	Learning the Sustainability Lesson	Royal Academy of Engineering	Sustainability/Sustainable Development	N
159	Skills for Sustainable Development (Draft)	Sustainable Development Commission	Skills	Y
160	Teaching Sustainable Development at Oxford	Royal Academy of Engineering	Sustainability/Sustainable Development	N
161	Skills for Sustainability Report	The Science Council	Skills	N
162	Sustainable Development in Higher Education	Higher Education Academy	Sustainability/Sustainable Development	N
163	Renewables Briefing Paper_2007	Royal Institute of Chartered Surveyors	Energy and Engineering	Y
165	Skills for the West Midlands Environmental Technologies Cluster	West Midlands Regional Observatory	Skills	Y
167	Occupational and Functional Map of the UK Renewable Energy Sector (2005)	Energy and Utility Skills Sector Skills Council	Energy and Engineering	Y
169	New Solutions to Address the Sustainability Challenge	Chemistry Innovation	Skills	N
170	Roadmap Charts Route to Sustainable Technologies	Chemistry Innovation	Skills	N
171	Resource Efficient Design – Sector Needs Analysis	East Midlands Development Agency	Other	Y
174	Market Requirement Proposal Document – Energy	North East England	Energy and Engineering	Y
175	Driving Success	Business and the Environment Programme	Sustainability/Sustainable Development	Y
176 177	Energy Markets Outlook Report World Class Skills : Implementing the Leitch Review of Skills in England	BERR DIUS	High Level High Level	Y Y

Appendix Eight – Summaries of Relevant Evidence

Agriculture and Land Management

Document Name	Climate Change and the European Countryside: Impacts on Land Management and Response Strategies (Scientific Report of the CLIO Project 2006 and Summary Report of the CLIO Project 2006)
Ref Number	119 & 134
Organisation	Various
Year of Publication	2006

Document Overview:

Scientific Report:

This document is part of the continuing work by European Landowners and their associations to inform themselves of threats and opportunities arising from climate change. It was based on a series of case studies from land managers rather than statistical representation. A specific theme is raising the role of carbon management amongst rural managers. The land owners sector is particularly important to the climate change debate as they have the ability to reduce the effects of emissions of carbon dioxide and other greenhouse gases by other sectors. It identifies specific policies for the mitigation of climate change and delivers an overriding message that policy must be global and cross-sectoral. A particular concern it identifies is a lack of long-term, challenging targets and tools for measuring current environmental performance. It suggests that land managers can help other sectors reduce the effect of their emissions as the technology currently exists, but the real driver for such change are issues of awareness and economics. Skills are not specifically referred to; this document is more about policy and cross sectoral approaches to achieving LCREE.

Summary Report:

This aims to document the different ways in which climate change is already affecting each of 21 rural estates reviewed, and consider the strategies to adapt to these changes – including carbon management. As land managers are in the position of being able to negate some of the emissions made by other sectors, through energy substitution, it is important that policy is used to good effect in this sector. For example it may be possible to mainstream through a coherent government approach, leading to a fully integrated climate policy which is in the best interests of society as a whole. It suggests as a first step closer integration between agriculture, forestry and land use. It is also important to use a recently developed carbon impact tool based on current IPPC methodology – CALM (Carbon Accounting for Land Managers). This document also acknowledges the importance of social change to tackling climate change, with the clear link between social, economic and environmental requirements.

Document Name	Climate Change and the Rural Economy
Ref Number	120
Organisation	Country Land and Business Association
Year of Publication	2001

Document Overview:

This is a policy statement focusing on the potential impact of climate change on owners and managers of rural businesses in England and Wales, in is the first attempt at such a task as far as they are aware. It proposes ways to mitigate the impacts of climate change and adapt management practices in order to sustain social and economic activity in the countryside. This document looks at a large number of specific areas for improvements in land

management, coming from a policy and support slant, but inferring the need for improved skills to meet the challenge of LCREE. Providing carbon sinks and adopting a cross-sectoral and cross-country approach are also key themes. It identifies government as a key player in driving a change toward LCREE, without discussing possible current or future delivery infrastructure. Skills are not the main focus, policy is.

Document Name	Skills Audit of Horticultural R &D
Ref Number	123
Organisation	National Horticultural Forum
Year of Publication	2004
Document Overview: A skills audit of Horticultural R&D whose aim is to analyse the data available on the R&D portfolios of the major funders in horticultural research and match these against published policies of funders and the skills base available. It identified that there is a wealth of R&D in certain areas of horticulture, and a noticeable lack in others, and that no clear overarching policy for horticulture is in place. There is a need for a consolidation of databases on available training courses and for industrial support for relevant training courses. A particular concern is that there are often no clear routes from the R&D to practical use of such information, and as such methodologies for achieving a more low carbon future take a while to filter through. A particular lack of programme planning, delivery and management skills, engineering and business management skills and technology transfer is noted. There is a noted weakening between science and industry, leading to poor communication and technology transfer. What is required is a national network of specialists and an improvement of the practical skills of the specialists. A common strategy with clear goals for development is required, as are demonstrator projects. The differences between different types of learning are identified and expanded upon, with the research/scientific side and the practical/capabilities side requiring greater interaction and a feedback mechanism.	

Document Name	Review of Bioenergy Research
Ref Number	124
Organisation	BBSRC
Year of Publication	2006
Document Overview: This is a review of current bioenergy research being undertaken in the UK, its strengths/weaknesses and capabilities. It finds that the bioenergy market in the UK is growing due to a combination of drivers but should be further driven through collaborative working partnerships and by learning from, and not repeating research work undertaken in the EU and US. Bioenergy has an important role to play as part of a multi-faceted low-carbon solution and has very strong medium-to-long term environmental and political drivers including the vulnerability and increasing price of fossil fuel, and CO2 reduction targets and bioenergy regulation. How successful bioenergy research and capability will become depends both on technological advances and the correct economic considerations to make bioenergy the cheapest alternative.	

Document Name	Review of BBSRC-Funded Research Relevant to Crop Science
Ref Number	125
Organisation	BBSRC
Year of Publication	2004
Document Overview: A review of BBSRC research in crop science that underpins much of agricultural and	

horticultural production. It finds that research is strong in certain areas but weak in others. Key to closing skills gaps in identified areas is a more coherent national and international research strategy. Large-scale collaborative projects should be supported by funding mechanisms. Also BBSRC should review its training programmes and career development for crop scientists by considering the introduction of targeted schemes for training and recruitment. The transfer of knowledge between plant and crop science is a high priority. The need for new crop research are driven by changes in food demand, climate change impacts and awareness and increasing international competition, particularly from the expanded EU. This document focuses more on research and international collaborations rather than skills set, but it is clear that skills will need to be developed to continue the research.

Built Environment, Planning and Construction

Document Name	A Green Profession? RICS Members and the Sustainability Agenda
Ref Number	9
Organisation	Royal Institution of Chartered Surveyors
Year of Publication	2007
Document Overview: The research aims included: • Assess the degree to which the surveying profession accesses and is able to make use of research-based information, tools and techniques to allow a contribution to achievement of key sustainable development objectives. • Identify and prioritise policy actions for RICS. The research identified main skills demands drivers as legal compliance, responsibility for the environment, ethical considerations and client requirements. Skills priorities identified are; building transport planning, sustainability design tools, sustainability awareness. Once basis in place additional future skills requirements are; planning, eco-design, financial modelling, renewable energy and strategy implementation.	

Document Name	Sustainability in the built environment skills matrix
Ref Number	48
Organisation	Joint Work by 3 SSC's
Year of Publication	2008
Document Overview: A skills matrix for construction / the built environment functions, including the skills required/used and the role of each function identified. It charts the key functional players and the sustainability issues relevant to making their practices more sustainable. Sector specific, generic skills are listed in the matrix which is to be used as a baseline and can be further utilised to identify skills gaps. There is no viewpoint as it is simply a current skills matrix.	

Document Name	Draft Brownfield Skills Strategy – Securing, Retaining and Developing the Workforce
Ref Number	88
Organisation	English Partnership
Year of Publication	2008
Document Overview: Strategy document put out for consultation in March 2008. The document presents findings on skills issues that prevent/hinder the re-use of brownfield land and how it might be addressed. Overall it suggests that in addition to technical skills, there are 9 wide ranging	

core skills, which include sustainable development awareness, for the development of brownfield projects, although there is no specific mention of LCREE. There is a lack of specific training programmes or courses for brownfield development.

Document Name	Brownfield Skills Evidence Base – Securing, Retaining and Developing the Workforce
Ref Number	89
Organisation	English Partnerships
Year of Publication	2008
Document Overview: The Academy for Sustainable Communities has worked with English Partnerships to examine the perceived national skills gaps and labour shortages that could hinder or prevent the reuse of brownfield land, with the findings within this document. It seeks to define brownfield land then the occupations and skills required to redevelop it.	

Document Name	CITB-Construction Skills Build to Last Reviewing Sustainable Construction
Ref Number	118
Organisation	National Skills Academy for Construction
Year of Publication	
Document Overview: The document is coming from the CITB-Construction Skills point of view and is based on extensive research and questionnaires of relevant companies in the industry. It focused particularly on the future skills needs of the industry, the drivers for change to these skill needs and the circumstances for change – although it did not tackle a routemap to achieve such changes. Currently companies do not pursue sustainability directly as there is not enough of a reason to do so, and any movement toward sustainability is through the benefit of lowering cost, particularly through waste minimization. It is a high level review and did not go too much into specific skills, but more generic, sector skills. "The immediate challenge, beyond meeting environmental legislation and building regulations, is changing the way the industry builds rather than what it builds." Future changes are likely to be the result of legislation and public and investor demand, rather than company originated. Barriers to change include project costing, rather than whole life costing, and barriers of communication across the industry. There needs to be a change of attitude, for example of away from 'that doesn't come under my job role' when looking at sustainability – only 18% of mangers recognised the environment as part of their responsibility.	

