



Skills Intelligence

**Occupational and Functional Map
of the UK Renewable Energy Sector**

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Occupational and Functional Map of the UK Renewable Energy Sector

In conjunction with:



Occupational and Functional Map of the UK Renewable Energy Sector

FINAL REPORT

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ECOTEC



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Contents

PAGE

| | | |
|------------|---|-----------|
| 1.0 | Background, Key Findings and Recommendations..... | 1 |
| 1.1 | Introduction | 1 |
| 1.2 | Policy Drivers: Labour Market Implications | 1 |
| 1.3 | Structural Changes | 2 |
| 1.4 | Specific Skill Issues: Priority Concerns | 2 |
| 1.5 | National Consultation Events: Qualifications and Training | 3 |
| 1.6 | Future Research: Recommendations | 4 |
| 2.0 | Introduction and Background | 6 |
| 3.0 | Definition and Coverage | 8 |
| 3.1 | The Renewable Energy Sub-Sectors: Definition and Coverage..... | 8 |
| 4.0 | Key Policy and Strategy Drivers | 11 |
| 4.1 | Introduction | 11 |
| 4.2 | Government Policy | 11 |
| 4.3 | Policy Drivers and Labour Market Implications..... | 13 |
| 4.4 | Policy Drivers and Future Skill Needs | 14 |
| 5.0 | The Research Approach | 15 |
| 5.1 | Introduction | 15 |
| 5.2 | The Consultation and Research Process | 15 |
| 6.0 | The Occupational and Functional Mapping Process | 17 |
| 6.1 | Introduction | 17 |
| 6.2 | Structure of the Occupational and Functional Maps | 19 |
| 7.0 | Occupational and Functional Maps | 20 |
| 8.0 | Overview of Consultative Process Findings..... | 26 |
| 8.1 | Introduction | 26 |
| 9.0 | Identified Course Provision for Renewable Energy Sub-Sectors | 32 |
| 9.1 | Identified Course Provision | 32 |
| 9.2 | Academic Energy Courses Accredited by or Approved by the Energy Institute | 36 |
| 9.3 | Renewable Energy-Related Courses of Interest..... | 37 |
| 9.4 | HEI Undergraduate and Post-Graduate Courses Associated with Renewable Energy | 37 |

| | | |
|--------------------|--|---------------|
| Annex One | Acknowledgments | i |
| Annex Two | References and Background Documents | v |
| Annex Three | Definitions of Generic Skills | viii |
| Annex Four | Occupational and Functional Maps..... | x |
| Annex Five | Consultative Process Findings..... | xxvii |
| Annex Six | Occupational and Functional Map of UK Waste Management Sector | xxxiii |
| Annex Seven | Standard Industrial and Occupational Classifications | xl |

Table of tables

| | |
|---|-----------|
| <i>Table 1.1 Key Occupations by Sub-Sector.....</i> | <i>3</i> |
| <i>Table 7.1 Sector-Specific Occupations and Functional Roles.....</i> | <i>20</i> |
| <i>Table 7.2 All Occupations, Functional Roles and SSC Responsibility</i> | <i>24</i> |
| <i>Table 8.1 Key Consultation Responses: Skills and Training (Selected).....</i> | <i>27</i> |
| <i>Table 9.1 Identified Course Provision by Sub-Sector.....</i> | <i>33</i> |
| <i>Table 9.2 University Course Provision - Accredited or Approved.....</i> | <i>36</i> |
| <i>Table 9.3 Non-Accredited Energy-Related Courses as at September 2005</i> | <i>37</i> |
| <i>Table 9.4. HEI - Undergraduate Courses</i> | <i>37</i> |
| <i>Table 9.5. HEI Taught Post-Graduate Courses.....</i> | <i>38</i> |

1.0 Background, Key Findings and Recommendations

1.1 Introduction

The main purpose of this research is to establish the occupations and functions that exist within the emerging renewable energy sector. This work will assist future developments for this relatively new market as policies develop and as there is greater demand on the labour market and an application of the skills within it. This report collates all the inputs from employers, key stakeholders, interest groups and attendees at four national consultation events organised by Energy & Utility Skills (EU Skills). In addition, it incorporates key policy and strategy documents associated with the sector. Importantly, the report establishes the boundaries between Sector Skills Councils and explores ownership and accountability for skills development within the sector. A number of occupational skill issues and challenges facing the renewable energy sector have been identified and are presented below under the following headings:

- Policy Drivers: Labour Market Implications
- Structural Changes
- Specific Skill Issues: Priority Concerns
- National Consultation Events: Qualifications and Training
- Future Research: Recommendations

1.2 Policy Drivers: Labour Market Implications

No major skill shortages in the renewable energy sectors were identified during the course of this research. However, some key occupations were identified within traditional sectors as being of importance in labour market terms. These are key and contribute to the future of renewable energy, in particular where the traditional sectors are already experiencing a strain on skilled resources. It was also recognised that certain policy decisions and the implementation of those decisions that stimulate the use of new technologies could increase the demand for skilled labour in these areas. These occupations were:

- Plumbers (including heat and venting, air conditioning and refrigeration).
- Electricians.

- Plumbers (including heat and venting, air conditioning and refrigeration) and electricians with installation and design skills capability.
- Civil engineers (Construction).

1.3 Structural Changes

There is a range of structural changes that have been identified as areas in need of attention to help drive the sector forward, particularly:

- More multi-skilling, multi-disciplinary working practices to cover cross-sectoral task opportunities.
- More diagnostic and fault finding skills.
- Greater integration of installation and design skills.
- More leadership/project management skills for those at S/NVQ Levels 2 and 3.
- Greater environmental and legal knowledge/contracting skills.
- More attention to integrating generic skills, particularly team building, communication, product knowledge.
- Attention to succession planning to address, firstly, an ageing workforce and, secondly, the attracting of more young people into the sector. In addition, developing pathways for young people to progress.
- Greater health and safety awareness and practice.

1.4 Specific Skill Issues: Priority Concerns

While this research found no major skill shortages, it did find that a number of occupations (e.g. plumbers, electricians) may come under increasing pressure as demand increases not just from within the sector but from other developments within the economy (e.g. government policies, environmental technology application, housing and major construction projects, including the London Olympics 2012).

Table 1.1 below presents the key occupations identified during the research process that suggest the need for standards development and further research on quantifiable numbers (see Table 7.1) within each sub-sector.

Table 1.1 Key Occupations by Sub-Sector

| Sub-Sector | Occupation | SSCs with joint responsibility |
|---------------|---|---|
| Biomass | Team Leaders, Rate of Burn Technologists, Electrical/Instrumentation Technician; mathematical modelling within IT skills | Energy & Utility Skills Lantra (supply chain) SEMTA SummitSkills |
| Hydroelectric | Engineers – Mechanical, Electrical and Electronic; Civil Engineers (construction); low skilled manual workers | ConstructionSkills ECITB Energy & Utility Skills SummitSkills |
| Photovoltaic | Electricians; Electricians with design skills | Energy & Utility Skills SummitSkills |
| Solar | Carpenters, Plumbers, Electricians; Electricians with design skills | ConstructionSkills Energy & Utility Skills SummitSkills |
| Geothermal | Electrical Engineers, Electricians; Electricians with design skills, Electronic Technicians; pipe and systems laying; mathematical modelling within IT skills | ConstructionSkills Energy & Utility Skills SummitSkills |
| Heat pumps | Heat Pump Installers, Plumbers, Electricians | Energy & Utility Skills SummitSkills |
| Wind | Service Engineers, Fabrication Engineers, Structural Engineers, Site Wardens, Installation Engineers (large scale) | AssetSkills ConstructionSkills ECITB Energy & Utility Skills SummitSkills |

Source: ECOTEC summary of consultations with employers, key stakeholders and interest groups

N.B. Occupations relating to waste-to-energy that may require some standards development can be found within the *Occupational and Functional Map of the UK Waste Management Sector*, produced by EU Skills in 2005 (See Annex Six).

Where electricity is generated and distributed across the network, Energy & Utility Skills will take the lead responsibility, while activities that produce electricity primarily for consumption within the producers' home/commercial premises will be taken forward either as lead or joint responsibility by agreement as indicated in Table 1.1. While these boundaries of responsibility have yet to be finalised (see 1.6 below), the likely lead and joint SSCs have been indicated. These will be finalised during 2006 as research into skills progresses and the sector is further understood. A review of the sector will be undertaken and a view taken on the whole supply chain from source of energy to output.

1.5 National Consultation Events: Qualifications and Training

A range of issues have been identified that particularly impact upon skills provision:

- The need for Personal Development Plans (PDPs) and Continuous Professional Development (CPD) to encourage employee development. These do not appear to be utilised within the sector any great extent, unlike within the more traditional and well established sectors.
- The need to address the apparent lack of awareness or understanding of vocational education and training i.e. qualifications alignment with skills and S/NVQs. This became apparent when employers were asked to articulate the skills of their employees in terms of S/NVQ levels.
- The need for an Apprenticeship framework for the renewable energy sub-sectors.
- Provide taster courses for 14-16 year-olds, for example the SQA Skills for Work courses.
- Further consider the validity of “Bolt-On” courses as extra units in terms of practicality and funding.
- Courses, up to degree level, for renewable energy should be established that support both vocational and academic routes. This will encourage entrants into courses such as engineering to consider the renewable energy sector as a career option. For example, the FdSc at Cornwall College Camborne.

1.6 Future Research: Recommendations

The recommendations below are for further research that should be carried out during 2006, plus an on-going need for collaborative working amongst the Sector Skills Councils (SSCs). They should be addressed within the Skills for Business Network, supported by EU Skills:

- EU Skills will, as a matter of priority, address areas of responsibility for each SSC based upon occupation, amount of output from electricity generation and standards development. They will form a UK forum such as the SSC’s Energy Definition Group (chaired by Cogent) and Highlands & Islands/Scottish Cross-SSC Forum (chaired by EU Skills) to determine sector priorities and ownership.

It will also undertake such activities as:

- Setting up a working group (with employers) to formally align the evidence from this research with the National Occupational Standards (NOS) setting process, especially for the priority occupations identified.
- A study that matches existing NOS against identified occupations supported by the relevant SSC.
- The SSCs will need to conduct a full Labour Market Investigation of the sector to establish the numbers within the labour market for all outputs of renewable energy (i.e. heat, electricity generation and fuels). This will need to consider the demand for and supply of skills to the renewable energy sub-sectors and to further test the initial accreditation and alignment with National Occupational Standards.
- SummitSkills, supported by EU Skills, will address the standards development needs of renewable energy technologies that can be described as “micro-generation” (i.e. photovoltaic, solar, heat pumps and geothermal).
- EU Skills (supported by all SSCs) will, in 2006, review this current OFM taking a view on the whole supply chain and advancements within each sector. Reviews of this OFM should occur regularly as the sub-sectors mature, grow and advance in terms of technological progress and labour/skill demand. This, in particular, is recommended for:
 - Offshore activities (e.g. Tidal, Wave and Wind).
 - Hydrogen and Hydrogen Fuel Cells.
 - Bio-diesels (linking with Cogent on their forthcoming study of the occupations and functions involved in the bio-refinery industry).
 - A supply chain approach.
- Develop training provision forum/fora to ensure the right quantity and quality of training is available around the UK, with sufficient flexibility, to meet the demands of the sector.
- Development of a renewable energy employer database, which captures all businesses in the sector, including those along the supply chain. SSCs also need to capture details of all training providers that deliver, or have the potential to deliver, to the sector.

2.0 Introduction and Background

Renewable energy is an emerging sector of the UK economy. It is a diverse sector that relies on the development of new technology and as a result has already formed a distinct sub-sectoral structure. At the sub-sector level, there exists little in terms of robust research on skills, occupations or functional roles. As a consequence, it is difficult to determine where there are gaps in qualifications and competence levels. Previous research¹ has covered renewable energy but only as part of the wider electricity generation industry and has treated the sector as one homogenous group of businesses and organisations. Also, research carried out on behalf of EU Skills into the waste management sector² provides occupational and standards information on waste-to-energy and landfill gas (see Annex Six).

Therefore, EU Skills commissioned ECOTEC Research and Consulting Ltd (ECOTEC) to research the production of an occupational and functional map of the renewable energy sector at sub-sector level. This map would recognise the wide diversity of activities within the sector and, through consultation and desk research, identify the occupations, skills and functions. In addition it would provide a foundation upon which the need for qualifications and standards can be identified where they are required.

EU Skills secured funding from the Qualifications Curriculum Authority (QCA) and the Scottish Qualifications Authority (SQA) and additional funding from the North West Regional Development Agency in order to carry out this research. EU Skills worked working alongside other SSCs and standard setting bodies (SSBs) - Asset Skills; Cogent, ConstructionSkills, ECITB, Financial Services, Lantra, SEMTA and SummitSkills - towards the delivery of an accurate assessment of the skills and competencies required by employers within the sector.

¹ ETA Employment and Skills Survey – Exploring the Skills Requirements of the UK Renewable Power Industry 2010.

² Occupational and Functional Map of the UK Waste Management Sector, Energy & Utility Skills, 2005

Wider research aim

The research also has wider aims:

- Enhance the knowledgebase and understanding of the sector and sub-sectors – defining the “footprint” of the sub-sectors and their interface with other sectors.
- Help articulate EU Skills’ and other SSCs’ priorities for the sector – particularly in relation to standards development.
- Form the basis of a proposed Labour Market Investigation (to be carried out in 2006).
- Highlight any further skills research required.
- Feed into Sector Skills Agreements (SSAs).
- Identify which SSCs have lead responsibility for each occupational/skill area.
- Identify, from the NOS directory, all potentially relevant occupational standards that already exist and determine whether they are totally relevant or require contextualisation to fit the renewable energy sector.

ECOTEC is addressing the first phase of this research, which is to identify the occupations, roles and functions of the workforce within each sub-sector of renewable energy - **the core element of this report**. In addition, it will provide inputs on strategic and policy drivers, qualitative responses from stakeholders, employers and other interest groups as well as an up-to-date, although not definitive, list of key players and reference documentation.

The second phase is to identify existing NOS that can be used by employers and employees within the sector to improve and demonstrate competence. It will also articulate gaps in the current stock of NOS, providing a basis for future standards development.

3.0 Definition and Coverage

3.1 The renewable energy sub-sectors: definition and coverage

Renewable energy forms are defined as those that are continuously available and will not run out, unlike fossil fuels, coal, oil and gas. The sector is politically sensitive as environmental concerns move up the UK Government's and devolved administrations' agendas and include energy conservation and renewable energy sourcing. The key driver is to see renewable energy as one sector that can make an important contribution to secure, sustainable and diverse energy supplies, while recognising the diverse nature of its sub-sectoral activities.

The definition and coverage of the sub-sectors covered in this report is shown below:

Biomass

Biomass covers the process, via a biomass power plant, of producing electricity or heat by combustion. Biomass is also known as biofuels or bioenergy. The sub-sector may utilise perennial crops for use as fuel in biomass power plants to provide heat and power. Forestry waste can also be utilised.

Energy from waste incineration and the tapping of landfill gas are also part of the sub-sector. Waste-to-energy is becoming widely acknowledged as an important energy source within the renewable energy sector. For more information regarding the occupations employed within these two activities, please refer to Annex Six (and also the full report *Occupational and Functional Map of the UK Waste Management Sector*³).