Document Name	SusCon Low Carbon Skills in Construction
Ref Number	128
Organisation	SusCon
Year of Publication	
Document Overview: A review document of SusCon and how it aims to tackle the practicalities of delivering low carbon development and sustainable communities. It discusses the reasoning behind, benefits of, and wider community benefits of their SusCon building and dedicated training centre, SmartLIFE, Cambridge. Although it did not refer directly to skills it demonstrated a good level of understanding of the requirements for a low carbon and sustainable future, with training centres to develop skills, a good idea of current skills sets and future requirements, and an understanding of the need to develop the supply chain, infrastructure, products, technologies, innovation and research. It also advocates clustering to achieve results. The	

local, sub-regional and regional economic benefits of SusCon are expected to be significant.

Document Name	Skills Gap Analysis
Ref Number	131
Organisation	National Skills Academy for Construction - CITB-ConstructionSkills
Year of Publication	2005
Document Overview: A summary of their evolving skills gap analysis in relation to sustainable development. It is designed to be sector specific and is informed by research carried out on construction companies. It has a particular focus on skills and the wider impact of the construction sector. The skills were not specifically defined, but the tools already developed for closing the apparent skills gap were listed. The demand for such new skills was identified as being driven by demand from consumers, potential employees and shareholders.	

Document Name	Employer Attitudes and Motivations to Learning and Training Wave 3 Presentation and Wave 6 Presentations
Ref Number	132 and 133
Organisation	National Skills Academy for Construction - CITB-ConstructionSkills
Year of Publication	2006 and 2008
Document Overview: Two presentations, the 2008 one being an update of the 2006 one, which investigate employer attitudes and motivations to learning and training. The information is based on interview results of company in the construction sector. The information obtained was purely sector specific and aimed at obtaining employers views on how sustainability will affect their industry. Skills are a secondary consideration to most respondents, after the effects of sustainability on customer demands, cost of jobs and reputation. Sustainability is largely seen as growing in importance; although a significant number of respondents are unsure what the terms defines/how it will affect them. Future considerations of sustainability issues appear to be predominately business driven, and less environmental or socially driven.	

Document Name	Great Skills Debate Regeneration England
Ref Number	141
Organisation	University of Manchester
Year of Publication	2005
Document Overview: A debate about skills deficiencies and the range of new skills required in order to address the 'new urban agenda'. It draws primarily on the work of the Planning Network and the outcomes of a specially convened conference held in October 2003, and was an impartial view of a range of documents. The focus was on the current skills gaps and ways of bridging them that have resulted particularly due to changes in the policy context leading to the demand for practitioners outstripping supply. Skills were constantly referred to, but only at a vague level i.e. no specific skills identified. 6 skills shortages during university education were identified, but these were generic. An obstacle to deliver is that many employers do not see it as their role to develop skill sets. Numerous potential delivery infrastructures are reviewed, and the reasons for them not being implemented are identified.	

Document Name	Joining-Up Participation in Environmental Planning – Developing a Learning Resource for Capacity Building
Ref Number	143
Organisation	Environment Agency North West & Manchester City Council
Year of Publication	2006

Document Overview:

Document is report of project which developed new methods for developing abilities of stakeholder engagement in planning. Research highlighted several themes for effective training in skills of engagement. The objectives were:

1. Capacity Building – develop and evaluate approaches for building capacity and skills in ecologically informed participatory process, so as to make it more readily available to a wide range of practitioners.

2. Pooling Knowledge – develop and test new approaches to support ongoing learning amongst participants, exploring ways to pool knowledge and experience so it can be easily shared.

Document Name	Sustainability Matrix for the Built Environment Functions
Ref Number	145
Organisation	Joint Work by 3 SSC's
Year of Publication	2008

Document Overview:

A skills matrix for the built environment functions, including the skills require/used and the role of each function identified. The source of the matrix data is unclear. There is no viewpoint as it is simply a current skills matrix. It could be used as a baseline for showing changed overtime, developing a list of skills gaps and from this a routemap for achieving closing these skills gap. Skills referred to are more generic than specific but cover across the social, environmental and economic sectors.

Document Name	Skills for the Built Environment – Team Effort
Ref Number	156
Organisation	ICE
Year of Publication	2001

Document Overview:

A review of documentation considering the current and projected skills shortage in those professions that contribute to the planning, design, construction commissioning and maintenance of the built environment. Key findings were that there is a widespread current shortage of skilled professionals and that these can be overcome by better training of young people, particularly in a work-based environment, improving the public image of the industry, encouraging women into the sector, monitoring of trends and paying closer attention to project procurement practices. It was constructed through the input of a working party. Skills were referred to throughout the document, but at a vague, generic level, with little reference to specific skills. Discusses how to better engage young people in the built environment sector, and discusses factors influencing employers to develop/not develop people. Also suggests that low pay may be a barrier to young people entering the profession.

Design

Document Name	Clean Design Study
Ref Number	78
Organisation	EMDA
Year of Publication	2008

Document Overview:

The project forms one of a series of 15 let under the East Midlands Programme for Implementing Resource Efficiency (EMPIRE) round 1 aiming to help the region's business community to implement a step change in the use of natural resources and perceptions around the use and disposal of waste.

The overall aim of the project is to recommend where *emda* might make interventions to foster increased productivity through better design. 'Clean design' refers to the process of systematic incorporation of environmental life cycle considerations into product design. The report is across the producer sector within the east midlands.

From the study it is clear that, at present, the uptake of clean design principles in the East Midlands is in its infancy.

However in the first case this study has identified the following sectors which are likely to most benefit from uptake of clean design practices (top 10):

- Office machinery & computers
- Radio, television & communication equipment & apparatus
- Medical, precision & optical instruments, watches & clocks
- Chemicals, chemical products & man-made fibres
- Motor vehicles, trailers & semi-trailers
- Other transport equipment
- Rubber & plastic products
- Electrical machinery & apparatus not elsewhere classified
- Construction
- Machinery & equipment not elsewhere classified.

Also has a cost benefit table in the report for the proposed actions.

The project has been carried out according to the following tasks:

1. Review of the producer sectors in the region & classification of appropriate product groups/types.
2. Identification of associated waste streams including materials, waste designation and existing waste management and costs.
3. Develop a methodology to identify wasteful design and process issues.
4. Map regional strengths for support of clean design, desk review of appropriate best practice of clean design.
5. Regional SWOT analysis of the above.
6. Identification of possible intervention methods to support improvements in the implementation of clean design.
7. Recommendations for regional intervention and the most appropriate sectors to engage with.

Need to improve resource efficiency and waste management, showing economic benefits.

Deals with design / resource management as specialism's and integrating into the sectors.

Makes it quite clear that the report has a narrow scope. Consultancy has a wider understanding, however from their report it would suggest that the sectors do not necessarily have a broader understanding of the LCREE skills needed.

Has identified a range of skill gaps for design and resource efficiency, and the general need for up skilling. The main point being that across the producer sectors there are

opportunities to improve skills, but that the sectors are "immature" at the moment.

Energy and Engineering

Document Name	Skills for a Low Carbon London (LEP Skills Research Summary, LEP Skills Desktop Research, LEP Skills Qualitative Research)
Ref Number	5 (35,65,66)
Organisation	London Energy Partnership
Year of Publication	2008 (2006)
Document Overview: The study (and contributing documents) examines current energy efficiency and renewable energy skills and employment resources in London, the existing gaps, and the education and training provision that exists within the capital to help address these needs. The report indicates that some companies are having a problem recruiting to maintain the skills set. There is a mixed result from companies on their current skills capabilities. In London energy efficiency skills are delivered through, higher education, further education, short courses and open learning. Renewable skills delivery is less available and tends to be located outside London. Although the title talks of a Low Carbon London, the report only really deals with energy.	

Document Name	Energy Skills Discussion Paper
Ref Number	13
Organisation	ProEnviro
Year of Publication	2007
Document Overview: A Pro-Enviro report for EMDA looking at strategy to allow the right skills for a low carbon economy based upon resulted from a previous report looking at the level and type of energy training, skills gap, future demand for energy skills training, and barriers. The research identified a number of energy skills gaps and training requirements together with a potential action plan. Looked at energy efficiency skills and new energy skills, using questionnaires and previous published data from industry and education establishments. The information looks at the skills gap and training provision and it is on this information that any conclusions are drawn. The skills are still too generalised to be specific. In house research paper so would depend upon the EMDA activities as a result of the research.	

Document Name	Investigation into High-Level Skills Shortages in the Energy Sector & Key Issues & Technologies for UK Energy Innovation
Ref Number	18 & 19
Organisation	Energy Research Partnership
Year of Publication	
Document Overview: One of the workstreams of the ERP is to address the high level skills shortages in the energy sector. The report is the result of a group with the following specific aims: • To map high-level skill deficiencies within the energy research and innovation chain. • Identify the reasons for, and the options to address, these high level skill deficiencies. Loss of technology / main stream skills. Skill loss from retirement, lack of graduates. Mentions renewables skills, environmental skills in general. Based mainly upon other reports, much of this is subjective based upon individual questionnaire responses. Very narrow scope, based on industry sector. Lack of detail on	

specific skill requirements and does not look to the future with a wider scope that the current skill sets.

Document Name	Emda Draft Energy Efficiency Training & Awareness
Ref Number	20
Organisation	EMCBE
Year of Publication	2008
Document Overview: To identify and develop the CPD material for the Design4Life project, which focuses on the construction sector and also looks a cross disciplinary training. Developed as part of the BREW programme.	

Ref Number	23
Organisation	Institute of Physics
Year of Publication	2008
Document Overview: This is a response to the House of Commons Innovation, Universities and Skills Committee's enquiry into renewable electricity-generation technologies. Energy infrastructure and renewable targets are cited as the main demand drivers. It only makes general conclusions on skills and skills areas cited are; wave, photovoltaic and whole life financial modelling.	

Document Name	Employment and Skills Study 2003
Ref Number	33
Organisation	Electricity Training Association (ETA)
Year of Publication	2003

Document Overview:

This report presents the findings of an employment and skills survey of the UK Renewable Power Industry carried out by the Electricity Training Association (ETA) at the end of 2002. The report is focused on the delivery of the governments renewables target and the skills required to get there.

Comprehensive review of skills although for the most part the same conclusions about STEM skills and lack of availability are made as other energy industry reports, although in greater detail about specific skills. Within the skills are inferences to specialist, environmental, financial, Marketing and management skills. There is also a suggestion that there is difficulty getting project team members with the right mix of inter disciplinary skills.
82 different renewable energy companies were consulted consisting of:

- Biomass (gasification/pyrolysis, energy crops).
- Biogas (landfill gas, sewage sludge digestion, anaerobic digestion).
- Energy from waste combustion.
- Water power (hydro, tidal, wave).
- Onshore wind.
- Offshore wind.
- Solar photovoltaics.

Employment in the wind industry is likely to constitute 75% of total employment by 2010, which is also seen as the key skill growth area.

Specific skills mentioned:

- Commercial/business/financial management.
- Strategic awareness.
- HR and people management.
- Leadership, team management, coaching and mentoring.
- Contract management.
- Project management.
- Quality management.
- Risk management.

- Civil engineering.
- Mechanical engineering.
- Electrical/electronic engineering.
- Control and instrumentation engineering.

- Business development/project development.
- Operation, maintenance and monitoring.
- Planning and design.
- Construction and installation.
- Equipment/component manufacture.
- Consultancy/research and development.

- Environmental science/surveying.
- Land development/landscape architecture/archaeology.
- Ecology - animal and plant wildlife surveying.
- Noise surveying.
- Meteorology - weather assessment.
- 'Wind/Hydro/Landfill gas' scientists – characteristics, predictions, viability studies.

- Business analysts/economics.
- Finance/accountancy.
- Legal expertise.
- Town planning/consents.
- Data analysts/logging/statisticians.
- Computer modelling.
- Public/community relations.
- Power sales contract negotiation.
- Trading.

- Information technology.
- Communication.
- Teamworking.
- Literacy and numeracy.
- Problem solving.
- Self-development.

A list of skills such as this could form part of any business. What is important is an understanding the LCREE skills that would integrate into these mainstream skills, this is not covered. However it is clear from the list that elements of LCREE skills are covered, but perhaps more as a specialism or consultancy.

Document Name	Renewable Supply Chain Gap Analysis
Ref Number	36
Organisation	DTI
Year of Publication	2004

Document Overview:

A study of the current status of the UK renewable industry and to assess future potential.

The aim of the study was to assist agencies in determining the most effective means of targeting their effort and resources. It included a summary section on of the findings obtained from the study's R&D survey and information gathered through the questionnaires and interviews on the condition of the UK's renewable industry skills base. The resulting recommendations were:

- Trade associations to liaise with education bodies and training providers to tailor renewable-specific courses to industry needs.
- Trade associations to discuss university student sponsorship with key players to increase appeal of engineering courses.
- Trade associations to discuss university sponsorship with key players to develop innovative technologies.

The following comments were also made:

"Funding around research projects leads to high employment instability for researchers and is frequently a reason for losing staff, and accumulated knowledge". The report also suggests the skills required by the renewable industry, although they are mainly common skills such as project management with a renewable content.

Detail on general engineering and management skills for the renewable industry but not much on specialist LCREE skills.

Document Name	Occupational & Functional Map Renewable Energy Sector
Ref Number	40 & 167
Organisation	Energy & Utility Skills
Year of Publication	2007 & 2005

Document Overview:

The purpose of this research is to determine the occupations and functions of the following sub-sectors:

- Offshore wind, wave and tidal.
- Hydrogen.
- Fuel Cells.

It also explores the supply chain of biomass and pays due regard to the work of Cogent on bio-ethanol production and use, which is articulated in its maps relating to bio-ethanol.

The following were the recommendations from the report:

1. Conduct detailed mapping of National Occupational Standards (NOS).
2. Benchmark to International Standards.
3. A full audit of the supply chain for each sector, once the sectors are more fully established
4. A full Occupational and Functional Map of the biomass sectors
5. A full audit of the Biomass supply chains
6. Conduct a full scale gap analysis on skills to identify where the priorities for skills lie.

In order to influence future skills developments, policy makers and educators need to understand which of the skills identified are already provided through other training programmes (representing transferable skills) and which are not covered.

The report is part of a series of initial and follow up research activities aimed at understanding skill / training requirements for the sector for EU Skills and should prove credible and reliable.
There is still a tendency to have "environmental" specialists, and to expand the detail on environmental skills might help to mainstream LCREE skills into existing roles.

The report identified common generic skills at various levels and therefore many of the skills covered are common to any industry albeit with a renewable energy sector bias. One or two areas mention where courses need the addition of new areas, such as CORGI which could need to add hydrogen to its content. Lack of integration of LCREE skills into the job profiles on the skills list.

Document Name	Microgeneration Report
Ref Number	41
Organisation	Summit Skills
Year of Publication	2007

Document Overview:
To assess the microgeneration requirements of the renewable energy sector in Wales. To determine the skills and training requirements of this evolving sector. Map the current training provision and ascertain those that have the potential to deliver the skills for the sector.
The majority of the companies surveyed (68%) needed training in microgeneration.
73% of companies surveyed identified a skills gap in microgeneration installation, and 68% of companies said they found it difficult to recruit staff with the relevant skills in microgeneration. This would involve the upskilling of the existing workforce and therefore unlikely to see the development of a separate skill set or occupation for microgeneration installers.
Understanding of the microgeneration fit with government policy concerning low carbon building, energy efficiency.

Document Name	Assessment of Microgeneration for Renewables Skills Requirements
Ref Number	73
Organisation	Summit and E&U Skills for Welsh Assembly Government
Year of Publication	2007

Document Overview:
To assess the microgeneration requirements of the renewable energy sector in Wales. To determine the skills and training requirements of this evolving sector. Map the current training provision and ascertain those that have the potential to deliver the skills for the sector.
Lack of micro generation courses. Lack of industry contact with training providers. Lack of demand for training from industry. The majority of the companies surveyed 68% needed training in microgeneration. 73% of companies surveyed identified a skills gap in microgeneration installation skills, and 68% of companies said they found it difficult to recruit staff with the relevant skills in microgeneration. Building services engineering sector see microgeneration courses as up skilling the existing workforce.
Considering the recognition for potential future micro generation / renewable in Wales, there appears to be a lack of enthusiasm from the industry.
Following the Welsh assemble policy line, but nothing to demonstrate a greater understanding of LCREE skill requirements.

Document Name	Renewables Labour Market Information Final Report
Ref Number	75
Organisation	Cross Sector Renewables Working Group
Year of Publication	2007

Document Overview:

This is exploratory research and a subsequent larger study aimed at identification of skills or capacity gaps that may prevent the generation or use of energy from renewable sources. The report comments on the lack of people with core skills, STEM and the need to generate more interest in the upstream industry. Downstream the conclusions are mainly about integration of renewables skills with existing trades.

Current drivers of demand are cited as; government policy and increased use / installation of renewable technologies whilst downstream complexity of installations is cited as a future driver of demand which will result in future skills priorities for increased integration of training.

Document Name	Powering a Sustainable Future – Policies and Measures to Make it Happen
Ref Number	106
Organisation	World Business Council for Sustainable Development
Year of Publication	Post 2006

Document Overview:

The document seeks to outline the policies and measures that are required for the full decarbonisation potential of the electricity sector to be realised. Whilst the focus of the report is not on skills requirements a number of skills can be inferred from the statement below.

'The electricity utilities sector has started addressing issues related to adaptation by developing a clear understanding of:

- How the science of climate change is advancing and what the physical impacts on facilities and operations will be;
- How risks can be identified, quantified and managed in a proactive manner, including through the development of early warning systems;
- How changes in global climate will affect the sector's stakeholders, (i.e. Employers and contract staff, customers and users, lenders and investors, suppliers and service providers;
- How utilities should work with governments and other parts of civil society and business on infrastructure development and disaster management.
- How new climate policies will affect the electricity utility business, and what new policies will be needed to facilitate adaptation of the economy and society;
- What technologies and R&D need to be deployed and developed to limit damage and to increase the sector's ability to adapt.

Document Name	Moving Closer… Identifying skills gaps and developing solutions: UK-wide
Ref Number	144
Organisation	Summit Skills
Year of Publication	

Document Overview:

The sector skills agreement for Building Services Engineering.