Wind (onshore and offshore)

Wind represents a vast source of energy and has been used for centuries to grind corn and pump water, so it is not a new energy source. However, the technique is now being applied to produce electricity. Wind energy is often known as an intermittent energy source and has to combine with other electricity sources to provide consistent output. However, as the technology

³ Occupational and Functional Map of the UK Waste Management Sector, Energy & Utility Skills, 2005.

has developed and system costs have reduced, less windy site locations are now feasible, which expands its potential. In addition to the turbine technology it utilises, the other capital input involves concrete turbine foundations, service roads and transformer buildings.

Solar and Photovoltaic

Solar energy involves capturing and harnessing the sun's energy. There are three main ways of doing this:

- Passive solar design - this ensures that a building's form and fabric captures the sun's energy and reduces the need for artificial light and heating.
- Active solar water heating - this converts solar radiation into heat, which can be used directly or stored.
- Solar photovoltaic (PV) panels or solar cells - which convert daylight into electricity.

Solar and photovoltaics involve generating electricity from the sun using photovoltaic or PV panels. They are made of materials that generate electricity when exposed to light. Essentially, they are placed on roofs or on walls and can also be used to replace conventional materials such as roofing tiles or cladding. They are increasingly being used to meet electricity needs when integrated into buildings and are particularly useful for providing power in locations that are not grid linked. Solar water or solar thermal panels trap the sun's heat in panels or tubes for use in homes or other buildings.

Geothermal and Ground Source Heat Pumps

Geothermal heat pumps use the ground's natural heat to provide heating and, in most cases, hot water. These systems take advantage of the earth's relatively constant temperature.

Ground source heat pumps (GSHPs) are electrically powered systems that tap the stored energy of the earth. Heat pumps are able to direct the heat flow, using a relatively small amount of high quality drive energy (electricity, fuel, or high-temperature waste heat). Thus, heat pumps can transfer heat from natural heat sources in the surroundings to a building or industrial application. Heat pumps can also be used in the reverse way for cooling.

Hydroelectric

Hydroelectric power is generated by extracting energy from falling water. There are three main types of hydro-electric scheme: storage schemes; run-of-river-schemes; and pumped storage. Electricity is produced when a flow of water, either from a river or a reservoir, is channelled through a turbine connected to an electricity generator. The amount of power generated depends on the rate of flow and the volume of water available. Large scale installations can generate more than 5MW, while small scale generally produce less than 5MW. Even smaller systems, generating a few tens of kilowatts, are called microhydro plants and are not usually connected to the main electricity network.

Hydrogen

Hydrogen is termed an *energy carrier* rather than a *fuel source* because, while it is used as a source of energy, it can only be produced using energy. It can be produced using fossil fuels such as natural gas or coal by the application of heat.

Little business activity was identified under Hydrogen as there is no fully developed market yet. It is not therefore included in this report. However, it is recommended that the progress of this sub-sector should be monitored.

Tidal and Wave

Wave energy and tidal power involve harnessing the movement and energy contained in the sea and converting it into electrical power. Waves have the potential to provide an unlimited source of renewable energy. Wave energy can be extracted and converted into electricity by turbines and can be deployed on the shoreline or offshore. Tidal energy exploits coastal and tidal waters, which can be used to turn mechanical devices to produce electricity.

This sub-sector is in the early stages of development and little business activity was identified to include in this report. However, there are plans to revisit both Hydrogen and Tidal and Wave during 2006's research programme, subject to a successful funding application.

4.0 Key Policy and Strategy Drivers

4.1 Introduction

With energy underpinning every aspect of the UK economy's activities, energy policy in the UK is now taking a step toward greater use of renewable energy sources to lower the release of greenhouse gases into the atmosphere. Current demand for energy is increasing and the impact of this energy generation has affected the climate system. Government policy is now looking not just to greater efficiency in the use of energy but also to the benefits of renewable energy sources.

Alternative forms of energy generation are becoming essential to preserve energy supply; in a few years the UK will no longer be self-sufficient in energy and it is expected to become a net importer of gas as early as 2006. This section provides a short review of the policy drivers that are aimed at encouraging growth within the renewable energy sector.

4.2 Government Policy^{4,5}

The UK Government has signed the Kyoto Protocol. The Government's Climate Change Programme⁶ set out its proposals for meeting its target of a 12.5% reduction in greenhouse gas emissions in the period 2008-12 and seeks to reduce emissions further – 20% below 1990 levels by 2010.

In the 2003 Energy White Paper⁷ the Government also pledged to cut current carbon dioxide emissions in the UK by 60% by 2050. The Paper highlights the potential contribution that microgeneration⁸ could make towards the UK Government's vision of the energy system by 2020. It suggests that there should be "much more local generation" and more specifically "much more microgeneration, for example CHP (combined heat and power) plant, fuel cells in buildings or photovoltaics".

⁴ Renewable Energy Development in Scotland (FREDS) Scottish Executive 2005

⁵ Securing a Renewable Future: Scotland's Renewable Energy Development Scottish Executive 2003

⁶ The UK Climate Change Programme November 2000

⁷ Energy White Paper Our energy future – creating a low carbon economy UK Government

⁸ Microgeneration is the small-scale production of energy using renewable sources at a local level

A core element of Government policy for the generation of electricity from renewable sources is that by 2010, 10% of UK electricity should come from renewable sources. It has been estimated by the UK Government that to meet the 10% target, approximately 10,000 megawatts of power will need to be generated in this way.

Generated electricity only accounts for a small part of the total energy consumed in the UK and efforts are being made to increase the use of renewable energy for heat production and within transport.

The Government's Sustainable Communities Plan⁹ outlines the Government's approach to meeting the increasing demands for houses. The intelligent use of microgeneration technologies is compatible with the sustainable community philosophy. In addition, the Code for Sustainable Buildings¹⁰ will incorporate minimum standards in key efficiency criteria, including energy, which will go beyond the minimum standards set out in the Building Regulations.

Scotland, Wales and Northern Ireland

In Scotland energy efficiency and renewable energy policies and strategies are devolved to the Scottish Executive. The Scottish Climate Change Programme commits Scotland to generating 18% of its electricity from renewable sources by 2010. However, the Scottish Executive has recently agreed that Scotland should aim for 40% of its electricity to be generated from renewable sources by 2020. One of the main measures to increase Scotland's renewable energy output is the Renewables Obligation Scotland (ROS) Order 2002.

In Wales, the Welsh Assembly Government has set out a target to generate 4 terawatt hours per year of energy from renewable sources by 2010 and this is likely to account for 10% of the electricity generated in Wales.

In order to meet the 2010 renewable energy target, the Welsh Assembly Government's energy policy allows for 800MW of renewables capacity to be provided from strategic onshore wind energy development – mostly in the form of a few large wind farms¹¹. A further 200MW should be provided from

⁹ ODPM Sustainable Communities: Building for the Future

¹⁰ DTI Code for Sustainable Buildings

¹¹ <http://www.wales.gov.uk/subiplanning/content/tans/tan08/newtan8/mipps-e.pdf>

offshore wind and other renewable technologies¹². This approach is based on Wales' abundant onshore wind resource and the fact that onshore wind power is currently the most viable commercial technology available that will provide a high degree of certainty of meeting the 2010 target (The Renewable Obligation covers both England and Wales and works in tandem with the Renewables Obligation Scotland).

Information on UK policies at the regional levels can be found at the DTI website on renewable energy. www.dti.gov.uk/renewables; see also DTI Clear Skies www.clear-skies.org

In Northern Ireland, the Northern Ireland Assembly, as outlined in the Department of Enterprise, Trade and Investment's Strategic Energy Framework 2004, has a development target that, by 2012, 12% of all electricity consumed in Northern Ireland should come from indigenous renewable energy sources. Work is currently under way to implement a Renewables Obligation scheme in Northern Ireland from April 2005 and also to ensure that the Renewables Obligation Certificates will be mutually recognised within the Renewables Obligation operating in England and Wales, and the Renewables Obligation Scotland.

4.3 Policy Drivers and Labour Market Implications

While this study did not identify major skill shortages¹³ at this present time (September 2005), there does appear to be significant skill issues emerging within some sub-sectors (*it should be noted that this research was not aimed at gaining an understanding of skill shortage issues and that a full Labour Market Investigation project is planned for 2006 that will assess demand and supply issues in greater depth*).

The policy drivers (see paragraph 4.2) stimulating renewable energy will exert further pressure on the renewables labour market within the UK, especially in regard to construction, electrical and plumbing skills. This is due to the inclination toward alternative energy sources and environmental protection; the projected house building programme in parts of the UK with its potential for renewable energy applications; and the pressures from other sectors of the economy where the demand for similar skills is competitive.

¹² Joint Ministerial Assembly Government Energy Statement, July 2004

¹³ Plumbers, electricians, electricians with installation and design skills, civil engineers were in increasing demand.

To ensure the supply of suitably qualified and experienced people for the renewable energy sector, the SSCs will need to ensure the labour force has the recognised competency levels and accredited training to meet any potential expected demand. In addition, re-training the existing workforce and encouraging training and learning providers to develop renewable energy specific courses, properly funded, is a key consideration for these stakeholders.

Policy seems to be moving quickly from conventional energy sources and conservation approaches only, towards encouraging greater efficiency in energy usage and application using the outputs of the renewable sector. Thus, demand for appropriate skills will be high.

4.4 Policy Drivers and Future Skill Needs

The research and consultation process identified a range of occupations, skills and functional areas (see section 7). Set against the policy drivers, the following have been identified as emerging or potential consequential actions. A full Labour Market Investigation will need to be carried out to elaborate on these areas:

- A shift in the balance toward more multi-skilling, multidisciplinary working and up-skilling.
- More diagnostic skills activity required.
- Greater demand for integrated installation and design skills.
- More leadership and project management skills at NVQ levels 2 and 3.
- Greater environmental and legal knowledge required.
- Greater contracting skills (e.g. procurement and contract management).
- Greater generic skill capability such as team building, communication, product knowledge and management skills.
- Clear requirement that skilled personnel at degree level and above are required, especially in the R&D and technology driven sub-sectors.
- More succession planning to encourage recruitment up to higher skill levels.
- Creation of career pathways for young people and existing employees.

5.0 The Research Approach

5.1 Introduction

The research programme aimed to ensure:

- Inclusivity across the employer and stakeholder spectrum.
- Spatial coverage reflecting the regional diversity or locational significance of the renewable energy sub-sectors.
- Size of business.

5.2 The Consultation and Research Process

The consultation and research process engaged with:

- Employers.
- Key stakeholders.
- Interest groups.

All those consulted are listed at Annex One.

Key documents on strategy and policy were reviewed for the project. These are listed at Annex Two.

Employer Engagement

ECOTEC structured its consultation programme to include businesses according to:

- Size – the majority of businesses were micro or small to medium size enterprises.
- Geographical location – the report recognises that some sub-sectors have a particular significance regionally, for example wind farms in the South West.
- Sub-sector – the study tried to ensure that the sample used was representative of all the sub-sectors and recognised multi-sectoral activity.

The process of engagement involved:

- Sending all employers a letter of introduction to the project, that outlined the aims and objectives and expected outputs from the research.

- Contacting employers by telephone for an appointment to carry out a short interview face to face or by telephone. The majority opted for a telephone interview.
- Sending to every interviewee a series of core questions that were to be asked during the interview covering:
 - ▶ Employment levels.
 - ▶ Occupational structure/roles/functions.
 - ▶ Qualification levels.
 - ▶ Policy or strategic drivers.
- Only outputs from those employers providing quality responses were used in this research. In addition, a majority of those contacted were unable or unwilling to provide the time to participate. The core part of the employer engagement was thus enhanced as the research developed and as ECOTEC and EU Skills identified new companies/stakeholders.

Stakeholders

ECOTEC and EU Skills also met face to face with a number of key stakeholders who were given the opportunity (along with employers) to attend the national events. These are listed at Annex One.

Interest Groups

A range of interest groups was invited to input into the consultation process. Several were interviewed face to face. See list at Annex One.

National Events

Four events were held across the four nations of the United Kingdom:

- Scotland.
- Northern Ireland.
- England.
- Wales.

At each event attendees were presented with:

- An overview of the aims and objectives of the project.
- The progress of the research to date.
- A set of key questions to be answered from their business or organisational perspective.

6.0 The Occupational and Functional Mapping Process

6.1 Introduction

There were challenges to obtaining good quality inputs to the research process.

The occupational and functional map for the renewable energy sector makes allowances for the following factors:

- There is no clearly defined Standard Industrial Classification (SIC) for the sectors, which would help fully define employment and activity for the renewable energy sector (see assessment of Standard Industrial and Occupational Classifications in Annex Seven).
- Some employers indicated multi-sectoral activity that complicated the mapping process and the research team had to unscramble responses pertinent to a particular sub-sector.
- There is a range of occupations and tasks that are not unique to the renewable energy sub-sectors. These roles or functional areas are not distinct to renewable energy; they could be found within sectors where for example, plumbing, construction, electrical, maintenance or design skills are applied.
- Those experienced in working in the renewable energy sector have the skills that make them equally employable elsewhere. There is commonality of work roles or functions within the sector itself and outside of it.
- Work roles may be shared between occupational groupings in some businesses and not in others.
- Partly as a consequence of the micro-nature of the structure of the majority of the businesses (e.g. sole traders, one or two employees) there was often little response obtained from employers on key issues and questions raised in relation to training and qualifications (however, the majority of employment was in large establishments and inputs from these were much more robust). There was some difficulty when employers were asked to link occupations and competency levels such as National Vocational Qualifications (NVQ/SVQs) with particular occupations.

- Within smaller enterprises it is more likely that an employee accredited to a certain standard (e.g. level 5) may carry out tasks that would be undertaken by employees qualified to lower levels (e.g. levels 2 or 3) within larger enterprises. It is generally not the case that the reverse would apply. Each of the functions/roles set against each occupation would ideally appear only once, irrespective of size of business, but in practice some occupations may include several job roles.
- A multiplicity of competence or accreditation levels already exist that may cover occupational and functional roles within renewable energy. Thus the mapping process would form the basis upon which gaps in competence or accreditation are identified (Phase 2).
- The occupational and functional map can only be an approximation of the workforce structure of a sector. Some businesses may put employees in different occupations so the level of consistency of classification would need to be taken into account. A technician in one business may be an operative within another. There is no distinct Standard Occupational Classification for renewable energy. However, it is at the National Occupational Standards setting stage that this micro-assessment will need to be made.

Despite these caveats, this report can provide a reasonably well defined and informed occupational and functional map.

The occupational and functional mapping process used for this current research aims to identify all occupations and functional roles that operate within the renewable energy sub-sectors set within the levels of the National Qualification Frameworks (NQF):

- The NQF currently operates in England, Wales and Northern Ireland, but the proposed English Framework for Achievement (FfA), the Credit and Qualifications Framework for Wales (CQFW) and Northern Ireland frameworks offer entry at nine levels (a basic entry level, then levels 1 to 8).
- The CQFW framework includes higher education, which is in separate frameworks in England and Northern Ireland.
- The Scottish Credit and Qualifications Framework (SCQF) has twelve levels. It includes community learning and higher education qualifications, alongside work-based, further education and access qualifications.
- NVQs/SVQs are currently assigned to the existing five levels in the home nations' frameworks. The respective UK bodies are working together with European partners to ensure general framework principles and links to the European Qualification Framework (EQF), which has eight levels.