Sets out the skills priorities and action plans. Specific reference to Renewable and environmental technology skill gap for design, installation and maintenance. Also integration

of technologies within other activities such as apprenticeships, implementation of national occupational standards for these and emerging technologies embracing craft & professional occupations. Little that is specific to LCREE skills

Document Name	The State of the Nation
Ref Number	157
Organisation	Institution of Civil Engineers
Year of Publication	2008

Document Overview:

This is a capacity and skills report, and aims to stimulate debate and to highlight the actions that believed needed to improve the state of the nation's infrastructure. ICE is a leading source of professional expertise in transport, water supply and treatment, flood management, waste and energy.

The industry requires a higher degree of visibility and certainty from government on its investment plans for the UK's infrastructure, to be able to commit to more investment in skills and innovation. They are asking for a national strategic body who will bring to an end the unpredictable, stop-start procurement by government departments.

Compiled each year by a panel of experts drawn from the various fields of expertise across ICE's membership. Skills have already been supplied by sourcing from other countries. The report suggested the uncertainty of government procurement causes many problems leading to skill gaps. Not clear from this report, although civil engineering skills are paramount to building a low carbon infrastructure, (sustainable development is mentioned in this context). Mainly about Civil Engineering core skills, no detail supplied.

Document Name	Renewables Briefing Paper
Ref Number	163
Organisation	Royal Institute for Chartered Surveyors
Year of Publication	2007

Document Overview:

Basically a checklist for surveyors who do not currently have the specialist renewable energy skills and to act as a resource guide for those seeking to make a basic assessment of the options for farmers and householders. It is not intended as a comprehensive source of information on renewable energy, but merely to set out the basics and highlight the issues which need to be addressed. It gives a brief but good background into climate change issues and the renewable options available. Covers general awareness and renewable technologies to add to the existing skill set – that's all for LCREE skills.

Document Name	Market Requirement Proposal Document
Ref Number	174
Organisation	North East Energy Resource Efficiency programme
Year of Publication	2007

Document Overview:

The document is an internal proposal for training delivery after recognising a market requirement. There is no indication that the proposal was accepted. However it does show that specific energy kills are required by manufacturing industry and that they should be integrated into a number of roles at different levels. Skills identified specifically were: Energy efficiency, Energy monitoring, Cost benefit (project payback), Energy efficient design, Energy Mapping, Legislation.

Finance

Document Name	Information for Better Markets - Sustainability: The Role of Accountants
Ref Number	114
Organisation	Institute of Chartered Accountants.
Year of Publication	2004

Document Overview:

This report, is the fourth in the series of reports for UK directors on information / reporting for better markets. It analyses the role of accountants in sustainability by considering how information supports mechanisms
through which market activity is directed towards more sustainable and, in that sense, better outcomes.

This report is an Institute of Chartered Accountants in England & Wales (ICAEW) contribution to thought leadership on sustainability, a subject of increasing importance that is broadly familiar to many people, even though few have any detailed knowledge.

The report identifies a number of mechanisms by which sustainability may be enhanced and describes the contributions that professionally qualified accountants can make to their effectiveness.

The essential objective of this report is to raise awareness amongst professionally qualified accountants of sustainability issues and to highlight some of the opportunities available to them as a direct result of developments related to sustainability.

A second objective, relevant to a wider readership, is to demonstrate the relevance of accountants' skills to the broad and potentially confusing range of initiatives and issues associated with sustainability.

A third and more ambitious objective is to assist public discussion and agreement on effective ways of promoting sustainability.

The report focuses on accountancy compatible skill areas with sustainability, but fails to make the link to new LCREE training provision in these areas for accountants. It does however take a quick look at the financial requirements of environmental accounting and the need for credible data. It also looks at the assurance of financial data reporting from an EMS / sustainability perspective. Also states that having consistent standards for financial statement audits and assurance on sustainability reports, given that sustainability information is already included in financial statements would help.

The report covers sustainability and accounting, and aims to raise awareness amongst the profession. Difficult to know if all accountants have a broad understanding or if they will be interested in the report.

Has general sustainability content but mainly raises awareness of accountancy practices that fit with sustainable development, no specific up skilling of accountancy profession with LCREE skills though.

Document Name	Environmental Management Accounting
Ref Number	117
Organisation	International Federation of Accountants.
Year of Publication	2005

Document Overview:

"The International Federation of Accountants (IFAC) decided to commission this guidance document to bring together some of the best existing information on EMA and, at the same time, to update it and add to it as necessary. This document is neither a standard with defined requirements, nor a descriptive practitioner or research report. It is not intended to be a standard that IFAC member Bodies are expected to follow or adopt as a part of their

responsibilities under IFAC's Statement of Membership Obligations (SMOs). It is intended to be a guidance document that falls into the middle ground between regulatory requirements, standards and pure information. As such, its goal is to reduce some of the international confusion on this important topic by providing a general framework and set of definitions for EMA that is fairly comprehensive and as consistent as possible with other existing, widely used environmental accounting frameworks with which EMA must coexist". Main experience is with the manufacturing sector. Mainly looks at the type of costs involved and gives international examples of methods. Little on up skilling the accountancy profession, but in general terms the report is focused on the skill area of EMA. The report states that it is a guidance document, but does start to bring together information on EMA. Looks at the different practices of EMA which could be the main Accountancy Skill for LCREE.

Green Jobs/Employment

Document Name	Background Paper on Green Jobs
Ref Number	10
Organisation	United Nations Environmental Programme
Year of Publication	2008
Document Overview: Presenting an understanding of green jobs and the impact of climate change on the world of work. It focused on future jobs requirements primarily and drew from this some of the required skills. A lot of the document was concerned with encouraging and facilitating the closing of skills and employment gaps, without identifying specific skills. Some skills were investigated at a sector specific level, but most were more generic in nature as the need for multi-disciplinary and international cooperation in adapting to LCREE was constantly reinforced. It mentioned that there are a wide range of responses available to respond to the effects on employment of climate change including technological, behavioural, managerial and policy responses. The company undertaking the research express an interest in becoming more involved with green jobs in the future, and repeatedly express the need for a transition toward more green jobs, whilst stating that there is a lack of empirical data to back up this claim.	

Document Name	Green Jobs: Towards Sustainable Work in a Low Carbon World (Preliminary Paper)
Ref Number	11
Organisation	Green Jobs Initiative
Year of Publication	2007
Document Overview: This document aimed to define green jobs and bring together a multitude of recent reports on green jobs. It states that many of these declaim a future of green jobs, with few presenting specifics or data. It recognises a particular lack of knowledge and available data pertaining to the developing world, but that changes here are as important as in the developed world. It introduces the concept of "shades of green in employment – the idea that a range of approaches will be required in the future, with perhaps not the glut of specific 'green' jobs as suggested by some, but more the gradual/slight greening of existing jobs. It suggests that the creation of green employment in key parts of the economy has the potential to radiate across large sections of the economy. It acknowledges that there will be a major shift in employment patterns and skill profiles.	

Document Name	European Commission DG Environment
Ref Number	59
Organisation	European Commission
Year of Publication	2006

Document Overview:
An investigation into the eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU. Its objective is to better understand the driving forces of the eco-industry development and of potential measures to support this development. Its main focus was on employment (rather than skills), but the two are clearly linked. It looked into emerging markets, how training and capacity building can be managed and implemented, but not the specific skills required. A review was conducted on a sector by sector basis, but with a number of common drivers identified. It acknowledges a lack of empirical data on current/future green skills requirements. It concludes that the eco-industry is growing but requires a more cross-sector and international approach to meet future employment needs. This infers future skills development, but this is not tackled directly.

Information Technology

Document Name	Technology Counts It & Telecoms Insights 2008
Ref Number	38
Organisation	e-skills UK
Year of Publication	2008

Document Overview:
Document summarises findings of e-skills (sector skills council) UK's IT & Telecoms Insights 2008 publications and forecast future based on best available global intelligence. Although LCREE associated skills are not mentioned specifically, the report does state that social and environmental factors are drivers since they are becoming customer considerations. There is no specific mention of LCREE skills, but it does report gaps in technical, business and interpersonal skills within the sector. There is no mention of delivery mechanisms.

Resource Efficiency

Document Name	The Feasibility of a Resource Recovery Park in Northamptonshire
Ref Number	55
Organisation	Northamptonshire Enterprise Ltd
Year of Publication	2007

Document Overview:
This report details the work carried out by Urban Mines Ltd, contracted by Northamptonshire Enterprise Ltd, into the feasibility of developing a Resource Recovery Park (RRP) in Northamptonshire; "a business park populated with companies that either provide a service that promotes the use of waste as a resource, or operates in a particularly environmentally friendly way with the main tenants proposed as recycling / reprocessing companies". They have put a simple mind map together which links the skill issues which, identify the major opportunities to create a ground breaking centre for practical learning, a waste academy and a centre as an exemplar of how to close the feedback loop between education institutions and industry. They specifically look at having an education and skills centre located on the same RRP site and a visitor centre. Conclusion was for the provision of the RRP within NCC plans.

While currently the drivers for skills are Waste legislation, fines, climate change, in the future they are seen as Cost of waste, market incentives / increased reprocessing facilities to waste / recycling industry. The demand and need for the skills will increase particularly pertaining to recycling, waste handling, management and application of new technologies at the expense of traditional skills of landfill management, operation, treatment and restoration. Skill priorities are across all roles from management to drivers and unskilled workers. Skills start with practical waste management, but recognising the sector is changing from landfill to recovery and energy, the future skills are seen as technology bias, materials technology, environmental economics and legislation etc.
While there is a good overall understanding of climate change and how it will effect the skills required to enable greater materials re-use, a review of training providers used by the waste management sector is required together with an assessment of those used by other sectors so that the prospect of cross-fertilisation of ideas and techniques can be developed. Many organisations delegate the selection of training providers to individual business units which leads to inconsistency in standards and outputs.

Document Name	Managed Trading Estates – Pilot Study
Ref Number	77
Organisation	Envirowise
Year of Publication	2007

Document Overview:
The report outlines a study that looked at the resource efficiency potential of three industrial estates in the West Midlands Region. It is shown that industrial estates have significant economic and environmental impacts and that they provide a distinctive grouping for innovative and commercially viable resource efficiency strategies.
Although not statistically representative, Envirowise state that the questionnaire data indicates that there is scope for reducing resource consumption costs by recycling and reusing materials.

Skills

Document Name	CBI Education and Skills Survey 2008
Ref Number	146
Organisation	CBI
Year of Publication	2008

Document Overview:
Document summarises findings of CBI survey of board level executives to see what skills are likely to be required in the future. Although LCREE not specifically mentioned (other than the fact that some firms want to reduce carbon footprint), there is heavy emphasis on Science, Technology, Engineering and Maths, some conversational languages and basic numeracy and literacy skills required at different levels. It is suggested that there is likely to be a large increase in environmental jobs. There is no mention of delivery mechanisms.

Document Name	Skills for Sustainable Development (draft)
Ref Number	159
Organisation	SDC
Year of Publication	2008

Document Overview:
Summary document of project to be undertaken by SDC. Project is to create a framework that highlights common/generic as well as sector specific skills needs i.e. technical and

specialist skills. The aim of developing such as framework is to highlight essential skills for sustainable development that may be common in all education and training, and to reduce the plethora of lists as well as some of the confusion.

Document Name	Skills for the West Midlands Environmental Technologies Cluster
Ref Number	165
Organisation	ECOTEC Research & Consulting Ltd for LSC Black Country
Year of Publication	2004

Document Overview:

The aim of this study was to characterise companies operating in the environmental technologies cluster in the West Midlands, to identify the current and future skills needs of these local employers, and to match these needs with current and potential future provision of environmental training. The study also includes views of managers of West Midlands companies operating in relevant sectors in the West Midlands who were interviewed for the 2003 National Employers' Skills Survey. Report on findings from study aimed to identify ways in which workforce development and support initiatives could best be targeted to support the current and future needs of the environmental technologies sector within the region.

The results from a survey of the companies reinforce the findings from other studies that the environmental technologies sector is a highly skilled sector, employing on average 60-70% of their staff in professional occupations. The main sub-sectors that employ significant numbers of staff in skilled trades, plant and machine operatives are waste management and water and waste water treatment areas.

A number of recommendations to improve relevance and availability of training were identified:

- Improve awareness of the benefits of skills and training (both environmental and business skills) to companies, e.g. through case studies.
- Extend links between companies and universities, including other university departments (environmental and non-environmental, such as business schools).
- Provide better information and support for establishing student placements and technology transfer activities.
- Develop a packaged training information resource for the industry within the region, such as a central website, newsletter, e-mail bulletin, etc.
- More transparency and awareness raising is needed on issues such as work-based learning and related qualifications, e.g. marketing NVQs and Foundation Degrees better to ensure freer movement of people throughout the industry.

Sustainability / Sustainable Development

Document Name	Mind the Skills Gap – The Skills We Need for Sustainable Communities
Ref Number	4
Organisation	Academy for Sustainable Communities
Year of Publication	2007

Document Overview:

This study was completed on behalf of the Academy which was created as a national centre for delivery skills/knowledge for developing sustainable communities, and consists of online surveys and case study audits. Although the document does not deal specifically with LCREE skills, it does state that the skills gap/labour shortages is increasing e.g. planners, architects, urban designers, environmental specialists etc. The research suggests that there are generic as well as technical skills gaps. There are no specific suggestions for delivery.

Document Name	Driving Success – Making the Link Between Human Resources and Sustainable Development
Ref Number	175
Organisation	University of Cambridge Programme for Industry
Year of Publication	2005

Document Overview:
This document is a briefing for HR managers and people responsible for recruitment, performance evaluation and training and development which looks into integrating sustainable development into company activities, including recruitment of new employees. It suggests that companies must continually enhance their workforces' skills to respond to the emerging demands of customers, investors and society as a whole – requirements that change with the ways that people live and work. To do this improves the standing of the company, together with the morale and efficiency of the employees. There are however, no specifics on the LCREE skills required.

Sustainable Procurement

Document Name	Mapping of Current Sustainable Procurement Activity and Support in the Yorkshire and Humber
Ref Number	138
Organisation	For Sustainable Procurement Network by Action Sustainability
Year of Publication	

Document Overview:
This is a research study carried out to review sustainable procurement activity, identify gaps in provision and make recommendations for future action in the Yorkshire and Humber. The research is the product of desk based literature review, interviews and a workshop.
The document is of limited relevance mainly setting out the current situation, some case studies and recommendations. The recommendations are not geared to skills for LCREE as such.

The research did not focus on skills requirements but did reveal that:

- In setting up a Sustainable Procurement Information Network (SPIN) a lack of meaningful commitment from the top (practical leadership) hampered success.
- Also with regards to the SPIN a positive approach by recipients was generally reported but there is a lack of connectivity between strategy/procurement and peoples work. The big picture cannot always be seen.
- The Higher Education Performance Improvement project is working on the following skills areas (although note these are cross sector skills):
    - Energy and environmental management.
    - High performance buildings.
    - Developing capacity of staff with regard to environment related responsibilities.
- Too much sustainable procurement activity and support is available and it is difficult to keep up with all the sources.

Document Name	Sustainable Procurement Training Needs Analysis
Ref Number	139
Organisation	For London Boroughs by Action Sustainability and London Remade
Year of Publication	

Document Overview:

Training needs analysis for sustainable procurement for the London Boroughs. Information gathered from 60 contacts in 31 London Boroughs and the GLA. Focus on sustainable procurement not LCREE as such.
Highlights the need for training in a number of cross sector skills in sustainable procurement including:

- General sustainable procurement awareness.
- Differences between products and services in terms of addressing sustainability requirements.
- Risk assessment.
- Development of a sustainable specification.
- How to evaluate and select suppliers.

Provision of this training should be through 3 courses at different levels (including advanced).

The need for skills in communication and change management for integration of sustainable procurement into day to day activities can also be inferred.
Also highlighted the need for consistency in definitions and raising the profile of this as an issue. Trainees work better learning by example – use of worked examples and case studies as opposed to purely theoretical knowledge.

Document Name	Joining the Gaps in Sustainable Procurement
Ref Number	140
Organisation	For London Centre of Excellence by Action Sustainability
Year of Publication	2007

Document Overview:
This report considers the current status of sustainable procurement across London Boroughs and the GLA group and identifies a series of gaps and opportunities in the form of 'quick win' actions to drive implementation forward. The work was developed using Action Sustainability tools alongside workshops and interviews. This involved self-assessment against the flexible framework and gives a snapshot of where organizations perceive themselves to be.
The research revealed that good practice for sustainable procurement is centred around having established skill sets in: people, policy and communications, processes, suppliers and results. These cross sector skills relate directly to Local Authorities but can be applied to other types of organisations.
Skills requirements which can be inferred are:

- Supplier and supply chain contract performance management.
- Results monitoring and evaluation.

A need to expand on current training provision was identified. The work also concentrated on integration/mainstreaming of sustainable procurement skills. Measures to promote this (which impact on skills requirements) include:

- Interlinking of sustainability and policy making.
- Alignment of funding mechanisms to support he implementation of sustainable procurement.
- Deploying flexible, internet based tools that can be used to measure results with a suite of common output indicators, targets for leaders and process based measures.

Other Research

Document Name	Delivering the Low-Carbon Economy – Business Opportunities for UK Manufacturers
Ref Number	3
Organisation	EEF and Deloitte
Year of Publication	2008

Document Overview:

Examines markets for Low-Carbon Energy, Motor Vehicles and Energy Efficiency in order to help members identify business opportunities which may arise as a result of climate change. The document gives examples of current technology positioning and the potential for future developments, including policy change. It sets out the current obstacles from legislation, and a changing economy, together with opportunities through technology development and skill transference. There is an emphasis on the need for industry to be pro active, building consumer awareness backed by government incentives. The report concludes that to deliver the opportunities discussed, long term relationships need to be developed between government and business in the three key areas of; creating a conductive business environment, establishing a strategic policy for key technologies and empowering consumers to make low-carbon choices. While the report does not deal with low carbon economy skill requirements specifically it does make inferences to skills throughout the text either a transferable skills or inferring the need for skills growth.

Main skills demand drivers identified as; Consumer, policy / planning, competition, economics, supply base, energy reduction, geographical location. Future demand drivers identified as; Renewables (wave / tidal / wind energy), CCS, EV, carbon policy, R&D.

Existing Skills Priorities; Eco-Design, planning, financial modelling, energy minimisation, systems integration, clean coal, advanced CO2 separation and purification, Pre combustion, EUETS, cables, tower building, micro / CHP, raising awareness, carbon policy, investment modelling. Future skills priorities; On / off shore wind, wave, tidal, direct drive motor technology, eco design, measuring & quantifying benefits, supply chain development, Investment modelling, science, engineering, planning / built environment, carbon policy.