6.2 Structure of the Occupational and Functional Maps

Annex Four presents the occupational and functional maps for the renewable energy sub-sectors. The process is as follows:

- Placement of employees within the various level descriptors of the NQF. The descriptors illustrating the levels are grouped under the following:
 - ▶ Intellectual Skills and Attributes.
 - ▶ Processes.
 - ▶ Accountability.
- Employers were asked to place their employees, within each of these levels, by occupation.
- Employers were then asked to describe the functional role of each employee and to specifically indicate if this was considered a specific renewable energy sector activity
- Employers articulated further the generic skills that were required for the functional role each employee undertook (ECOTEC also used its experience to consider the relevance of generic skills¹⁴ to each occupation)
- Employers were then asked to indicate what qualification they considered was appropriate for that occupation and functional role.

Classifying employees according to various occupations and functional roles was difficult and resulted in some inconsistency. The research team used its experience and judgement to ensure the allocation of employees within the maps was as accurate as possible.

¹⁴ Generic skills are defined at Annex Three

7.0 Occupational and Functional Maps

This section presents summary evidence from the research on:

- Specific occupations and functional roles.
- All occupations and functional roles.

Consultees were asked to consider which of the occupations and associated functional roles could be considered renewable energy specific. Many of the occupations are common to other sectors of the economy, only a few have been highlighted as renewable energy sector specific. However, many of the tasks employed can equally be applied to other sectors. Table 7.1 shows the renewable energy-specific occupations and functional roles.

Table 7.1 Specific Occupations and Functional Roles

| Sub-sector | Occupation | Functional roles | SSCs with joint responsibility |
|-----------------------|--|--|--|
| Biomass | Professional Engineers, Scientists and Technologists | Hands on development and application of processes and product, research, development technology and solutions | SEMTA Lantra (supply chain) SummitSkills |
| | Rate of Burn Technologists | Technology application at technician level including testing and monitoring, instrumentation, heat treatment process | SEMTA |
| | Ash/Wheel Loader | Manual support-handling inputs via truck/vehicle methods | ConstructionSkills Proskills |
| | Tipping Hall Supervisor | Supervising movement of waste via heavy plant and machinery-health and safety operations | Energy & Utility Skills |
| | Products/Residue Operative | Basic manual and operative tasks and monitoring outputs | Energy & Utility Skills |
| Hydro-electric | Mechanical Engineers | Hydraulics and compressor design application | SEMTA |
| | Civil Engineers (Construction) | Engineering construction, planning and technical advice; project management | ConstructionSkills ECITB Energy & Utility Skills SummitSkills |

| Sub-sector | Occupation | Functional roles | SSCs with joint responsibility | |
|---------------------|---------------------------------|---|--|--------------------------------------|
| Photovoltaic | Electricians with design skills | Installation and testing of photovoltaic systems, measuring outputs and installation to grid system | Energy & Utility Skills SummitSkills | |
| | Project Engineers | Technical applications, installation and management, Systems engineering, CAD, building/architectural skills | ConstructionSkills SummitSkills | |
| Solar | Installation Depot Managers | Day-to-day management of the installation process | Energy & Utility Skills SummitSkills | |
| | Solar Technicians | Installation of solar technology, metering skills application; electronics (testing and monitoring) | ConstructionSkills SummitSkills | |
| | Design Technicians | Applying design of products to individual projects | SummitSkills | |
| | Carpenters | Fitting and construction | ConstructionSkills | |
| | Pipe Fitters | Installation (fitters and technicians) | SummitSkills | |
| | Geothermal | Surveyors | Seismic surveying | SEMTA |
| | | Electrical Engineers | Maintenance and installation activities, measurement and testing | Energy & Utility Skills SummitSkills |
| Heat Pumps | Technologists | Knowledge of energy issues, climate change and environmental issues, sustainable technology, geothermal resources and heating regulations | SummitSkills | |
| | Heat Pump Installers | For example, as for Plumbers and Electricians below knowledge of compressors, expansion valves, evaporators, condensers, refrigeration and superheating, hydraulic integration, fault finding and diagnosis | SummitSkills | |
| | Plumbers | For example: plumbing and refrigeration processes, heating systems fault testing, ventilation and air quality (also as above for HP Installers) | SummitSkills | |
| | Electricians | Electrical installation (also as above for HP Installers) | Energy & Utility Skills SummitSkills | |

| Sub-sector | Occupation | Functional roles | SSCs with joint responsibility |
|------------|---|--|--|
| Wind | Electrical/ Mechanical Engineers | Research and Development | Energy & Utility Skills SummitSkills |
| | Installation Engineers | Engineering applications and maintenance | ConstructionSkills ECITB Energy & Utility Skills SummitSkills |
| | Service Engineers | Servicing of wind turbines with focus on electrical systems | Energy & Utility Skills SummitSkills |
| | Technicians Level 1 and 2 (Wind Operator Company) | For example, service, maintenance and replacement of main components, assisting with craneage and heavy lifting | Energy & Utility Skills SummitSkills |
| | Technicians Level 4 (Wind operator company) | Team leadership, planning and implementing work, managing other teams | Energy & Utility Skills SummitSkills |
| | Divers | Survey, installation and maintenance | Cogent |
| | Fabrication Engineers | Steel tower erection | ConstructionSkills ECITB |
| | Site Wardens | Day-to-day supervision of sites- communication to public | AssetSkills |
| | Operations Supervisors | Production and performance reporting | Energy & Utility Skills |
| | Wind Turbine Technicians (Client Company) | Working to a senior wind turbine technician as below | Energy & Utility Skills SummitSkills |
| | Senior Wind Turbine Technician (Client Company) | Managing wind turbine technical operational process | Energy & Utility Skills SummitSkills |
| | Level 1 Technicians (Wind Operator Company) | Familiarisation and induction to Health and Safety, evaluation and HV, FAW | Energy & Utility Skills SummitSkills |

Source: ECOTEC Research and Consulting Ltd 2005

* The responsibility or owner for the appropriate national occupational standard is to be confirmed by the appropriate standard setting body.

For Biomass: see also *Incineration* and *Landfill* at Annex Six.

There were a number of occupations and functional roles that should be considered as priorities by the SSCs from the list of **all occupations** provided by consultees. Table 7.2 shows a number of the occupational and functional roles where there was strong evidence of increasing demand within each of the sub-sectors of renewable energy. ECOTEC has provided a number of general comments against each sub-sector. SSCs and key players may consider these issues in relation to ownership, current standards in place or adequacy of supply of training provision. See also Tables 9.1 to 9.5 for identified training courses associated with renewable energy.

Table 7.2 All Occupations, Functional Roles and SSC Responsibility

| Sub-sector | Occupation | Functional roles | SSCs with joint responsibility* |
|------------------------|--|---|---|
| Biomass | Team Leaders | Supervising employees in production, process and maintenance tasks | N/A |
| | Rate of Burn Technologists | Technology application at technician level including testing and monitoring, instrumentation, heat treatment process | SEMTA |
| | Electrical/Instrumentation Technicians | Installation and maintenance support, electrical and mechanical, fault and risk diagnosis/monitoring | Energy & Utility Skills SummitSkills |
| <i>General comment</i> | <i>Multi-skilled teams required</i> | <i>Greater requirement for multi-skilled employees at all technical levels to work in project team approach</i> | N/A |
| Hydroelectric | Engineers – mechanical, electrical, electronic | Managing multi-skilled tasks – maintenance, electrical installation electrical flow monitoring, hydraulics, water flow and pressure | Energy & Utility Skills SEMTA SummitSkills |
| | Civil Engineers (Construction) | Engineering Construction, planning and technical advice, project planning | ConstructionSkills ECITB Energy & Utility Skills |
| | Low skilled workers | Basic manual tasks | N/A |
| <i>General comment</i> | <i>Rural location of projects is a barrier to higher level skill recruitment</i> | <i>Civil Engineers in particular</i> | N/A |
| Photovoltaic | Electricians; Electricians with design skills | Installation and testing of PV systems, measuring outputs, installation to grid systems | Energy & Utility Skills SummitSkills |
| <i>General Comment</i> | <i>Low skilled and unaccredited installers</i> | <i>Tendency for low skilled and unaccredited installers with no design skills to operate in the sector</i> | N/A |
| Solar | Carpenters, Plumbers, Electricians; Electricians with design skills | All with installation and design skills | ConstructionSkills Energy & Utility Skills SummitSkills |
| <i>General Comment</i> | <i>Low skilled and unaccredited installers</i> | <i>Confidence in some installers is an issue</i> | N/A |

| Sub-sector | Occupation | Functional roles | SSCs with joint responsibility* |
|------------------------|--|--|---|
| Geothermal | Electrical Engineers | Maintenance and installation activity, measuring and testing | Energy & Utility Skills SummitSkills |
| | Electricians; Electricians with design skills | Wiring and Installation, monitoring of heat and temperature outputs and flow | Energy & Utility Skills SummitSkills |
| | Electronic Technicians | Measuring and testing, monitoring and diagnostics | SummitSkills |
| | Pipe and systems laying | Pipe laying operatives | ConstructionSkills SummitSkills |
| <i>General Comment</i> | <i>Employees with multi-skilled and flexible approaches are required</i> | <i>Technical staff need to see the whole product not just their specific input</i> | N/A |
| Heat Pumps | Heat Pump Installers-plumbers and Electricians | Accredited Installation staff | SummitSkills |
| <i>General Comment</i> | <i>Employees with multi-skilled and flexible approaches are required</i> | <i>Technical staff need to see the whole product not just their specific input</i> | N/A |
| Wind | Service Engineers | Servicing wind turbines with focus on electrical and electronic systems | SummitSkills Energy & Utility Skills |
| | Structural Engineers | Construction skills | ConstructionSkills ECITB |
| | Fabrication Engineers | Steel tower erection | ConstructionSkills ECITB |
| | Site Wardens | Day-to-day supervision of sites-communication and media skills | AssetSkills |
| | <i>General Comment</i> | <i>Employees need holistic understanding of whole operation</i> | <i>Greater holistic approach to the sector is required in terms of skills</i> |

Source: ECOTECH Research and Consulting Ltd 2005

For Biomass: See also *Incineration* and *Landfill* at Annex Six.

* The responsibility or owner for the appropriate national occupational standard is to be confirmed by the appropriate standard setting body.

8.0 Overview of Consultative Process Findings

8.1 Introduction

The consultation process used for this research was designed to capture qualitative responses from across the renewable energy sub-sectors. At the national events responses from stakeholders and interest groups and some employers were recorded. No attempt has been made to prioritise them. Further research would need to be carried out to weigh or fully confirm their significance. The responses were recorded under a range of key areas:

- Key policy and strategic drivers.
- Core occupations and skills.
- Qualifications and future plans for FE/HE vocational development.
- Training provision sufficiency to meet current and future skills needs.
- Community engagement.

Table 8.1 shows the most significant responses in relation to core occupations and skills, qualifications and training provision. The majority of responses reported are verbatim and are individual perceptions. It is intended that these will need to be further tested, validated and qualified in the proposed future Labour Market Investigation by EU Skills. Annex Five shows the full range of consultative process findings.

Table 8.1 Key Consultation Responses: Skills and Training (Selected)

| Sub-sector | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs |
|--------------------|--|--|--|
| All Sectors | Engineering skills are central to the renewable energy sector but there is greater competition between sectors in the economy for such skills. | Personal Development Plans (PDP) and Continuous Personal Development (CPD) need greater recognition to build up skills and promote succession planning. | University courses need more hands-on training and not just theory; need for theory at University courses in engineering to be put in context of renewable energy applications. |
| | There is a greater expectation by customers of technical reliability and associated skills of workforce. | FE Colleges that have Plumbing, Electrical Installation, Electronic Control, Construction and Civil Engineering courses should ensure a renewables content. | There needs to be an apprenticeship framework that includes Renewable Energy qualifications or core elements. |
| | Plumbing, electrical installation, electronic control, construction skills across all sectors are core skills. | Partnership working between HE/FE and employers is a way forward to ensure skills of trainers, employees and trainees are updated in relation to manufacturers. | The adequacy of current and future training provision is dependent upon policy drivers and future market position, considered to be adequate at present in general terms but systems and processes change and so should courses. |
| | A combination of integrated electrical and plumbing skills is required. | Funding learning opportunities is an issue. Some Colleges are offering a range of courses in 2006 leading to formal qualifications as and when QCA provides funding, which address skills for renewables. Employers are not necessarily aware of this. | Need for funding of units as well as qualifications. Some concern over 'bolt on' courses. |
| | Welding and mechanical fitting skills/pipe fitting/steel erecting trades are in demand. | SQA Skills for Work Courses that provide taster opportunities for learners aged between 14-16 should be applied to renewable energy skills for work courses. | |

| Sub-sector | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs |
|----------------|--|---|--|
| Biomass | <p>High turnover at low skill levels in Biomass.</p> <p>Potential shortage of engineering graduates may affect Biomass.</p> <p>Design and modelling, production of plant is staffed by highly skilled people; low staff turnover.</p> <p>At the waste treatment level little interest in skill development at operative/manual levels.</p> | <p>Businesses use HE for selection of staff, courses are considered more than adequate at graduate level.</p> | <p>Linkage with HEIs is strong and recruitment is made through this linkage with relevant departments.</p> |

| Sub-sector | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs |
|---------------------|---|---|---|
| <p>Hydro</p> | <p>Rural nature of site location hinders recruitment.</p> <p>Shortage of Civil Engineers in Hydro. They are out there in the economy but rural location of businesses is an issue affecting supply.</p> <p>In power systems the Electrical Engineer is the core occupation.</p> <p>In R&D Compressor design staff and Mechanical Engineers are required.</p> <p>New build programmes will involve a range of construction skills including repair and maintenance - these skills are competitive.</p> | <p>Workforce at management and professional level is ageing - PDP and CPD essential to promote succession planning.</p> | <p>Very little apprenticeship training is in place which negates early capture of young people.</p> <p>Industry would like to see sandwich courses that combined academic and work experience.</p> <p>Graduates lack hands-on vocational experience</p> |

| Sub-sector | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs |
|--|--|---|---|
| <p>PV, Solar, Geothermal and Heat Pumps</p> | <p>Shortage of plumbers and qualified electricians.</p> <p>Increasing demand for accredited Heating installers in PV, Solar and Heat Pumps; Design Engineers with CAD capability.</p> <p>Engineering skills-mechanical, electrical and thermal technology application.</p> <p>Accredited installers with knowledge/skills in above and building and construction regulations.</p> <p>Quality verifiers are required.</p> <p>Installation and maintenance skills at craft level are increasingly required</p> | <p>Various courses are appropriate and adequate for plumbers, electricians and installers.</p> <p>Plenty of courses available for electro-technical, plumbing, refrigeration and air conditioning, heating and ventilation building services occupations.</p> <p>There is a Solar Domestic Heating Hot Water (SDHW) Heating course being developed for qualified or experienced domestic Heating Engineers and Plumbers. A BPEC certificate will be awarded and exemption from the mentoring aspect of SCHRI accreditation.</p> | <p>More integrated courses are required that capture flexible working and multi-skilling.</p> <p>But note: These conventional trades need training or retraining and development for qualifications on renewable installation. Is there a case for freestanding renewable energy sector qualifications or should they be 'Bolt-Ons' to existing courses?</p> <p>Encouraging Heating Engineers to participate in solar training courses can only be driven by good potential market opportunities.</p> <p>The Government should support the development of accredited installation and design training courses, especially the recently developed BPEC accredited solar water heating training course.</p> |

| Sub-sector | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs |
|-------------|--|---|---|
| Wind | <p>Tendency to use overseas skilled labour to construct wind turbines.</p> <p>Local contractors input into the construction of foundations and access roads.</p> <p>Electricians, Builders, Generator Operators with wind turbine and switching skills/Electrical Engineers.</p> <p>Considerable mobility of staff at operator and supervisory levels.</p> <p>Technicians with basic mechanical and electrical technical background, enhanced with specific plant maintenance and operations training by the manufacturer.</p> | <p>NVQ3 level for Technicians.</p> <p>HNC or above for Supervisors or Operations Managers.</p> <p>For Developer Managers an academic and professional qualification in planning or an environmental discipline.</p> | <p>Needs to be a common set of competencies across the industry and standards that can be assessed.</p> |

Source: ECOTEC Consultations

9.0 Identified Course Provision for Renewable Energy Sub-Sectors

9.1 Identified Course provision

This section provides an overview of course provision and those in development that could be linked directly or indirectly to renewable energy sub-sectors. This study is not a training audit and this section does not provide a definitive list of all courses that are purely renewable energy based. This applies to the volume of training carried out by manufacturers in-house. There are very few formal courses that are stand alone. Many courses have elements of skill training that are part of wider courses such as engineering or construction.