Document Name	Towards Sustainable Energy Use for Transport
Ref Number	14
Organisation	UK Energy Research Council
Year of Publication	2007

Document Overview:

A review of technology roadmaps on sustainable energy use for transport, including road, rail, shipping and aviation. The paper summarises the environmental impacts of 'renewable' energy use for transport and the advances in knowledge and technology required to mitigate negative environmental impacts and to ensure environmental sustainability. It will asses the extent to which these issues are addressed by roadmaps from both Europe and North America and will highlight omissions and apparent gaps in knowledge.

Main skills demand drivers identified as; A cost-benefit analysis of biofuels for transportation. Increasing awareness of environmental impacts of crop cultivation for the production of transport fuels. Future skills demand drivers identified as; The full extent of environmental impacts of crop cultivation for the production of transport fuels are unknown. Problems associated with the storage of biofuels and biomass. Security of supply and requirements for substantial imports from the third world.

Skills priorities are identified as; a lack of life-cycle assessments of bio-fuels, development of fuel cells, hybrid engines, low viscosity lubricants and waste heat recovery systems. Significant current technological developments in areas of alternative fuels, technologies and energy efficiencies. A priority is to achieve a modal shift to rail. There has been relatively

little basic research and optimization with regard to locomotive engines using these or alternative fuels.
Future skills priorities are identified as; governmental policies aimed at reducing environmental externalities in the agricultural sector. None of the roadmaps reviewed that have been produced for governments establish a strong system of safeguards for environmental protection. Specific targets – a need to guarantee that site-specific environmental requirements are observed when producing biomass. Minimal sustainability standards required for targets. Environmental impacts of biofuels. Legally binding certification system. Environmental concerns of biomass production – overall systems approach against other alternatives. Impact of genetic modified crops on existing habitats. Clean-up technologies for the emissions from the combustion of biomass and wastes. Air transportation roadmaps. A clear identification of any current and future research priorities. Move toward low carbon shipping.

Document Name	Bioscience Skills Gap
Ref Number	152
Organisation	SEMTA SSC
Year of Publication	2007

Document Overview:
This report provides a link between the first two stages of the Sector Skills Agreement: the Skills Needs Analysis and the Assessment of Current Provision, and informs the later action planning stages: Scoping Collaborative Action and the development of the Costed Action Plan. It summarises the demand issues and identifies the trends in supply to highlight the gaps in workforce development.
Existing priorities: Strategic Alignment of the UK Bioscience Sector needs with the education supply chain to ensure a good supply of well qualified and appropriately skilled employees. Transform the perception of the sector to be attractive and underpinned by effective Information, Advice and Guidance (p4).
Aspirations: UK Bioscience Sector Internationally recognised for World Class Science, Education & Research training provision with significant reach (accessibility); An increase in science literacy across the UK; An aspiration to become a net exporter of science talent; Match the skills demand with the supply 'Skills Balance Sheet'; Identify 'CORE' subjects and activities within the curriculum i.e. the STEM subjects and a focus on Practical skills; Requirement for some form of high level review on an on-going basis (p4).
The greatest skills shortages are in: Clinical/pharmacology/experimental medicine; Bioscience and molecular biology; Analytical and physical chemistry; Process and chemical engineering; In vivo sciences; Bioinformatics (p21).
The main scientific skills gaps were in: Bioscience and molecular biology; Analytical and physical chemistry; Biochemistry; Biotechnology/biopharmaceuticals; Genomics/proteomics/metabolomics; Synthetic organic chemistry/medicinal chemistry; Mathematics or statistics (p22)
The main generic skills gaps were in: Business skills; Management skills; IT skills (general); Project management; Team working; Regulation (p22).
The major skills shortages in the bioscience sector are substantially higher than the UK average across all industries (p25).
Employers identified that they are looking for when recruiting as being: depth of scientific knowledge and skills, in Chemistry, Biological Sciences and Mathematics; interdisciplinary awareness, practical skills, experience in industry and the ability to work to regulatory standards and communication skills (p25).
Overall, the current system is not providing the number of cutting edge researchers, good bench scientists, or skilled technicians required for the development of bioscience and the

adoption of biotechnologies in manufacturing. Supply is not meeting demand and is in fact diverging from it (p32).
Future Skills Needs;
Technical and scientific workforce development (p16).
Capacity building through recruitment and retention (p16).
Management and leadership (p16).
Specialist areas of bioprocessing and biomanufacturing; genomics, proteomics, metabolomics (p25).
There is also a need for multidisciplinary approaches covering genetics, molecular biology, biochemistry, IT, mathematics and statistics. There is a growth in the use of in silico design tools and in silico modelling (p25).
Areas for activity to improve performance in the following areas have been identified: Leadership & Entrepreneurships; Networks and Clusters; Image and Attractiveness of the Sector; Availability of a top quality workforce (p35).

Document Name	Resource Efficient Design – Sector Needs Analysis
Ref Number	171
Organisation	East Midlands Development Agency
Year of Publication	2008

Document Overview:
Aims: Identifying the East Midlands' design and manufacturing industry's low carbon product design support requirements (p1).
Findings: There is an aspiration amongst the East Midlands product design and manufacturing industry to provide low carbon product design solutions. However this desire is not currently matched by commercial incentives or by a thorough understanding of what opportunities low carbon product design can bring to businesses. Current practice in low carbon product design is limited to larger organisations and conceptual product design solutions. It has been established that there is a need to demonstrate the opportunities and how to overcome the barriers associated with low carbon product design (p2).
Skills Demand; The desire to develop business practice in relation to low carbon design is not currently met by practical demand from either small or large clients. It has become such a concern for some small businesses that they are considering how they can push low carbon design requirements onto their clients. Without the demand to develop more environmentally considered products there is little incentive to develop understanding or skills in the field of low carbon product design (p8).
There is very little understanding of what lifecycle design methodology entails, nor how to apply it to design projects (p8).
There is a wealth of research, eco-design tools and literature on eco-design; however a lack of practical application, in everyday design projects, seems to be turning product developers off from engaging with the application of eco-design (p8).
Existing skills priorities; Identifying/tackling the waste impact of SMEs products throughout its lifecycle and applying a carbon footprint to this (p3).
Environmental impacts of SME products including waste, toxicity and natural resource depletion (p3).
In addition to reducing the environmental impact of existing products, there are opportunities to invest in the application of new eco-technologies (p6).
The UK manufacturing industry must stay ahead in efficiency of production (p6).
Skills priorities; Identifying/tackling the waste impact of SMEs products throughout its lifecycle and applying a carbon footprint to this (p3).
Environmental impacts of SME products including waste, toxicity and natural resource depletion (p3).

In addition to reducing the environmental impact of existing products, there are opportunities to invest in the application of new eco-technologies (p6).
The UK manufacturing industry must stay ahead in efficiency of production (p6).
Future skills priorities; Various phrases are used to describe this considered approach to the development of environmentally considered products – "eco-design", "sustainable design", "design-for-environment" (p3).
The following issues have been identified that need to be addressed for designers: Develop awareness of eco-design/lifecycle analysis methods; Designers' capabilities and confidence needs to be raised so that they can communicate the advantages and opportunities in investing in eco-design to clients; Practical, 'hands-on' training is required in order to develop designers understanding and skills in eco-design; Case study projects required to demonstrate the potential for eco-design within conventional design projects. (p9).
The following issues have been identified that need to be addressed for manufactures: Businesses considering undertaking their first new product development project may require additional support in understanding the process; Financial support may be required; Support in engaging with and selecting appropriate design consultancies (p10).
Eco-design services required by manufacturers may include: Low environmental impact materials selection; Low environmental impact technologies selection; Material reduction advice; Waste reduction in manufacturing (p10).

Appendix Nine – Academic Literature Review

ISI Web of Knowledge

1. Initiating a waste management and resource recovery network: A college, NGO and corporate partnership
Dunmade, I Rosentrater, K
Conference on Environmentally Conscious Manufacturing VI
OCT 01-03, 2006

The increasing awareness of sustainable development concept and its economic benefits are making environmentally proactive companies to consider how they can achieve eco-efficiency improvement through material exchange and by partnering with academic, governmental and non-governmental agencies. This paper reports the experiences and achievements of a tripartite partnership initiated by the author with a number of companies in Calgary and a Calgarian NGO. The network is a form of eco-industrial network that is being developed to benefit the participating companies and to develop industrial ecology students' skill in eco-industrial network modelling. The paper highlights the initial difficulties, how they were overcome and a conceptual model developed for assessing the sustainability of the material exchange loop. The preliminary results obtained revealed that the companies are enthusiastic in taking part if it will help them achieve waste management cost reduction, improvement in their corporate environmental performance and corporate goodwill, and protection of their proprietary information. It also reveals that such corporate exposure to students develop their skills in balancing their academic view with what works in the corporate world.

2. The effects of flexibility in employee skills, employee behaviours, and human resource practices on firm performance
Bhattacharya, M Gibson, DE
Journal Of Management VI 31 Is 4

The components of human resource (HR) flexibility and their potential relationship to firm performance have not been empirically examined. The authors hypothesize that flexibility of employee skills, employee behaviours; and. HR practices represent critical sub dimensions of HR flexibility and are related to superior firm performance. Results based on perceptual measures of HR flexibility and accounting measures of firm performance support this prediction. Whereas skill, behaviour, and HR practice flexibility are significantly associated with an index of firm financial performance, the authors find that only skill flexibility, contributes to cost-efficiency.