However, the research identified a number of courses that could be directly applied to renewable energy and these are shown below. Research undertaken by Avayl Engineering Consultancy¹ could not find any certified vocational training courses or qualifications in renewable energy, apart from the City & Guilds Unit in PV Installation. It appears that none of the current apprenticeship programmes or S/NVQs relevant to the sub-sectors includes specific requirements for renewable energy installations.

The following tables outline differing types of provision.

Table 9.1 Identified Course Provision by Sub-Sector

Table 9.2 University Course Provision Accredited or Approved

Table 9.3 Unaccredited Energy-Related Courses of Interest

Table 9.4 HEI Undergraduate Courses Associated with Renewable Energy

Table 9.5 HEI Taught Post-Graduate Courses Associated with Renewable Energy

Table 9.1 shows a selection of identified courses associated with identified sub-sector renewable energy elements.

¹ Avayl Engineering Consultancy Towards A Workforce development Plan for Renewable Energy Technologies in the Highlands and Islands March 2004 prepared for Highlands and Islands Enterprise

Table 9.1 Identified Course Provision by Sub-Sector

| Sub-sector | Provider | Course | Occupation/role/skills |
|---|--|--|---|
| Solar | School of Construction, Inverness College UHI | Solar Domestic Hot Water (SDHW) Heating to assist in SCHRI accreditation – BPEC derived and no connection to C&G 2372 (see PVs) See www.inverness.uhi.ac.uk/construction | For experienced plumbing and heating engineers |
| Renewable Energy Technologies Course modules include: Planning for energy Conventional sources of energy Biomass as a source of energy Tidal and Hydroelectric sources Geothermal energy Environmental law Project Management Energy from wind and waves Solar energy. | Cornwall College Camborne | FdSc (Foundation Degree) in Renewable Energy Technologies See michael.hunt@cornwall.ac.uk | For occupations applying law, economics, science , engineering and technology |
| Renewable Energy Systems. 8 taught modules includes: Wind, solar, bio-energy and water power technologies as well as electrical integration and energy policy. | Loughborough University | MSc in Renewable Energy Systems Technology Approval by Institute of Electrical Engineers, Institute of Mechanical Engineers and the Energy Institute for those seeking Chartered Engineer status See http://crestdl.lboro.ac.uk | Undergraduates or career changers. |
| Renewable Energy and Resource Management Covers: Hydrogen Renewable Energies – Hydro, Tidal, Wave and Bio-energy, Wind, Solar and Geothermal Resource management. | University of Glamorgan | MSc Renewable Energy and Resource Management See www.glam.ac.uk | Graduates in a science or engineering related subject. |

| Sub-sector | Provider | Course | Occupation/role/skills |
|---|---|--|---|
| Heat Pump Installers Key competencies for certified heat pump installers including for example monitoring HP systems, fault diagnosis, heat distribution systems and hydraulics, integration and planning. | In UK | See European Commission SAVE Programme | Trainees must already hold a plumbing or refrigeration qualification |
| Installation and ongoing maintenance of a wide range of new and distributed technologies such as solar panel installation, micro-CHP, wind turbines and biomass plant. | Empower's COVE working with industry to ensure that training provision is demand led | Covers electricity generation, distribution and supply including renewable sources Contact: www.empower-training.com | Emphasis on Level 3 (equivalent to skilled craftsperson/A Level). |
| Domestic Solar Water Heating (DSWH) Installers' Course. | CAT, Solar Design Company and Filsol Ltd | | |
| Renewable Energy Essentials | Centre for Sustainable Energy www.cse.org.uk/training/courses | Not accredited but approved by the Energy Institute. | Targets managers, Local Authority staff, planning officers, architects and building services engineers. Approved by the Energy Institute(EI) and an EI CPD Certificate is awarded |

| Sub-sector | Provider | Course | Occupation/role/skills |
|---|---|---|---|
| PV Installation | Bedford College www.bedford.ac.uk Blackburn College www.blackburn.ac.uk Empower Training www.empower-training.com Guildford College www.guildford.ac.uk Redcar and Cleveland College www.cleveland.ac.uk Lews Castle College www.lews.com.uk Installation Training Courses for qualified electricians City & Guilds 2372 neil.walker@empower-training.com | C&G Unit 2372 (Accredited through Clear Skies) Covers the installation of domestic grid connected photovoltaic systems by qualified electricians. | Experienced electricians Level 3 or equivalent knowledge of the IEE Inspection (City & Guilds courses 2381 and 2391). |
| Alternative Technology Various courses include: Heating and Wood Fuels; Wind Power; Solar Electric Systems (DIY); Solar Water Heating Systems (For Installers); Solar Electric Systems Installation (For Professionals); Renewable Energy Systems (DIY); Solar Water Heating Systems (DIY); Domestic Wind power Systems, Hydroelectric Power Systems. | Centre for Alternative Technology www.cat.org.uk | Delivered by specialists in their field | |

Source: ECOTEC Consultations

9.2 Academic Energy Courses Accredited by or Approved by the Energy Institute

The Energy Institute lists on its website (www.energyinst.org.uk) a range of academic energy courses accredited or approved by them. The site indicates whether the course will obtain chartered or incorporated status.

Of these, there are a number that cover renewable energy:

Table 9.2 University Course Provision – Accredited or Approved

| Institution | Course title | Qualification | Accreditation or approval |
|---|---|---------------|---------------------------|
| City University, London | Energy and Environmental Technology and Economics | MSc | CEng FL |
| De Montfort University http://www.iesd.dmu.ac.uk | Climate Change and Sustainable Development | MSc | MEI |
| Herriot-Watt University www.hw.ac.uk | Energy (FLAME Programme) | MSc | MEI |
| Loughborough University www.loughborough.ac.uk | Electronic and Renewable Energy Systems Engineering | BEng | CEng FL |
| University of Nottingham www.nottingham.ac.uk | Renewable Energy and Architecture | MSc | MEI |
| South Bank University www.sbu.ac.uk | Sustainable Energy Systems | MSc | CEng FL |
| Strathclyde University www.strath.ac.uk | Energy Systems and the Environment | MSc | CEng FL |
| University of Ulster www.ulster.ac.uk | Renewable Energy | MSc | CEng FL |
| University of Southampton Solar Energy Sector www.south.ac.uk | Renewable Energy | MSC | N/A |
| Reading University www.reading.ac.uk | Renewable Energy and the Environment | MSc | N/A |

Source: Energy Institute; ECOTEC Consultations

9.3 Renewable Energy-Related Courses of Interest

The Energy Institute also lists on the above website a range of courses that are not accredited.

Table 9.3 Non-Accredited Energy-Related Courses as at September 2005

| Institution | Course title | Qualification |
|-----------------------------------|---|---------------|
| De Montfort University | Climate Change and Sustainable Development | PGCert. |
| Glamorgan University | Energy Management (Combined Studies) | BA (Hons)/BSc |
| Loughborough University | Renewable Energy Systems Engineering | MEng |
| Loughborough University | Renewable Energy Systems | MSc |
| Staffordshire University | Design Technology for Renewable Energy | BSc (Hons) |
| University of the West of England | Environmental Management and Sustainability | N/A |

Source: Energy Institute Website

9.4 HEI Undergraduate and Post-Graduate Courses Associated with Renewable Energy

The following is not a definitive list of courses available. Equally since some learning activity is cross-sectoral, engineering courses for example, it is also not a reflection of courses where renewable energy may form part of the content. It can not, therefore, be considered a complete and definitive audit of provision. Renewable Energy is also a relatively new subject area and is very much covered by basic engineering, building technologies and construction subjects. What it does show is that there is a considerable number of course opportunities beyond level 3.

Table 9.4 HEI - Undergraduate Courses

| Institution | Course title | Renewable energy content | Accreditation or approval where identified |
|--|--------------------------|--|--|
| University of Dundee www.dundee.ac.uk | BSc/MSc Renewable Energy | Includes renewable energy technologies such as solar cells, wind and tidal energy and geothermal sources | N/A |
| University of Exeter www.ex.ac.uk | BSc Renewable Energy | Facilities for solar, wind, geothermal and wave power | N/A |

| Institution | Course title | Renewable energy content | Accreditation or approval where identified |
|--|---|--|--|
| Aberdeen University www.abdn.ac.uk | BSc Renewable Resources | - | N/A |
| University of Loughborough www.lboro.ac.uk | MEng Electrical and Renewable Energy Systems | Programme builds on foundation modules to include wind power and photovoltaic systems and integration into power supply systems. | N/A |
| University of Plymouth www.plymouth.ac.uk | BSc Mechanical Design and Manufacture with Renewable Energy | Includes renewable energy in some depth | N/A |
| University of Southampton www.soton.ac.uk | MEng Mechanical Engineering/Sustainable Energy Systems | Includes renewable energy sources | N/A |

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Table 9.5 HEI Taught Post-Graduate Courses

| Institution | Course title | Renewable energy content | Accreditation or approval where identified |
|--|--|---|---|
| City University www.city.ac.uk | MSc Energy, Environmental Technology and Economics | Renewable energy and sustainability; energy supply and conversion technology. | MSc Accredited by Energy Institute. |
| Durham University www.dur.ac.uk | MSc New and Renewable Energy | Harnessing renewable resources, network integration. | Set up by New and Renewable Energy Group (NaREG). |
| University of East London www.uel.ac.uk | MSc Advanced Environmental and Energy Studies | Principles and practice of renewable energy; focus on building. | N/A |
| Edinburgh University www.see.ed.ac.uk | MSc, Postgraduate Diploma Sustainable Energy Systems | Sustainable energy-principles and processes, energy and systems, renewable energy engineering, network simulation, energy policy. | N/A |

| Institution | Course title | Renewable energy content | Accreditation or approval where identified |
|---|--|---|--|
| Glamorgan University www.glam.ac.uk | MSc Renewable Energy and Resource Management | Climate change; renewable energy supply, hydrogen as a vector fuel; policy and legislation. | Delivered by members of Sustainable Development Research Centre. |
| Glasgow Caledonian University www.sbne.gcal.ac.uk | MSc, PgD Energy and Environmental Management | Focuses on renewable energy technologies most likely to succeed in UK, includes integrated systems. | N/A |
| Herriot Watt University www.postgraduate.hw.ac.uk | MSc/Diploma Sustainability Engineering | Renewable energy technologies, policy and legislation. | N/A |
| Herriot Watt University www.icit.org.uk | MSC Flexible Learning in Renewable Energy | Economics of renewable energy; Includes renewable technology: generation, integration. | N/A |
| Leeds University www.leeds.ac.uk | MSc PgDs Energy and Resources | Built up from a number of discrete modules e.g. energy from biomass and use of biomass as energy. | Delivered through the Energy and Resources Research Institute. |
| London Metropolitan University www.londonmet.ac.uk | MSc Integration of Renewable Energies in Buildings | Low energy design; integration of renewables in buildings; EU collaboration for placements; simulation projects. | Delivered through Low Energy Architecture Research Unit (LEARN). |
| Loughborough University www.lboro.ac.uk | MSc Electronic and Electrical Engineering | Sustainability, policy and environmental management; introduction to solar, wind, water and biomass power; integration of renewables. | Delivered through Centre for Renewable Energy Systems Technology (CREST). |
| De Montfort University www.iesd.dmu.ac.uk | MSc Climate Change and Sustainable Development | Includes Sustainable Development, Renewable Energy, Integrated Environmental Strategies, and Energy in Buildings. | Delivered through Institute of Energy and Sustainable Development-aim is the integration of new and renewable energy in buildings. |
| De Montfort University www.iesd.dmu.ac.uk | MSC Energy and Sustainable Building Design | Includes Renewable Energy Sustainable Development. | As above. |

| Institution | Course title | Renewable energy content | Accreditation or approval where identified |
|--|---|---|---|
| University of Manchester www.manchester.ac.uk | MSc Electrical Power Engineering (Sustainable electrical systems) | Power generation including renewable generation and integration of distributed generation, economics of power supply. | Electrical Energy and Power Systems Research Group. |
| University of Newcastle www.ncl.ac.uk | MSC Renewable Energy Flexible Training Programme | Includes wind and hydro energy technology, hydrogen and fuel cell technology, biomass and waste technology; solar energy. | Links with NaREC. |
| Ulster University www.ulster.ac.uk | MSc in Renewable Energy | - | N/A |

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Annex One

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| Gary Fisher | Develop (Develop-Solutions) |
| Robin Curtis | Earth Energy |
| Neil Walker | Empower Training |
| Mike Carney | Energy & Utility Skills |
| Jane McKenzie | Energy & Utility Skills |
| Nic Wilkinson | Energy Institute |
| Philip Hirst | Energy Saving Trust |
| Richard Johnstone | Energy Saving Trust |
| Jenny Mercer | Engineering Construction Industry Training Board |
| Marian Kelly | Environmental Services Association |
| Sandra Renicks | Forward Scotland |
| Paul Balmer | Gastec CRE Ltd |
| Fred Thompson | Glen Dimplex |
| Charles King | GMB |
| John MacNulty | Green Dragon Energy Ltd |
| Andy Hewson | Hand Made |
| David Mckenzie | Highland Light and Power Ltd |
| Sandy Kerr | ICIT Herriot Watt University |
| Alex MacDonald | Inverness College |
| Rolf Oldach | IT Power Ltd |
| John Ross | Lisburn Institute of FE/HE |
| Duncan Scott | MWH Global |
| Desmond Bell | North West Institute of FE/HE |
| Kevin Murray | North West Institute of FE/HE |
| Nicola Pearshall | Northumbria University (Northumbria Photovoltaics Applications Course) |
| Rod Blunden | RWE Npower |
| Rhys Howells | RWE Npower |
| Mike Davies | RWE Npower |

| Name | Organisation |
|------------------------|---|
| Mark McGuigan | Omagh College |
| Phil Coker | PC Energy |
| Bob Smith | Perth College/UHI |
| Alison Kingdon | PV Systems |
| Dermot Roddy | Renew Tees Valley Ltd |
| John Finnegan | Renewable Energy Systems (Ireland) Ltd |
| Henning von Barsewisch | REPower Ltd |
| Tony Book | Riomay Ltd |
| Michael Doran | Rural Generation Ltd (Northern Ireland) |
| Jim Davis | Scottish Enterprise Energy Team |
| Bobbie Ronnie | Scottish Executive |
| Andrew Jamieson | Scottish Power |
| Neils Dam | Siemens Wind Energy |
| Alun Berry | Smart Energy UK Ltd |
| David Rose | South West Water |
| Bob Blake | Summit Skills |
| Ronnie Geary | Summit Skills |
| Neil Collishaw | Summit Skills |
| Ian Stirrat | Summit Skills |
| Christine Ballard | The National Energy Foundation |
| Rowan Hewson | Unilever |
| Ruth Goodyear | Welsh Assembly Government |
| Charlotte Cosserat | Welsh Development Agency |
| Helen Plowman | Wind Prospects Ltd |
| Bev Foster | Yorkshire Forward |

| British Hydro Association | |
|---------------------------|-----------------------------|
| Martin Foster | Ashfield Hydro |
| Matt Palmer | Dulas Ltd |
| Alan Denver | Gardner Denver |
| Nick Pike | Gilbert Gilkes & Gordon Ltd |
| Kieran Hanson | HydroPlan |
| Steve Cryer | South West Hydro |
| Prof. David Williams | |
| Dr. Tom Jardine | |

| Sector Skills Councils | Sector responsibilities |
|-------------------------------|---|
| Asset Skills | Property services, housing, cleaning services and facilities management |
| Cogent | Chemical, nuclear, oil and gas, petroleum and polymer industries |
| ConstructionSkills | Construction sector |
| ECITB | Engineering construction industry |
| Energy & Utility Skills | Electricity, gas, waste management and water industries |
| Financial Services | Financial services industry |
| Lantra | Environmental and land-based industries |
| SEMTA | Science, engineering and manufacturing technologies |
| SummitSkills | Building services engineering |