3. Sustainability science and engineering: The emergence of a new metadiscipline
Mihelcic, JR Crittenden, JC Small, MJ Shonnard, DR Hokanson, DR Zhang, Q Chen, H Sorby, SA James, VU Sutherland, JW Schnoor, JL
Environmental Science & Technology VI 37 Is 23

A case is made for growth of a new metadiscipline of sustainability science and engineering. This new field integrates industrial, social, and environmental processes in a global context. The skills required for this higher level discipline represent a metadisciplinary endeavour, combining information and insights across multiple disciplines and perspectives with the common goal of achieving a desired balance among economic, environmental, and societal objectives. Skills and capabilities that are required to support the new metadiscipline are summarized. Examples of integrative projects are discussed in the areas of sustainability metrics and integration of industrial, societal, and environmental impacts. It is clear that a focus on green engineering that employs pollution prevention and industrial ecology alone are not sufficient to achieve sustainability, because even systems with efficient material and energy use can overwhelm the carrying capacity of a region or lead to other socially unacceptable outcomes.

4. Energy efficiency and renewable energy in Russia – Transaction barriers, market intermediation, and capacity building
Martinot, E
Energy Policy Vl 26 Is 11

Technical-economic and geographical opportunities for energy efficiency and renewable energy in Russia are enormous - cost-effective investments are possible in district heating systems, buildings, and industry, and for wind, biomass, solar and geothermal energy. Market-level energy prices, privatization, and the possibility of independent power production all favour investments in these technologies and technology transfer with other countries. But many transaction barriers limit such investments and transfers, especially barriers that are related to capital, information, infrastructure, market institutions, human resource capabilities, and institutional incentives. Market intermediation and joint ventures are important in overcoming these transaction barriers. International policies, for example by bilateral and multilateral agencies, should facilitate market intermediation. Capacity building should target skills in economic analysis, management, and finance; information services; regulatory development; new market intermediation institutions; stronger legal and market institutions; and implementation mechanisms supporting independent power producers. Policies that encourage and support energy service companies are especially important.

5. Designing The Future - Sustainable Agriculture In The United-States
Francis, CA Madden, JP
Agriculture Ecosystems & Environment Vl 46 Is 1-4

Global agriculture is entering a challenging and difficult period with an increasing human population and an accelerating need for food, fiber, feed, and raw materials for other industries. This challenge will need to be met on fewer hectares of available land and a reduced supply of the fossil fuel inputs that have catalyzed the increased productivity of the past five decades. Agriculture in some forms has negative and lasting effects on the environment. The research and education community is seeking a more resource-efficient, sustainable system of food production that has less negative impact on the environment. This system is characterized by increased resource use efficiency, greater reliance on internal or renewable resources, increased short- and long-term profitability, enhancement of soil productivity, minimal negative environmental impact, and social viability for families and communities. Agricultural research over the last half century has contributed many components to sustainable productivity, but its focus in the future will be more on systems, interactions among components, and the impact of the activity on the broader environment and community. Education in agriculture is moving from a concentration on memorizing detail and cook-book approaches to a development of creative thinking and problem solving skills. We are building the capacity to access and apply a wide range of information resources. There is a growing congruence of classroom teaching and adult education in extension, an evolution that will lead to better curriculum planning for a life-long educational and learning experience. All the key players in US agriculture will take greater responsibility for their own learning in this system, being empowered to conduct both on-station and on-farm research, design learning activities, and evaluate progress and applications of information to real world challenges. This paper describes what is happening in the US in research, in teaching, and in extension. We also envision a new paradigm for education in the future. Instead of preparing to react or adjust to a predictable future, an empowered rural populace can begin to design a more desirable future. With increased focus on scarce resources, fragility of the environment, and the lessons of nature, we can take creative approaches to systems design and begin to make decisions today to create a more sustainable future for tomorrow.

Cambridge Scientific Abstracts Illumina Database

Teaching Students Sustainability: An Interdisciplinary Design Project for Sophomore Engineering Students
Hollar, Kathryn A; Sukumaran, Beena
2002 ASEE Annual Conference & Exposition: Vive L'ingenieur!; Montreal; Canada; 16-19 June 2002.

Universities can be leaders not only in research advances in reducing greenhouse gas emissions, but also have the potential to be leaders in practices that reduce greenhouse gas emissions. All 56 colleges and universities in New Jersey recently joined together to endorse a Sustainability Greenhouse Gas Action Plan for New Jersey. In signing this "sustainability covenant," Rowan University has pledged to reduce its greenhouse gas emissions to 3.5% below 1990 levels by 2005. We have used this agreement as the basis for a novel collaboration between the New Jersey Higher Education Partnership for Sustainability (NJHEPS) and the College of Engineering at Rowan University. We have developed a course project in which sophomore students from all engineering disciplines calculate CO2 emissions for the university and propose methods for further reducing our greenhouse gas emissions. This project has been developed for Sophomore Clinic II, the 4th course in an innovative eight semester multidisciplinary engineering design and practice, project-oriented course sequence that is a hallmark of the Rowan Engineering program. Sophomore Clinic II emphasizes public speaking **skills**, design principles, and engineering economics. Objectives for the course include the following: 1. Calculate greenhouse gas emissions for the university from 1990 to present according to the NJHEPS format. 2. Propose **low**-cost solutions to improve energy efficiency. 3. Propose alternative energy sources that can be incorporated into the future growth of the university. 4. Perform an economic analysis and report any short-term and long-term costs or savings associated with implementing **low**-cost solutions and/or alternative energy sources. 5. Formulate a well-supported, articulate oral argument for using alternative energy sources at Rowan University.

Google Scholar

Skills for a low carbon future and the need to train 10,000 new energy surveyors
Day Tony;
Energy world: 2005, n°329, pp. 10-12

The general shortage of qualified and experienced engineers in the UK is much more acute for energy and building services engineers, and is due to become more so. So what is the academic establishment about to do to about it, and when? Here, Dr Tony Day, Reader in Energy Studies at London South Bank University, discusses the growing need for engineers who understand low and zero energy technologies and can survey buildings and plant, and how they might be trained.

Appendix Ten – Stakeholder Advisory Group

Stakeholder Advisory Group Members
(Please note: not all present at both meetings)

Mark Spilsbury - UK Commission for Employment and Skills
Charlie King - GMB
Sue Ferns - Prospect
Nick Jagger - Institute of Employment Studies
Martin Baxter - Institute of Environmental Management and Assessment
Peter Strutton - East Midlands Development Agency
Rachel Brennan - ISL
Rachel Eade - Birmingham Chamber of Commerce
Jake Reynolds - DCSF and the Sustainable Development Comission
Rob Evans - Defra Natural Environment Group
Shirley Rolfe - BERR
Tim Down - DIUS - by phone
Colin Potter – Unite
Penny Morley – Unite
Andrew Price – DIUS
Alice Williams – Sustainable Development Commission and DCSF
Rob Evans – Defra Natural Environment Group
Shirley Rolfe – BERR
Liam McAleese - Defra Climate Change Group

First Stakeholder Advisory Group Meeting

AGENDA

1.	Introductions.	Defra
2.	Stakeholder Advisory Group Purpose, Terms of Reference and Project Background.	Defra
3.	Project Methodology, Progress and Overview of Findings to Date.	Pro Enviro
4.	Project Website and Consultation Mechanisms.	
5.	Discussion.	All Attendees

Discussion topics:

- Do you have any comments on the results and how they match your expectations and experiences?
- What are your perceptions on the current levels of understanding and awareness of Low Carbon and Resource Efficient Economies and the importance of associated skills within organisations?
- What are the main obstacles to raising levels of understanding and awareness of Low Carbon and Resource Efficient Economy issues and skills requirements within organisations?
- What are the main issues and barriers affecting the mainstreaming of Low Carbon and Resource Efficient Economy skills, competencies and practices?

MEETING NOTES

Liam McAleese outlined the purpose of the project.
There has been a lot of interest in the topic but there is not enough understanding of the skills required for a LCREE; there have been "lots" of high level studies and recent work has been directed towards skills and employability.

This project is an evidence review and is designed to provide an initial start point. This is a very wide review which is being undertaken in a short period and will cover a wide range of skills and evidence sources.

This project is expected to lead to further work based on the findings of the report.

The SAG should be seen as an informal group of interested parties who can provide support and views on the direction of the project and possible next steps.

The proposed terms of reference for the SAG were reviewed and agreed.

Galit Hart presented the Project Methodology, Progress and Overview of Findings to Date and the Project Website and Consultation Mechanisms.

The following comments were made following the presentation;

- The role of universities and HE provision was discussed. The findings so far indicate that the funding mechanisms and the drivers for what is taught in HE do not cater for what employers believe they need in the arena of LCREE.
- It was noted that demand for skills is an important aspect of the project and there is a level of latent demand that is not catered for by the SSC's due to a lack of awareness of the long term need and the funding mechanisms in place to support modular training.
- It was raised that understanding and awareness are key stages which are required before businesses will think about and understand the need for skills development.
- The issue of making key decision makers aware of the need for, and business opportunities of, working in a LCREE manner was discussed. It was agreed there is a need to incentivise employers to do this, but also that there is a place for legislation in 'pushing' this.
- Leadership and general management skills have been recognised as an issue but it is clear that this is not just an issue relating to a LCREE but to management in general. Where it may be an issue is in the lack of management awareness of the issues and therefore a lack of action.
- The question of who needs the skills was raised and that there were a range of skills from technical and higher level scientific and engineering to operational and manual skills
- It was noted that "mainstreaming" LCREE skills into the economic structure of businesses and skills delivery was probably going to be the most effective approach. However, given the difficulty in delivering skills, mainstreaming may also be difficult in the short term.
- It was recognised that 75% of the 2020 workforce are already in work and that there must be an effective way of reaching this group with appropriate qualifications and a fiscal policy that supports re skilling and upskilling in a modular way.
- Business advisors and support professionals need to have the necessary knowledge and competencies to identify and support businesses in the development of skills for a LCREE. This is especially relevant given the Business Support Simplification agenda and the use of the Business Links as the primary gateway for business support.