Annex Two

References and Background Documents

| Organisation | Document title |
|---|---|
| AEA Technology | Renewable Heat and Heat from Combined Heat and Power Plants – Study and Analysis Report (to DTI and DEFRA) (http://www.defra.gov.uk/farm/acu/energy/fes-renewable-chp.pdf) |
| City & Guilds | Choose your future Guide to Qualifications 2005 (www.city-and-guilds.co.uk) |
| Compact Power | Renewable Energy Solutions (www.compactpower.co.uk) |
| DEFRA/TUSDAC | Greening the Workplace (A Fair and Just Transition) (www.tuc.org.uk/economy/tuc-9996-f0.pdf) |
| Department for Trade and Industry | Microgeneration Strategy and Low Carbon Buildings Programme (www.dti.gov.uk/energy/consultations/microgen.pdf) |
| Electricity Training Association | Employment and Skills Survey – Exploring the Skills Requirements of the UK Renewable Power Industry to 2010 (www.euskills.co.uk/opencms/export/www/Research/Publications/9_Renew_Employment_x_Skills_Survey_2003.pdf) |
| Energy & Utility Skills | Electricity Labour Market Investigation, 2004 (www.euskills.co.uk) |
| | Occupational and Functional Map of the UK Waste Management Sector, 2005 (www.euskills.co.uk) |
| Envirolink North West | Wind Energy Supply Chain Directory (www.envirolinknorthwest.co.uk/downloads/3rd%20Edition%20low%20ores.pdf) |
| Forum for Renewable Development in Scotland | Developing Skills for Scotland's Renewable Energy Workforce (www.scotland.gov.uk/Resource/Doc/69582/0018015.pdf) |
| | Biomass Energy Group Report 2005: "Promoting and Accelerating the Market Penetration of Biomass Technology in Scotland 2004" (http://www.scotland.gov.uk/library5/enterprise/pabtis.pdf) |
| | "Harnessing Scotland's Marine Energy potential" (http://www.scotland.gov.uk/Resource/Doc/1086/0006191.pdf) |
| Highlands & Islands Enterprise | Towards A Workforce Development Plan for Renewable Energy Technologies in the Highlands and Islands, 2004 |
| HM Government | Securing the Future: Delivering UK Sustainable Development Strategy, 2005 (http://www.sustainable-development.gov.uk/documents/publications/strategy/SecFut_complete.pdf) |
| International Energy Agency | Photovoltaic Power Systems Programme (www.oja-services.nl/iea-pvps/home.htm) |
| National Assembly for Wales | Strategic Study of Renewable Energy Resources in Wales (Draft Report) (www.wales.gov.uk/subitradeindustry/content/consultations/renewable-resources-e.htm) |
| National Energy Foundation | Phase II of the National Energy Centre (www.nef.org.uk/aboutus/phase2.htm) |

| Organisation | Document title |
|---------------------------|---|
| RWE Npower | Company Profile – Clean Power for a Sustainable Future (www.natwindpower.co.uk) |
| Scottish Enterprise | Energy Industries Strategy: 2005-2010, A Strategic Framework for Scotland's Energy Sectors (www.scottish-enterprise.com/publications/energy-strategy-2005-10.pdf) |
| Scottish Executive | Future Energy Group Report 2005: "Scotland's Renewable Energy Potential: Realising the 2020 Target" (www.scotland.gov.uk/Resource/Doc/69582/0017404.pdf) |
| | Going for Green: A Green Jobs Strategy for Scotland (www.scotland.gov.uk/Resource/Doc/54357/0013160.pdf) |
| Solar Trade Association | Response to the Microgeneration and Low Carbon Buildings Strategy (www.greenenergy.org.uk/sta/reference/documents/sta-microgeneration-response.pdf) |
| Welsh Assembly Government | The Sustainable Development Plan 2004-2007 (http://www.wales.gov.uk/themessustainabledev/content/action-plan-e.pdf) |
| | Ministerial Interim Planning Policy Statement (01/2005): Planning for Renewable Energy (http://www.wales.gov.uk/subiplanning/content/tans/tan08/newtan8/mi-pps-e.pdf) |

Annex Three

Definitions of Generic Skills

Generic Skill Definitions

| Generic skill | Definition |
|---|--|
| Numeracy | The ability to use numbers/mathematics at a level necessary to function and get on, both in work and outside work. |
| Literacy | The ability to read, write and speak English (or English and Welsh) at a level necessary to function and get on, both in work and outside work. |
| Welsh language skills | The ability to read, write and speak through the medium of Welsh at a level necessary to function and get on, both in work and outside work. |
| Foreign language skills | The ability to read, write and speak in a foreign language at a level necessary to function and get on, both in work and outside of work. |
| Problem solving skills | The ability to identify a difficulty and put it right. |
| Communication skills | The ability to share and exchange information clearly, using appropriate language and images. |
| Ability to follow instructions | To undertake a task successfully. |
| Ability to learn | The capacity to take in and apply information. |
| IT skills | By this we mean user IT skills – that is the knowledge and non IT-professional skills, required at work, to use effectively computer hardware, software and electronic communications. |
| Showing initiative | To act independently, without prompting or instruction. |
| Leadership skills | To direct and motivate others. |
| Management skills | The management of tasks and resources to the benefit of the organisation. |
| Organising own learning and development | Identifying learning needs and acting upon them. |
| Team working skills | Establishing effective working relationships in a team to achieve a common goal. |
| Understanding consumer needs | An awareness of customer needs and desires and having the ability to respond appropriately. |
| Entrepreneurial skills | The drive to take considered risks with new ideas. |
| Adaptability/flexibility | Intuitively understood, no definition supplied. |

These skill definitions were designed as a prompt to allow interviewers in the field to respond to queries from interviewees.

Annex Four

Renewable Energy – Occupational and Functional
Maps

Table 1A: Occupational and Functional Map of the Biomass Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|---|---|--|--|---|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or group outcomes. | Managing Director Director Plant Manager Process Manager HR Manager Team Managers Project Task Manager Professional Engineers, Scientists and Technologists Marketing Director |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| | Analyse, reformat and evaluate a wide range of information. | | | |
| Make a significant and original contribution to a specialised field of enquiry. | | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Production Manager Plant Manager (Design) Maintenance Manager Rate of Burn Technologists IT software specialists |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. | | Take responsibility for the nature and quantity of outputs. | |
| | Evaluate information, using it to plan and develop investigative strategies. | | Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Production Controller Process Controller Laboratory Technician Shift Change Engineer Team Leader Chargehand Health and Safety Manager |
| | Access and evaluate information independently. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. | |
| Level 2 | Analyse information and make reasoned judgements. | | Accept limited responsibility for the quantity and quality of the output of others. | |
| | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | Operative Technician Monitoring Technician Plant Operative Wheel Shovel Operative Ash/Wheel Loader Operative Tipping Hall Supervisor Revenue Clerk LGV Driver Electrician/Instrumentation Technician Welder Weighbridge Operative Crane Operative |
| | Make comparisons. | Co-ordinate with others. | Achieve outcomes within time constraints. | |
| | Interpret available information. | | Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| Demonstrate a range of skills. | | | | |
| Level 1 | Employ a narrow range of applied knowledge and basic comprehension. | Show basic competence in a limited range of predictable and structured contexts. | Exercise a very limited degree of discretion and judgement about possible actions. | Shift Operative Plant Cleaner Products/Residue Operative Maintenance Support Operative |
| | Demonstrate a narrow range of skills. | Utilise a clear choice of routine responses. | Carry restricted responsibility for quantity and quality of output. | |
| | Apply known solutions to familiar problems. | Co-operate with others. | Operate under direct supervision and quality control. | |
| Entry Level | Present and record information from readily available sources. | | | |
| | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | |
| | Exercise basic skills. | Carry out processes that are repetitive and predictable. | Rely entirely on external monitoring of output and quality. | |
| | Receive and pass on information. | Undertake clearly defined tasks. | | |

Table 1.B: ECOTEC-Identified Occupational and Functional Role Characteristics – Biomass Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|------------------|---|---|--|--|
| Level 5-8 | Managing Director. | Senior overseeing of company strategy and policy. | Entrepreneurial and management skills; leadership skills. | PhD or Higher degree/first degree |
| | Director. | Day-to-day management and policy application/legal and regulatory and compliance issues; quality; operating planning. | Management and leadership skills. | First and higher degrees |
| | Plant Manager. | Site or project management including implementing operating plan. | Management and leadership skills; communication skills. | First degree/diploma |
| | Process Manager. | Specific technology process production control. | Management and leadership skills; team working skills; Problem solving skills; communication skills. | First degree or professional qualification |
| | HR Manager. | Management of staff and employees; training. | Communication skills; management and leadership skills. | |
| | Team Managers. | Small project team management. | Management and leadership skills. | Diploma or professional qualification |
| | Project Task Manager. | Specific project task management and monitoring. | Management skills. | Diploma or professional qualification |
| | Professional Engineers, Scientists and Technologists. | Hands on development and application of processes and product; research; develop technology and solutions. | Problem solving skills; communication skills. | PhD or Higher degree/first degree |
| | Marketing Director. | Marketing strategy and policy development. | Understanding consumer needs. | Marketing Qualification Membership of Institute of Marketing |
| Level 4 | Production Manager. | Supporting senior managers; quality. | Problem solving skills; management skills; team working skills; showing initiative. | Graduate |
| | Plant Manager (Design). | Supporting senior managers and overseeing waste treatment functions. | Problem solving skills; management skills; team working skills; showing initiative. | Graduate |
| | Maintenance Manager. | Maintenance - overseeing upkeep of the plant and site; inspection of facilities. | Problem solving skills; management skills; team working skills; showing initiative. | Diploma |
| | Rate of Burn Technologists. | Technology application at technician level including testing and monitoring, instrumentation, heat treatment process. | Problem solving skills; management skills; team working skills; showing initiative. | Degree/Diploma |
| | IT software specialists. | Computer software applications; mathematical modelling. | IT skills; adaptability/flexibility. | Graduate, NVQ/HNC |
| Level 3 | Production Controller. | Managing and organising production day-to-day. | Problem solving skills; management skills; team working skills; showing initiative. | Diploma; GSCE 0 / A Levels |
| | Process Controller. | Process control day-to-day. | Problem solving skills; management skills; team working skills. | Diploma; GSCE 0/A Levels |
| | Laboratory technician. | Product testing and monitoring. | Problem solving skills. | Diploma; GSCE 0/A Levels |
| | Shift Change Engineer. | Managing operational changes. | Adaptability/flexibility. | Engineering Craft/Technician Certificate |
| | Team Leader. | Supervising employees in production, process and maintenance tasks. | Management skills. | Engineering Craft/Technician Certificate |
| | Chargehand. | Supporting production process. | Ability to follow instructions; adaptability/flexibility. | Engineering Craft/Technician Certificate |
| | Health and Safety Manager. | Applying company health and safety rules. | Communication skills; organising ones own learning and development. | H&S Certificate of competence |

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|--------------------|---|---|---|---|
| Level 2 | Operative Technician. | Technical support-carrying out basic operation of equipment in biomass process. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Monitoring Technician. | Technical Support – monitoring process outputs. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Plant Operative. | Technical Support – supporting operations and maintenance. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Wheel Shovel Operative. | Manual support-basic operation of biomass processes and operations via tip, grab, bucket or piping methods. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Ash/Wheel Loader Operative. | Manual support-handling inputs and outputs via truck/vehicle methods. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Tipping Hall Supervisor. | Supervising movement of waste-health and safety operations. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| | Revenue Clerk. | Clerical support-administrative operations. | Numeracy and literacy. | GCSEs |
| | LGV Driver. | Operative skills-driving internal and external vehicles carrying waste and other inputs to the biomass process. | Ability to follow instructions; adaptability/flexibility. | LGV Licence |
| | Electrician/ Instrumentation Technician. | Installation and maintenance support; electrical and mechanical, fault and risk diagnosis/monitoring. | Ability to follow instructions; adaptability/flexibility. | NVQ Level 2/3 |
| | Welder. | Welding applications. | Adaptability/flexibility. | NVQ Level 2 |
| | Weighbridge Operative. | Operative tasks-weighing and measurement of inputs and outputs from biomass process; includes calibration and measurement instrumentation applications. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence |
| Crane Operative. | Operative tasks-operating cranes to transport and move loads between locations on site. | Ability to follow instructions; adaptability/flexibility. | Certificate of competence | |
| Level 1 | Shift Operative. | Basic manual and operative tasks. | Ability to follow instructions. | No specific qualification |
| | Plant Cleaner. | Basic manual and operative tasks. | Ability to follow instructions. | No specific qualification |
| | Products/Residue Operative. | Basic manual and operative tasks. | Ability to follow instructions. | No specific qualification |
| | Maintenance Support Operative. | Carrying out identified maintenance tasks under supervision. | Ability to follow instructions. | No specific qualification |
| Entry Level | | | No information provided. | |

Table 2A: Occupational and Functional Map of the Hydroelectric Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|--------------------|--|--|---|--|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or outcomes. | Directors Managers Accountants Engineers Environmental Engineers Mechanical Engineers |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| | Analyse, reformat and evaluate a wide range of information. Make a significant and original contribution to a specialised field of enquiry. | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Engineers Civil Engineers (Construction) |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. | | Take responsibility for the nature and quantity of outputs. | |
| | Evaluate information, using it to plan and develop investigative strategies. | | Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Accountants Officers |
| | Access and evaluate information independently. Analyse information and make reasoned judgements. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. Accept limited responsibility for the quantity and quality of the output of others. | |
| Level 2 | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | No Information provided |
| | Make comparisons. Interpret available information. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| | Demonstrate a range of skills. | | | |
| Level 1 | Employ a narrow range of applied knowledge and basic comprehension. | Show basic competence in a limited range of predictable and structured contexts. | Exercise a very limited degree of discretion and judgement about possible actions. | No Information provided |
| | Demonstrate a narrow range of skills. | Utilise a clear choice of routine responses. | Carry restricted responsibility for quantity and quality of output. | |
| | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| Entry Level | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | No information provided |
| | Exercise basic skills. | Carry out processes that are repetitive and predictable. | Rely entirely on external monitoring of output and quality. | |
| | Receive and pass on information. | Undertake the performance of clearly defined tasks. | | |

Table 2B: ECOTEC-Identified Occupational and Functional Role Characteristics – Hydroelectric Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic Skills (to varying levels) | Indicative qualifications expected by employers |
|--------------------|---------------------------------|---|---|--|
| Level 5-8 | Directors. | Overall overseeing of business policy and strategy. | Entrepreneurial and management skills; leadership skills. | Civil Engineering Qualification, Building and construction degree and membership of professional association/institute |
| | Managers. | Management and leadership; direction and application of company policy/strategy. | | |
| | Accountants. | Financial management and control. | Management skills. | Chartered Accountancy Status |
| | Engineers. | Managing multi-skilled tasks – engineering maintenance, electrical installation, electrical flow monitoring, hydraulics, and water flow dynamics. | Management and leadership skills; communication skills. | |
| | Environmental Engineers. | Environmental appraisal. | Management and leadership skills; team working skills. | |
| | Mechanical Engineers. | Hydraulics and compressor design application. | Problem solving skills; communication skills. | |
| Level 4 | Engineers. | Engineering tasks-engineering maintenance, electrical installation, electrical flow monitoring, hydraulics, and water flow dynamics. | Problem solving skills; management skills; team working skills; showing initiative. | Mechanical Engineering Craft Certificate |
| | Civil Engineers (Construction). | Engineering construction, planning and technical advice; project management. | Team working skills, product knowledge. | Civil Engineering Qualification and membership of professional association/institute |
| Level 3 | Accountants Officers. | Financial administration. | Management skills. | QCA |
| Level 2 | | | No information provided. | |
| Level 1 | | | No information provided. | |
| Entry Level | | | No information provided. | |

Table 3A: Occupational and Functional Map of the Photovoltaic Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|--------------------|---|--|---|--|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or outcomes. | Director Project Engineers |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Student Engineers Operational Managers Electricians Systems Engineers |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. Evaluate information, using it to plan and develop investigative strategies. | | Take responsibility for the nature and quantity of outputs. Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Technical Assemblers/Production Sales staff internal Sales force in field |
| | Access and evaluate information independently. Analyse information and make reasoned judgements. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. Accept limited responsibility for the quantity and quality of the output of others. | |
| Level 2 | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | Workshop Technicians Building Construction Skills Roofers/Plasterers/Bricklayers |
| | Make comparisons. Interpret available information. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| | Demonstrate a range of skills. | | | |
| Level 1 | Employ a narrow range of applied knowledge and basic comprehension. Demonstrate a narrow range of skills. | Show basic competence in a limited range of predictable and structured contexts. Utilise a clear choice of routine responses. | Exercise a very limited degree of discretion and judgement about possible actions. Carry restricted responsibility for quantity and quality of output. | No evidence available |
| | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| | | | | |
| Entry Level | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | No evidence available |
| | Exercise basic skills. | Carry out processes that are repetitive and predictable. | Rely entirely on external monitoring of output and quality. | |
| | Receive and pass on information. | Undertake the performance of clearly defined tasks. | | |

Table 3B: ECOTEC-Identified Occupational and Functional Role Characteristics – Photovoltaic Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|-------------|---------------------------------|---|---|---|
| Level 5-8 | Director. | Overall control of business, process and policy. | Entrepreneurial and management skills; leadership skills. | Graduates, NVQ levels 4 and above |
| | Project Engineers. | Technical applications, installation and management; systems engineering/CAD building and architecture skills. | Management and leadership skills, communication skills, team working skills, problem solving skills, understanding customer needs. | |
| Level 4 | Student Engineers. | Electrical research. | Problem solving skills; management skills team working skills; showing initiative. | Postgraduate level |
| | Operational Managers. | Day-to-day running of process and operations, installation, organising and applying health and safety. | Problem solving skills; management skills; team working skills; showing initiative. | General engineering |
| | Electricians. | Installation and testing of photovoltaic systems; measuring outputs; installation to grid systems; design skills. | Problem solving skills; management skills; team working skills; IT skills; adaptability/flexibility. | City & Guilds 2372 Clear Skies recognises Major PV Demonstration Programme run by EST. Certificate confirming the PV Installation complies with Part P of Building Regulations. |
| Level 3 | Technical Assemblers/Production | Assembling highly technical equipment. | Problem solving skills; management skills; team working skills; adaptability/flexibility, ability to follow instructions, communication skills, organising ones own learning and development. | HNC/Graduate |
| | Sales staff internal. | Marketing and selling; negotiation skills; process transactions; purchasing process and control. | Communication skills, product knowledge. | GCSE/A |
| | Sales force in field. | Marketing and selling; negotiation skills; process transactions; purchasing process and control. | Communication skills, product knowledge. | GCSE/A |
| Level 2 | Roofers/Plasterers/Bricklayers. | Construction skills-complex and high structures. | Product knowledge. | NVQ2/3 |
| | Workshop Technicians. | General workshop support for technical staff. | Ability to follow instructions; adaptability/flexibility; numeracy and literacy. | ONC |
| Level 1 | | No information provided. | | |
| Entry Level | | No information provided. | | |

Table 4A: Occupational and Functional Map of the Solar Thermal Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|-------------|--|--|---|--|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal outcomes. | Chief Executive Managing Director Operations Director National Installation Technical Manager |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| | Analyse, reformat and evaluate a wide range of information. Make a significant and original contribution to a specialised field of enquiry. | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Regional Operational Managers National Sales and Marketing Managers Health and Safety Managers |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. | | Take responsibility for the nature and quantity of outputs. | |
| | Evaluate information, using it to plan and develop investigative strategies. | | Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. Access and evaluate information independently. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Installation Depot Managers Solar Technicians Design Technicians Surveyors Sales staff internal Sales force in field Warehouse Managers Carpenters, Plumbers, Electricians Pipe Fitters Office Managers |
| | Analyse information and make reasoned judgements. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. Accept limited responsibility for the quantity and quality of the output of others. | |
| Level 2 | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | Roofers Scaffolders Telesales staff Storeperson |
| | Make comparisons. Interpret available information. Demonstrate a range of skills. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| | Employ a narrow range of applied knowledge and basic comprehension. Demonstrate a narrow range of skills. | Show basic competence in a limited range of predictable and structured contexts. Utilise a clear choice of routine responses. | Exercise a very limited degree of discretion and judgement about possible actions. Carry restricted responsibility for quantity and quality of output. | |
| Level 1 | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. Exercise basic skills. | Operate mainly in closely defined and highly structured contexts. Carry out processes that are repetitive and predictable. | Carry out directed activity under close supervision. Rely entirely on external monitoring of output and quality. | |
| Entry Level | Receive and pass on information. | Undertake the performance of clearly defined tasks. | | |

Table 4B: ECOTEC-Identified Occupational and Functional Role Characteristics – Solar Thermal Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|--------------------|--|--|--|---|
| Level 5-8 | Chief Executive. | Management of strategic business direction. | Entrepreneurial and management skills; leadership skills. | Graduate level |
| | Managing Director. | Management of day-to-day business direction. | Management and leadership skills, team working skills, problem solving skills, communication skills, understanding customer needs. | Graduate level; knowledge of hydraulics, meteorology |
| | Operations Director. | Management of business at operational level. | Management and leadership skills. | Building control and town planning issues |
| | National Installation Technical Manager. | Overseeing installation operation. | Management and leadership skills, team working skills, problem solving skills, communication skills, understanding customer needs. | Energy efficiency C&G, installation design skills |
| Level 4 | Regional Operational Managers. | Management of the installation work on a regional non-HQ basis. | Problem solving skills; management skills; team working skills; showing initiative. | HNDs |
| | National Sales and Marketing Managers. | Sales and marketing. | Problem solving skills; management skills; team working skills; Showing initiative. | Marketing Diploma/Certificate |
| | Health and Safety Managers. | Health and Safety legislation application, monitoring and evaluation. | Problem solving skills; management skills; team working skills; showing initiative. | Recognised health and safety trainer certificate |
| Level 3 | Installation Depot Managers. | Day-to-day management of the installation process. | Problem solving skills; management skills; team working skills. | Technical certification |
| | Solar Technicians. | Installation of solar technology, metering skills application; electronics testing and monitoring. | Problem solving skills; management skills; team working skills, ability to follow instructions. | Vocational qualification and 2/3 NEBOSH qualified |
| | Design Technicians. | Applying design of products to individual projects. | Product knowledge; problem solving. | |
| | Surveyors. | Project planning and site surveying. | Problem solving skills. | Surveyor certificate of competence |
| | Sales Staff internal. | Marketing and selling; negotiation skills; process transactions; purchasing process and control. | Communication skills, product knowledge. | Sales and marketing competence certificate |
| | Sales Force in field. | Marketing and selling; negotiation skills; process transactions; purchasing process and control. | Communication skills, product knowledge. | |
| | Warehouse Managers. | Managing logistics. | Organisation and management skills. | Management and administration certificate |
| | Carpenters. | Fitting and construction. | Team working skills. | Construction craft certification; Building Services qualification |
| | Plumbers. | Installation, pipe fitting; maintenance. | Team working skills. | Plumbing craft certification |
| | Electricians. | Installation; maintenance. | Team working skills. | Approved electrical qualification |
| | Pipe Fitters. | Installation (fitters and technicians). | Team working skills. | Certificate of competence |
| | Office Managers. | Operational management of field teams. | Management skills, communication skills, product knowledge. | Administration certificate |
| Level 2 | Roofers. | Installation of panels and other equipment. | Ability to follow instructions. | Building related qualification |
| | Scaffolders. | Scaffold and rigging assembly. | Ability to follow instructions. | Building related qualification |
| | Telesales staff. | Sales. | Product Knowledge, communication skills. | GCSEs |
| | Storemen. | Logistics. | Ability to follow instructions. | Trade background |
| Level 1 | | No information provided. | | |
| Entry Level | | No information provided. | | |

Table 5A: Occupational and Functional Map of the Geothermal Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|--------------------|---|--|---|---|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or outcomes. | Directors/Managers Geophysicists Geologists |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | Environmental Engineers |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| | Analyse, reformat and evaluate a wide range of information. Make a significant and original contribution to a specialised field of enquiry. | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Surveyors Electrical engineers |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. Evaluate information, using it to plan and develop investigative strategies. | | Take responsibility for the nature and quantity of outputs. Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Drilling Supervisors Electricians Electronic Technicians |
| | Access and evaluate information independently. Analyse information and make reasoned judgements. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. Accept limited responsibility for the quantity and quality of the output of others. | |
| Level 2 | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | Drilling Operatives Administrative staff Pipe Laying Operatives |
| | Make comparisons. Interpret available information. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| | Demonstrate a range of skills. | | | |
| Level 1 | Employ a narrow range of applied knowledge and basic comprehension. | Show basic competence in a limited range of predictable and structured contexts. | Exercise a very limited degree of discretion and judgement about possible actions. | Labourers Drillers/Trench Workers |
| | Demonstrate a narrow range of skills. | Utilise a clear choice of routine responses. | Carry restricted responsibility for quantity and quality of output. | |
| | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| Entry Level | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | |
| | Exercise basic skills. Receive and pass on information. | Carry out processes that are repetitive and predictable. Undertake the performance of clearly defined tasks. | Rely entirely on external monitoring of output and quality. | |

Table 5B: ECOTEC-Identified Occupational and Functional Role Characteristics – Geothermal Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|--------------------|--------------------------|--|--|--|
| Level 5-8 | Directors/Managers. | Strategic direction; management; decision making and planning. | Entrepreneurial and management skills; leadership skills. | Graduate or postgraduates in a science based subject |
| | Geophysicists. | Electromagnetic operations, microgravity, magnetometry, measurement and testing. | Management and leadership skills; communication skills. | Graduate or postgraduates in a science based subject |
| | Geologists. | Advising on physical environment-geology and surveying. | Product and technical knowledge; communication skills. | Degree in Geology |
| | Environmental Engineers. | Environmental engineering. | Management and leadership skills; team working skills; problem solving skills; communication skills. | Degree in environmental engineering or equivalent |
| Level 4 | Surveyors. | Seismic surveying. | Problem solving skills; management skills; team working skills; showing initiative. | Geoscience or surveying degrees or equivalent |
| | Electrical Engineers. | Maintenance and installation activities; measurement and testing. | Problem solving skills; management skills; team working skills; showing initiative. | Qualified electrical engineers |
| Level 3 | Drilling Supervisors. | Drilling and trench operational supervision. | Adaptability/flexibility; Ability to follow instructions; organisational skills and product knowledge. | Basic engineering skills; bore hole drilling skills |
| | Electricians. | Wiring and installation; monitoring of heat and temperature outputs. | Ability to follow instructions. | Qualified electricians |
| | Electronic Technicians. | Measurement and testing, monitoring and diagnostics. | Product knowledge. | Qualified to engineering technician NVQ level 3 |
| Level 2 | Drilling Operatives. | Drilling and trench digging. | Ability to follow instructions. | Experience and basic engineering knowledge/construction skills |
| | Administrative staff. | Administrative duties with a degree of technical and product knowledge. | Product knowledge and organisational skills. | GCSEs |
| | Pipe Laying Operatives. | Pipe laying. | Ability to follow instructions. | Basic construction skills |
| Level 1 | Labourers. | Digging and trench work. | Ability to follow instructions. | Basic manual skills, construction. |
| | Drillers/Trench Workers. | Drilling and trench digging. | Ability to follow instructions. | Basic manual skills, construction. |
| Entry Level | | No information provided. | | |

Table 6A: Occupational and Functional Map of the Heat Pumps Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|-------------|---|--|---|---|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or outcomes. | Directors Managers Technologists |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Office Managers |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Heat Pump Installers Plumbers Electricians Sales Professionals |
| | Access and evaluate information independently. | Give presentations to an audience. | Accept responsibility for quantity and quality of output. | |
| Level 2 | Analyse information and make reasoned judgements. | | Accept limited responsibility for the quantity and quality of the output of others. | Office Workers; Administrators |
| | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | |
| | Make comparisons. Interpret available information. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| Level 1 | Demonstrate a range of skills. | | | |
| | Employ a narrow range of applied knowledge and basic comprehension. | Show basic competence in a limited range of predictable and structured contexts. | Exercise a very limited degree of discretion and judgement about possible actions. | |
| | Demonstrate a narrow range of skills. | Utilise a clear choice of routine responses. | Carry restricted responsibility for quantity and quality of output. | |
| Entry Level | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | |
| | Exercise basic skills. | Carry out processes that are repetitive and predictable. | Rely entirely on external monitoring of output and quality. | |
| | Receive and pass on information. | Undertake the performance of clearly defined tasks. | | |

Table 6B: ECOTEC-Identified Occupational and Functional Role Characteristics – Heat Pumps Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|-------------|---------------------------------|---|--|---|
| Level 5-8 | Directors. | Overall direction of the operation. | Entrepreneurial and management skills; leadership skills. | Graduate or equivalent |
| | Managers. | Management of process and technical support; heating regulations and building regulations. | | Experience and technical training |
| | Technologists. | Knowledge of energy issues, climate change and environmental issues, sustainable technology, geothermal resources and heating regulations. | Management and leadership skills; team working skills; problem solving skills, communication skills. | Degree or Engineering Certificate in science based or engineering subject |
| Level 4 | Office Managers. | Basic office management and administration, building regulations. | Management skills; IT skills; adaptability/flexibility. | Management and regulatory certification |
| Level 3 | Heat Pump Installers. | As for plumbers and electricians below plus knowledge of compressors, expansion valves, evaporators, condensers, fixtures and fittings, oils, refrigeration, superheating and cooling, heat loads, hydraulic integration, legal requirements, site assessment skills, operational and functionality issues, safety issues, system maintenance; fault finding and diagnosis. | Plumbing and electrical technical product knowledge. | Certified plumbers and electricians, heating and ventilation basic skills; electrotechnical |
| | Plumbers. | Plumbing and refrigeration processes; pipe cutting, soldering pipe joints, gluing pipe joints, lagging, sealing fittings, heating systems fault testing; ventilation and air quality plus as for Heat Pump Installers. | Project planning; problem solving; dealing with customers. | Certified plumbers, heating and ventilation basic skills |
| | Electricians. | Electrical installation plus as for Heat Pump installers. | Project planning; problem solving; dealing with customers. | Certified electricians, heating and ventilation basic skills |
| | Sales Professionals. | Sales techniques. | Dealing with customers; Heat Pump installation costing. | Sales/marketing |
| Level 2 | Office Workers; Administrators. | | Ability to follow instructions; adaptability/flexibility. | Basic office qualifications |
| Level 1 | | | No information supplied. | |
| Entry Level | | | No information supplied. | |