- There may be a shortage of trainers in the marketplace and there is a heavy reliance on manufacturers to train installers. This does not provide accredited training and qualifications at the present time.
- The language of Sustainable Development, Low Carbon, Resource Efficiency, Green, Eco etc is often used interchangeably and there is a lack of clarity in the economy as a whole.
- Many of the skills associated with LCREE are already in existence and are generic; these do not match with the sector specific approach adopted by the SSC's.
- It was noted that the majority of the SSC's do not cover the issue of a LCREE at all. It was recognised that this is a function of the lack of demand from the employers and backward looking approach as opposed to a forecast of potential future requirements. SSC's should be given a clear mandate to consider longer term issues, including actively collaborating on cross-cutting skills issues.
- Given that many of the skills required for a LCREE already exist but not necessarily in the sectors they will be needed in the future there is a need to identify transferable skills and mechanisms to encourage this transferability.
- There were questions on the skills checklist and whether they were really skills or not. It was accepted that this was a high level framework developed for discussion through this research. The document cascades through a number of tiers and could end with specific skills in each subject area. However it is beyond the scope of this project to develop the document to this level.
- The question of how "experts" were identified and how people were signposted to them.

Second Stakeholder Advisory Group Meeting

AGENDA

1.	Introduction.	Defra	5 mins
2.	Project Aims, Methodology and Summary of Findings and Conclusions.	Pro Enviro	20 mins
4.	Knowledge Management Platform.	Pro Enviro	10 mins
5.	Discussion.	All Attendees	
a.	Do you have any comments on the results and how they match your expectations and experiences?		30 mins
b.	Do you have any comments and/or suggestions on areas for further research?		30 mins
c.	Do you have any comments and/or suggestions on future stakeholder events and ways of managing wider engagement on this topic?		30 mins

DISCUSSION QUESTIONS

A. Do you have any comments on the results and how they match your expectations and experiences?
B. Do you have any comments and/or suggestions on areas for further research?
C. Do you have any comments and/or suggestions on future stakeholder events and ways of managing wider engagement on this topic?

MEETING NOTES

1. Overall the report was helpful and important in terms of influencing the supply and demand sides. It is clear there is currently a low base of evidence.

2. It is difficult to unpack the concept of Low Carbon and Resource Efficient Economy (LCREE) skills and which skills this covers.
3. There is a clear need to reach people already in the workplace – but use of the education system (which has mechanisms in place for skills development) to support LCREE should not be discounted.
4. Confirmation that a culture change is needed to achieve a LCREE.
5. A lot of work is going on in terms of LCREE within organizations and this should be acknowledged.
6. Employers find it difficult at the moment to get their heads round skills, for this reason there should be consistency in the acronyms used.
7. There was a suggestion that the phrase 'chicken and egg' should replace the use of 'catch-22'.
8. Lots of enthusiasm for LCREE has been observed coming directly from employees – many feel that their employers are not doing enough but they are not sure how to further this agenda. The workplace issues and employer enthusiasm which is present should be reflected more in the final report along with the current focus on management and leadership. To gauge the demand from employees, employers could be encouraged to ask staff about LCREE in employer satisfaction surveys. There is a need to establish ways and mechanisms to empower employees to be able to take action (preventing this from being blocked by rigid organisation structure and processes).
9. It is difficult for employees to get time off for training and/or to fit training in.
10. There was support for legislation being a key driver of LCREE skills and practices implementation. Energy prices are going to be a huge driver in future.
11. The discussion on skills is a separate issue from understanding, awareness and capability to make changes. Skills development is different to implementation activities (lots of implementation activities can be made without and changes to current skills levels) with different routes to market. Lots of implementation activities can be made without any changes to current skills levels.
12. There are good examples of large organisations who are taking action in this area.
13. It was felt that there is a more deep seated reason that organisations don't take LCREE action – not just a case of clarifying the business case. Organisation motivation needs to be understood so we can get past this.
14. There is still some way to go to set up a shared understanding of LCREE. The importance of establishing the definition clearly was discussed – essential to get the UK on the right path.
15. Sustainable Development has been struggling to gain hold due to the business case not being strong enough. There isn't yet sufficient incentive in organisations to drive this. Driving factors for this will include more than just the business case. They will include things like legislation and the threat of environmental degradation too.
16. LCREE falls within sustainable development and the point was made that everything has to be set within this context so the relationship between the two is understood. All of government should be subscribing to sustainable development and if government is going to go down the LCREE route then they should not lose sight of the bigger sustainable development whole.
17. Innovation and change management skills are key.
18. The language used to convey the message for different audiences is important and there is a case for tailoring contact with different groups. Targeting the report will be required to move this forward and motivate different groups of people. This work could be publicised with a focus on business skills in general for a better economy (skills for a successful modern economy) to have a wider appeal.
19. More clarity is needed on who needs the skills and who will deliver them. This is important to know which skills 'levers' to pull to reach different target audiences.
20. There needs to be a focus on many levels of the workforce not just leadership and management.
21. Leadership and management skills are very important for getting this systematically applied in organizations. Professional bodies courses don't include emphasis on LCREE (although it is worth

noting that the IOD have recently commenced some work on energy efficiency and climate change).

22. Climate change adaptation skills are needed now – the discussion shouldn't be about future provision.
23. Government is not promoting this strongly enough – it should come through in all official reports.
24. It was observed that the entry level qualifications for many occupations are pitched too high in comparison with what entry level jobs actually entail in practice – this is leading to those receiving the training becoming bored in the jobs and leaving.
25. It was felt by one member that the market would be able to respond to potential increased demand for skills and to provide more deliverers, especially in the case of existing skills.
26. HEFCE are currently promoting short courses – this is an opportunity to appeal to people already in work to undertake further training with an LCREE focus.
27. There are a number of public sector opportunities to further this message which could be utilised (such as re-writes of procurement codes). There is currently no strategy / mechanism to do this.
28. The way HE research funding is apportioned does not foster collaborative cross-sector research. This could prove to be a structural problem in developing the evidence base.
29. There is a reach paucity of benchmarking.
30. There is a need to understand what support, skills and knowledge business advisors will need to successfully identify LCREE issues and broker support. Work has been done to see what skills business advisors with regards to resource efficiency – the business advisor training in the East Midlands on RE should be highlighted as an example of best practice.
31. A wider stakeholder event will be held.

Recommendations for further research work:

32. There is a need for a large scale study on employers perceptions to see what they think and what would get them thinking about and acting on LCREE. Use of networks to reach companies – get a broad cross-section.

ADDITIONAL NOTES AND COMMENTS FROM SAG MEMBERS

- People at all skills and employment levels will have a part to play. Moving to a LCREE will take action from all parts of society.
- LCREE skills include those at lower levels too.
- Some actions have been taken to stimulate LCREE such as EU ETS, renewables obligation certificates, grants for low carbon building, biofuel commitments and EU policy.
- The financial drivers are not yet, or only just, in place for the widespread integration of many of the LCREE skills. For example, tradeable carbon credits and consumer preference. But these are not yet having enough of an impact on the economy to provide a substantial leverage.
- Surprise that there was not more evidence available on resource efficiency skills.
- Business doesn't understand existing skills jargon so can't articulate what is needed to make and effective demand-led system. This makes it difficult to articulate what they need for LCREE.
- This is all about getting people to think differently but not necessarily have a different skills set.
- On new skills areas, there is agreement that land management and production is an important area but this needs to be underpinned by research and development of new crops and production systems recognising, for example, that with a changing climate it may be more appropriate to grow different types of crops.
- It was felt by one of the stakeholder advisory group members that current or future activities overlap with some of the areas of recommended further research work.

Glossary

BERR	Department for Business, Enterprise and Regulatory Reform
BREEAM	Building Research Establishment Environmental Assessment Method
CALM	Carbon Accounting for Land Managers
CEMEP	Commission on Environmental Markets and Economic Performance
CES	Commission for Employment and Skills
CPD	Continued Professional Development
CSA	Cambridge Scientific Abstracts
Defra	Department for Environment, Food and Rural Affairs
DIUS	Department for Innovation, Universities and Skills
DCSF	Department for Children, Schools and Families
DTi	Department for Trade and Industry
ECTIB	Engineering Construction Industry Training Board
EMA	Environmental Management Accounting
EMS	Environmental Management System
E&US	Energy and Utility Skills Sector Skills Council
FE	Further Education
GWINTO	Gas and Water Industry National Training
HE	Higher Education
ICT	Information and Communication Technology
IEMA	Institute of Environmental Management and Assessment
LCREE	Low Carbon Resource Efficient Economy
LSC	Learning and Skills Council
MBA	Master of Business Administration
NSA	National Skills Academy
NOS	National Occupational Standards
RSPB	Royal Society for the Protection of Birds
R&D	Research and Development
SSA	Sector Skills Agreement
SSC	Sector Skills Council
SME	Small and Medium Enterprise
STEM	Science, Technology, Engineering and Mathematics
WWF	World Wide Fund for Nature