Table 7A: Occupational and Functional Map of the Wind Sub-Sector – NQF Level Descriptors

| Level | Intellectual skills and attributes | Processes | Accountability | Occupations |
|-------------|---|--|---|--|
| Level 5-8 | Generate ideas through the analysis of information and concepts at an abstract level. | Utilise diagnostic and creative skills in a range of technical, professional or management functions. | Accept responsibility and accountability within broad parameters for determining and achieving personal and/or outcomes. | Directors Senior Managers Civil Engineers |
| | Command wide ranging, specialised technical, creative and/or conceptual skills. | Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes. | Accept accountability in related decision making including use of supervision. | Electrical/Mechanical Engineer Professional Engineers Installation Engineers Planners HR Professionals |
| | Formulate appropriate responses to resolve well defined and abstract problems. | | | |
| | Analyse, reformat and evaluate a wide range of information. | | | |
| | Make a significant and original contribution to a specialised field of enquiry. | | | |
| Level 4 | Employ a range of specialised skills. | Operate in a range of varied and specific contexts involving creative and non-routine activities. | Undertake self directed and a limited amount of directive activity. | Managers (Client Company; Deputy/Regional; Client Company; Assistant Project Managers) |
| | Determine solutions to a variety of unpredictable problems. | Exercise appropriate judgement in planning, selecting or presenting information, methods or resources. | Operate within broad general guidelines or functions. | Health and Safety specialists Accountant |
| | Generate a range of responses, a limited number of which are innovative, to well defined but often unfamiliar problems. | | Take responsibility for the nature and quantity of outputs. | Forecasting and taxation specialist IT Specialists Service Engineers Ornithologists Supervisors Operations Supervisors (Client Company) |
| | Evaluate information, using it to plan and develop investigative strategies. | | Meet specified quality standards. | |
| Level 3 | Apply knowledge and skills in a range of complex activities, demonstrating comprehension of relevant theories. | Operate in a variety of familiar and unfamiliar contexts using a range of technical or learning skills. | Engage in self directed activity with guidance/evaluation. | Accounts and Administration assistants Technicians Wind Turbine Technicians (Client Company) |
| | Access and evaluate information independently. | Presentations to audiences. | Accept responsibility for quantity and quality of output. | Senior Wind Turbine Technician (Client Company) |
| | Analyse information and make reasoned judgements. | | Accept limited responsibility for the quantity and quality of the output of others. | Levels 1-4 Technicians (Wind Operator company) Divers Fabrication Engineers |
| Level 2 | Apply knowledge with underpinning comprehension in a number of areas. | Choose from a range of procedures performed in a number of contexts, some of which may be non-routine. | Undertake directed activity with a degree of autonomy. | Clerical and Administrative Staff Site Wardens |
| | Make comparisons. Interpret available information. | Co-ordinate with others. | Achieve outcomes within time constraints. Accept increased responsibility for quantity and quality of output subject to external quality checking. | |
| | Demonstrate a range of skills. | | | |
| Level 1 | Employ a narrow range of applied knowledge and basic comprehension. | Show basic competence in a limited range of predictable and structured contexts. | Exercise a very limited degree of discretion and judgement about possible actions. | Clerical and Administrative Staff |
| | Demonstrate a narrow range of skills. | Utilise a clear choice of routine responses. | Carry restricted responsibility for quantity and quality of output. | |
| | Apply known solutions to familiar problems. Present and record information from readily available sources. | Co-operate with others. | Operate under direct supervision and quality control. | |
| Entry Level | Employ recall and demonstrate elementary comprehension in a narrow range of areas with dependency on ideas of others. | Operate mainly in closely defined and highly structured contexts. | Carry out directed activity under close supervision. | |
| | Exercise basic skills. | Carry out processes that are repetitive and predictable. | Rely entirely on external monitoring of output and quality. | |
| | Receive and pass on information. | Undertake the performance of clearly defined tasks. | | |

Table 7B: ECOTEC-Identified Occupational and Functional Role Characteristics – Wind Sub-Sector

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|--|--|---|--|---|
| Level 5-8 | Directors. | Strategic management and policy / strategy presentations. | Entrepreneurial and management skills; leadership skills. | Professional engineer and management qualifications |
| | Senior Managers. | Accountancy and legal; operational managers. | Management and organisational skills. | HND/BSc and management training |
| | Civil Engineers. | Construction advice, process and application. | Management and leadership skills. | Civil Engineer status |
| | Electrical/Mechanical Engineer. | Research and Development. | Management and leadership skills; communication skills. | Graduate entry |
| | Professional Engineers. | Operational applications. | Management and leadership skills; team working skills. | Graduates |
| | Installation Engineers. | Engineering applications and maintenance. | Problem solving skills; communication skills management and leadership skills, understanding customer needs. | Professional qualification |
| | Planners. | Consultancy, current and future planning issues. | Communication skills. | |
| | HR Professional. | People management. | Management and organisational skills. | |
| Level 4 | Managers (Client Company). | Operational and process development (Client Company). | Problem solving skills; management skills; team working skills; showing initiative. | Professional management certification |
| | Managers (Deputy/Regional) (Client Company). | Various management level applications (Wind Operator Company). | Management and leadership skills. | 5-10 years experience of the industry with a technical background; further management training |
| | Managers (Assistant). | Assisting senior managers. | Management and leadership skills; IT skills. | Recruited from Level 4 technicians; technical background and basic knowledge of project management. May need training including procurement procedures and IT training. Must undertake IOSH Managing Safely and carry a Safety Passport such as CCNSG or CSCS |
| | Project Managers. | Managing the building of turn-key wind farms including management of electrical and civil contractors, WTG supply and installation and commissioning. | Project management, leadership skills, product knowledge. | Electrical and maintenance engineering certificate-graduate/HNC/HND. |
| | Health and Safety specialists. | Health and safety applications, regulations. | Problem solving skills; management skills; team working skills; showing initiative. | NEBOSH Diploma |
| | Accountant. | Financial control. | Problem solving skills; management skills; team working skills; showing initiative. | Suitable ACA or similar qualifications |
| | Forecasting and Taxation Specialist. | Financial assessment. | Problem solving skills; management skills; team working skills. | Financial qualifications |
| | IT Specialists. | IT software and hardware control. | IT skills; adaptability/flexibility. | IT Certification |
| | Service Engineers. | Servicing of wind turbines with focus on electrical systems. | Problem solving. | Technical electrical background is a requirement NVQ level 3 |
| | Ornithologists. | Bird Studies. | Problem Solving. | Ecological/ornithological training |
| | Supervisors. | Supervising and office management; commercial/contractual matters, budgets and financial control. | Management skills. | Management or clerical skills training; technical officer training for those letting of work to contractors includes: specification writing, H&S legislation; environmental legislation, company legislation, procurement. |
| Operations Supervisors (Client Company). | Production and performance reporting. | Management skills; communication skills. | HNC Standard in an electrical or mechanical engineering background, non-Technical training | |

| Level | Occupations | Principal role/function | Dominant generic skills (to varying levels) | Indicative qualifications expected by employers |
|--------------------|--|---|--|---|
| Level 3 | Accounts and Administrative Assistants. | | | |
| | Technicians. | Laboratory work on fatigue properties of materials. | Technical knowledge in support of managers. | HNC |
| | Wind Turbine Technicians (Client Company). | Working to a Senior Wind Turbine Technician. | Team working skills, ability to follow instructions. | NVQ3 via an apprentice grade and recruited with some mechanical, C+1, or electrical experience on conventional generation plant or with some other similar industry experience. In company training (as with Npower) may cover WAH, H&S, Safety Rules Application, evaluation procedures; on the job 2-3 week training course run by WTG manufacturer for the specific WTG on which technician is likely to work. |
| | Senior Wind Turbine Technician (Client Company). | Managing wind turbine technical operational process. | Team working, project management. | Qualifications as above but with at least two years field experience on WTGs Further refresher or additional training may be required. |
| | Level 1 Technicians (Wind Operator Company). | Probationary period includes company induction and H&S, FAW, evaluation and HV familiarisation training. Working with a fully trained Level 4 Technician. Once signed off as a Level 1 Technician capable of working as one of a pair with a Level 2 Technician. After 6-12 months they will become an accredited Level 1 Technician and be upgraded to a Level 2 Technician. | Ability to follow instructions, ability to learn. | Experience is key to development (see principal role/function) |
| | Level 2 Technicians (Wind Operator Company). | A level 2 Technician can work with a Level 1 Technician gaining confidence via more field experience. Service and maintenance and replacement of main components as one of a team working with more senior technicians. Assisting with craneage and heavy lifting and will undergo training in the role of banksman. Further training will be given to allow planning and slinging of lifts. Work with Level 3 or 4 Technician on major component replacement and should start to carry out general servicing/maintenance work as a lead technician. Attends refresher H&S Course. Following about 12 months experience in this role he/she should be capable of moving to Level 3. | As above. | Experience is key to development (see principal role/function) |
| | Level 4 Technician (Wind Operator Company). | Top Technician grade, could train other technicians in the field for Levels 1-3. Could act as Team Leaders and plan and implement work managing other teams. WTG and QA Inspection role. Minimum three years required in this role before advancing to manager role. | | More H&S training possibly IOSH Managing Safely. Good knowledge of SCADA systems |
| | Divers. | Survey, installation and maintenance, fault finding and safety. | Problem solving skills; team working skills, ability to follow instructions, communication skills. | |
| | Fabrication Engineers. | Steel tower erection. | Ability to follow instructions. | Basic engineering construction qualification |
| Level 2 | Clerical and Administrative Staff Site Wardens. | Clerical and administrative duties. | Team working and organisational skills. | GCSEs |
| | | Day-to-day supervision of sites, communication with public. | Communication skills, product knowledge. | No specific qualification |
| Level 1 | Clerical and Administrative Staff. | Clerical and administrative duties. | Ability to follow instructions. | GCSEs |
| Entry Level | No information provided. | | | |

Annex Five

Consultative Process Findings

Annex Five: Key Issues Raised During Consultations – All Comments

The majority of these comments are verbatim and are individual comments.

| Observations on renewable energy sectors | | | | | |
|--|--|--|--|---|--|
| | Key policy and strategic drivers | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs | Community engagement |
| All Sectors | <p>Government policy toward renewables and emission targets.</p> <p>Lack of clear strategic direction and market stability is a barrier to investment.</p> <p>Decisions needed on upgrading electricity transmission network to facilitate renewables development in rural areas.</p> <p>A decision on new nuclear power stations is needed. The outcome will impact upon demand for renewables.</p> <p>The Housing Programme potential for renewables input is a major driver.</p> <p>Building regulations and planning guidelines; new build – an opportunity for promoting energy efficiency and renewable energy.</p> <p>More support for employers and SSCs in line with strategic drivers of government in developing skills.</p> <p>Needs to be more joined up thinking between government departments and agencies as well as between sectors in relation to renewables to drive forward strategy.</p> <p>Government backing for</p> | <p>Engineering skills are central to the renewable energy sector but greater competition between sectors in the economy for such skills.</p> <p>There is a greater expectation by customers of technical reliability and associated skills of workforce.</p> <p>Lack of key skills is an issue; basic skills are in short supply.</p> <p>Plumbing, electrical installation, electronic control, construction skills across all sectors are core skills.</p> <p>Management and leadership skills are of growing core importance.</p> <p>... along with traditional maths and sciences subjects.</p> <p>A combination of integrated electrical and plumbing skills is required.</p> <p>Contracting skills. are increasingly in demand Welding and mechanical</p> | <p>Personal Development Plans (PDP) and Continuous Personal Development (CPD) need greater recognition to build up skills and promote succession planning.</p> <p>Partnership working between HE/FE and employers is a way forward to ensure skills of trainers, employees and trainees are updated in relation to manufacturers.</p> <p>FE colleges that have Plumbing, Electrical Installation, Electronic Control, Construction and Civil Engineering courses should ensure a renewables content.</p> <p>Funding of learning opportunities is an issue. Some colleges are offering a range of courses in 2006 leading to formal qualifications as and when QCA provides funding, which address skills for renewables. Employers are not necessarily aware of this.</p> <p>FEs indicate that a range of vocational courses to meet needs of employers at level 3 and 4 are to be offered requiring little change to the curriculum.</p> <p>The growth in MSc level</p> | <p>University courses need more hands-on training and not just theory; need for theory at University courses in engineering to be put in context of renewable energy applications.</p> <p>Lack of awareness of what is actually out there in relation to renewables.</p> <p>There is a lack of 2381 and 2391 City & Guilds.</p> <p>Needs to be clear progression routes for 14 year-olds and upwards which include maths and sciences.</p> <p>There needs to be an apprenticeship framework that includes Renewable Energy qualifications or core elements.</p> <p>The adequacy of current and future training provision is dependent upon policy drivers and future market position, considered to be adequate at present in general terms but systems and processes change and so should courses.</p> <p>Need for funding of units as</p> | <p>General recognition that young people recognise and accept the need for renewable energy.</p> <p>Responsible use of resources, and greater conservation efforts; more localised micro-generation.</p> <p>Local colleges are considering community engagement in energy efficiency, PVs for example via new learning or community centres.</p> <p>Need to engage with schools and parents in the community.</p> <p>There are Community Renewables initiatives supported through such programmes as CAFE (Community Action for Energy). Consultancy and training for community members in terms of finance applications/grants, and for professionals on how to work in the community is provided for by CAFE.</p> <p>Others include Scottish Community and Household Renewables Initiative (SCHRI) which encourages/provides</p> |

| Observations on renewable energy sectors | | | | | |
|--|---|--|---|--|---|
| | Key policy and strategic drivers | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs | Community engagement |
| | <p>renewables technology to be used as part of public funded projects in schools, hospitals and social housing. Provide incentives to public/private organisations to use renewable products.</p> <p>Establishing Renewable Energy Skills Sector Development Group (SDG) as in Scotland, to progress actions.</p> | <p>fitting skills/pipe fitting/steel erecting trades are in demand.</p> <p>Project management skills for engineers.</p> <p>Research and problem solving/data analysis and interpretation skills.</p> | <p>qualifications is a positive.</p> <p>Needs to be continuity of skill provision across curriculum in relation to renewables, tendency for lack of consistency.</p> <p>Recruiting trainers is a key issue for FE. Poor remuneration or lack of interest may be the key reasons, especially the case for specialist courses.</p> <p>Ensuring basic NVQ level 3 in all areas.</p> <p>SQA Skills for Work Courses that provide taster opportunities for learners aged between 14-16. This should be applied to renewable energy skills for work course.</p> | <p>well as qualifications. Some concern over 'bolt on' courses.</p> | <p>support for Renewables in the community.</p> <p>Centre for Alternative Technology at Machynlleth in mid Wales is an exemplar of good practice.</p> |
| Biomass | <p>Philosophy and innovative ideas drive the sector. Innovative ideas in particular require high quality R&D and associated research skills.</p> <p>Technology driven - developing technology and treatment of waste are two distinct areas being developed.</p> <p>Long development cycle for application of idea to market.</p> | <p>Staff are highly skilled at design function levels and low skilled at waste treatment end of operation</p> <p>High turnover at low skill levels in Biomass.</p> <p>Potential shortage of engineering graduates may affect Biomass.</p> <p>Design and modelling, production of plant is staffed by highly skilled people; low staff turnover.</p> <p>At the waste treatment level little interest in skill development at operative/manual levels.</p> | <p>Businesses use HE for selection of staff, courses are considered more than adequate at graduate level.</p> | <p>Linkage with HEIs is strong and recruitment is made through this linkage with relevant departments.</p> | <p>Little community engagement identified.</p> |

| Observations on renewable energy sectors | | | | | |
|--|--|--|---|---|--|
| | Key policy and strategic drivers | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs | Community engagement |
| Hydro | <p>Sector has an image problem (especially manufacturing side); needs to be sold and marketed better, particularly to new entrants into the labour market.</p> <p>Rural nature of site location hinders recruitment.</p> <p>High business tax rates are pushing jobs abroad due to low profit margins.</p> | <p>Fierce competition for graduates and engineers across the UK economy.</p> <p>In power systems the electrical engineer is the core occupation.</p> <p>In R&D compressor design staff and Mechanical Engineers are required.</p> <p>Shortage of Civil Engineers in Hydro. They are out there in the economy but rural location of businesses is an issue affecting supply.</p> <p>The labour force consists of a large proportion of operatives.</p> <p>New build programmes will involve a range of construction skills including repair and maintenance - these skills are competitive. Staff with investment appraisal skills are needed for future planning</p> | <p>Workforce at management and professional level is ageing - PDP and CPD essential to promote succession planning.</p> | <p>Very little apprenticeship training is in place which negates early capture of young people.</p> <p>Industry would like to see sandwich courses that combined academic and work experience.</p> <p>Graduates lack hands-on vocational experience</p> | <p>No community engagement identified.</p> |
| PV, Solar, Geothermal and Heat Pumps | <p>Philosophy and innovative ideas drive these sectors.</p> <p>General awareness of market growth, market stimulus and regulation and Government promotion for all the sub-sectors.</p> <p>Environmental and energy saving in relation to cost is driving the Sub-Sectors.</p> | <p>Shortage of plumbers and qualified Electricians.</p> <p>Increasing demand for accredited Heating Installers in PV, Solar and Heat Pumps; Design Engineers with CAD capability. Engineering skills-mechanical, electrical and thermal technology application.</p> | <p>Various courses are appropriate and adequate for plumbers, electricians and installers.</p> <p>Plenty of courses available for electro-technical, plumbing, refrigeration and air conditioning, heating and ventilation building services occupations.</p> | <p>More integrated courses are required that capture flexible working and multi-skilling.</p> <p>But</p> <p>These conventional trades need training or retraining and development for qualifications on renewable installation.</p> | <p>Responsible use of resources, and greater conservation efforts; more localised micro-generation.</p> <p>Local colleges are considering community engagement in energy efficiency, PVs for example, via new learning or community centres.</p> |

| Observations on renewable energy sectors | | | | | |
|--|--|--|--|--|---|
| | Key policy and strategic drivers | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs | Community engagement |
| | <p>Households are “risk-averse” when making a decision to purchase a system.</p> <p>The objectives of the Low Carbon Buildings Programme should be changed according to the Solar Trade Association (STA) to include development of a steadily growing market for renewable micro-generation technologies and of installation skills capacity (this is a key supply chain issue). See www.solartradeassociation.org.uk</p> | <p>Accredited installers with knowledge/skills in above and building and construction regulations.</p> <p>Quality verifiers are required.</p> <p>Installation and maintenance skills at craft level are increasingly required.</p> | <p>There is a Solar Domestic Heating Hot Water (SDHW) Heating course being developed for qualified or experienced domestic Heating Engineers and plumbers. A BPEC certificate will be awarded and exemption from the mentoring aspect of SCHRI accreditation. See www.inverness.uhi.ac.uk/construction</p> | <p>Is there a case for freestanding renewable energy sector qualifications or should they be 'Bolt-ons' to existing courses?</p> <p>Encouraging heating engineers to participate in solar training courses can only be driven by good potential market opportunities.</p> <p>The Government should support the development of accredited installation and design training courses, especially the recently developed BPEC accredited solar water heating training course.</p> <p>The Solar Trade Association (STA) is working with the gas industry to develop new training schemes, modular in nature, so that at a later date, design and other RE heat modules can be added to the scheme.</p> <p>The solar water heating training sector could act as a template for a micro-generation training strategy that could develop in the longer term into open and distance learning, according to the STA.</p> | <p>Centre for Alternative Technology at Machynlleth in mid Wales is an exemplar of good practice (see section 8).</p> |

| Observations on renewable energy sectors | | | | | |
|--|---|---|--|--|--|
| | Key policy and strategic drivers | Core occupations and skills | Qualifications and future plans for FE/HE vocational development | Training provision sufficiency to meet current and future skills needs | Community engagement |
| Wind | From the business perspective the strategy should be to have a highly motivated and competent workforce with a high degree of technical competence. | <p>Tendency to use overseas skilled labour to construct wind turbines.</p> <p>Local contractors input into the construction of foundations and access roads.</p> <p>Electricians, Builders Generator Operators with wind turbine and switching skills/Electrical Engineers.</p> <p>Considerable mobility of staff at operator and supervisory levels.</p> <p>Technicians with basic mechanical and electrical technical background, enhanced with specific plant maintenance and operations training by the manufacturer.</p> | <p>NVQ Level 3 for Technicians.</p> <p>HNC or above for Supervisors or Operations Managers.</p> <p>For Developer Managers an academic and professional qualification in planning or an environmental discipline.</p> | Needs to be a common set of competencies across the industry and standards that can be assessed. | <p>Need for staff to be trained for media and public contact</p> <p>Centre for Alternative Technology at Machynlleth in mid Wales is an exemplar of good practice (see section 8).</p> |

Annex Six

Occupational and Functional Map of UK Waste
Management Sector

- *Incineration (including Waste-to-Energy)*
- *Landfill*

Incineration (including Waste-to-Energy)

Level 5-8

| | |
|-----------------|---|
| General Manager | Senior manager who is likely to have had operational experience in waste management or in power generation or process industry. Directs operations, ensures effective performance of process plant and that contingency management arrangements are in place. |
| Plant Manager | Responsible for the operations of a major waste treatment plant. Key features of this role are the performance of all operations staff and dealing with customers, local residents and other interested parties. |

Level 4

| | |
|---------------------------|--|
| Production Manager | Ensures that the production processes involved are safe, efficient and optimal. Outputs will vary and energy generation may only be one of several outputs. The purpose of the Production Manager is to recover as much value as possible from the waste material supplied. |
| Plant Manager | Responsible for the operations of a waste treatment plant. On a small plant could effectively be the general manager. Key features of this role are the performance of all operations staff and dealing with customers, local residents and other interested parties. |
| Maintenance Manager | Responsible for the routine maintenance and repair of process plant. Role will involve the management of a maintenance team and contracting of specialist work to others. Also, ensuring that contingency management plans are in place when there are emergency breakdowns. |
| Rate of Burn Technologist | This specialist role involves the monitoring of the incineration process and use of control technology to ensure that high enough temperatures are reached to break down certain pollutants but that temperatures are also maintained to optimise heat recovery for power generation purposes. |

Level 3

| | |
|-----------------------|--|
| Production Controller | Responsible for controlling and maintaining the operation of the treatment plant. Also responsible for the effective management of the plant including health and safety, licence compliance and environmental issues. One key feature of this role is an internal relationship with the Plant Manager. Working as part of a plant operation team. |
| Process Controller | Responsible for the operation, production and utilisation of process plant and equipment. Must ensure cost effective management of the plant including health and safety, licence compliance/authorisation and environmental issues. One key feature of this role is an internal relationship with the Plant Manager. Working as part of a plant operation team. |

| Incineration (including Waste-to-Energy) | |
|--|---|
| Laboratory Technician | Work involves the sampling, testing and analysis of materials of any type and at any stage of the treatment cycle. Increasingly, materials are sampled, handled and tested remotely and there are many new processes being introduced to facilitate testing and analysis. |
| Shift Change Engineer | Responsible for managing the turnaround procedures at the end of each shift on continuous process plant operations. The monitoring, checking and recording procedures are rigorous and verifying compliance with health, safety and environmental management requirements is an essential component of the job. |
| Team Leader | Responsible for overseeing the work of one or more teams on process plant operations. Motivating staff and maintaining high standards is a central part of this role. |
| Chargehand | A hands-on role working with and leading a small team. Work is likely to include some manual activities, but increasingly it is about the use of mobile and fixed plant and equipment. |
| Level 2 | |
| Operative Technician | This is a hands-on role involving the monitoring of materials being passed through the treatment process and making interventions where there is a real or potential problem. |
| Monitoring Technician | This is primarily concerned with monitoring of the process plant through control room or other instrumentation systems. |
| Plant Operative | This is a hands-on role that is likely to include both manual and mechanical handling of materials being transferred into or from treatment plants. Health and safety plays a very big part in this work role. |
| Wheel Shovel Operative | Responsible for the remote operation of specialised mechanical plant. |
| Ash/Wheel Loader Operative | Responsible for the remote operation of specialised mechanical plant. |
| Tipping Hall Supervisor | Oversight of team(s) operating in the tipping hall. The conjunction of multiple vehicles, heavy plant and machinery and potentially hazardous materials makes this a highly responsible task with health and safety playing a very big part. |
| Revenue Clerk | Collects payments and maintains records of transactions related to collection and disposal operations. |
| LGV Driver | Likely to drive a range of specialist LGVs, some of which have complex remote control equipment systems for loading and off-loading containers, compressing materials and lifting and emptying bins. Health and safety and effective communications are a major consideration in this work role. |
| Electrician/Instrumentation Technician | Responsible for the installation, checking and repair of electrical and electronic systems related to fixed and mobile plant on waste sites. |
| Maintenance Technician | Responsible for the installation, checking and maintenance of mechanical, electro-mechanical and hydraulic systems related to plant on waste sites. |

Incineration (including Waste-to-Energy)

| | |
|----------------------------|--|
| Welder | This role is generally concerned with making on-site repairs to damaged equipment operating on sites. A range of basic welding skills is required, but must also be able to work closely with mechanical fitters to assist in the dismantling and re-assembling of mechanical plant and equipment. |
| Weighbridge Operative | Ensures that vehicles are put through the weighbridge process correctly and that records are maintained accurately. The job will require instrumentation to be checked regularly and re-calibrated when required. |
| Crane Operative | Responsible for the remote operation of specialised lifting plant. |
| Level 1 | |
| Shift Operative | Work role primarily involves the monitoring of continuous process operations on sites. Likely to have some manual handling responsibilities. |
| Plant Cleaner | Responsible for cleaning all designated areas of plant and buildings. Working as part of a plant operations team. A key feature is conformity with statutory hygiene regulations. |
| Products/Residue Operative | Work role involves the monitoring of outputs from treatment operations on sites. Likely to have some manual handling responsibilities. |
| Entry level | |
| Not defined | |

Landfill

Level 5-8

| | |
|----------------------------|---|
| General Manager (Disposal) | Senior manager who is likely to have had operational experience in waste management or in the quarry or mining industry. Directs operations, ensures effective compliance with planning and, health, safety and environmental legislation on sites and that contingency management arrangements are in place. |
| Regional Landfill Manager | Prepares and implements a landfill strategy in compliance with planning permissions and aimed at the optimum use of sites in relation to waste collection and treatment centres. Will have a continuing role in securing additional capacity and also ensuring that sites that have been closed are returned in a state that meets the original conditions. |
| Area Operations Manager | Implements landfill operations in compliance with planning permissions and to schedules geared to making best use of sites in relation to collection and treatment centres. Will have a continuing role in logistics and will contribute to the development of new capacity. |

Landfill**Level 4**

| | |
|---------------------------------|--|
| Site Manager (Operations) | Responsible for achieving the operational and financial targets of a landfill site. Also responsible for the effective management of the site including site management, landfill operations, health and safety, licence compliance and environmental issues. One key feature of this role is an internal relationship with senior managers. |
| Plant/Facility Manager | Responsible for all fixed and mobile plant and for any buildings and facilities on a landfill site. Also responsible for contributing to the effective management of the site including signing, site security, plant maintenance and repair, health and safety, licence compliance and environmental issues. |
| Shift Manager | Responsible for managing the site operations procedures for each shift. Also, ensuring that the monitoring, checking and recording procedures are rigorous and for verifying compliance with health, safety and environmental management requirements. |
| Maintenance Manager | Responsible for the routine maintenance and repair of fixed and mobile plant. Role will involve the management of a maintenance team and the contracting of specialist work to others. Also, ensuring that contingency management plans are in place when there are emergency breakdowns. |
| Surveyor | This role will involve the evaluation of sites, the specification of requirements for environmental compliance, contributing to applications and appeals for planning approval, the measurement and monitoring of on-site operations and advice on geo-technical and hydrological matters. |
| Project Manager – Design/Energy | This is a specialist role concerned with the design of landfill sites to achieve the best performance from methane recovery and related power generation systems. |
| Pest Control Manager | This is a specialist role, normally contracted out, that is concerned with minimising nuisance from pests without damaging the local wildlife and ecology. It can involve a range of techniques from weed suppression to animal trapping and re-location. |
| Manager Gas/Power | This is a specialist role concerned with the design and performance management of power generation systems on sites. |
| Laboratory Manager | Work involves the management of sampling, testing and analytical services on sites at any stage of the landfill cycle. |
| Chemist (Special Waste) | This specialist role involves the sampling, testing and analysis of materials on sites that do or may present a hazard risk. It will also involve giving advice on treatment procedures that have the potential to reduce or remove risk. |

| Landfill | |
|-----------------------------------|--|
| Level 3 | |
| Landfill Supervisor | Responsible for the day-to-day operation of a landfill site. This includes site management, landfill operations, health and safety, licence compliance and environmental issues. One key feature of this role is an interface with customers, regulators, local residents and other interested parties. |
| Gas and Leachate Foreman | Responsible for the day-to-day operation of the gas and leachate plants on a landfill site. This includes operation performance, health and safety, licence compliance and environmental issues. One key feature of this role is to support the landfill manager in the efficient and effective supervision of plant operations. |
| Weighbridge Controller | Responsible for the management of weighbridges on landfill sites. Works with the landfill operative/banksman to ensure the effective and efficient routing of vehicles on sites. |
| Landfill Foreman /Chargehand | Responsible for the plant and disposal aspects of a landfill site. This includes plant utilisation, landfill operations, health and safety, licence compliance and environmental issues. One key feature of this role is to support the landfill manager in the efficient and effective supervision of plant operations. |
| Supervisor (Non-Conforming Waste) | Responsible for the re-routing of materials that cannot be accepted on landfill sites. The role requires effective negotiating and communication skills and also a good knowledge of the options available when materials are rejected. |
| Mechanical Technician | Normally responsible for the specialist electro-mechanical and hydraulic equipment on site plant and vehicles. Increasingly, this role includes electronic control systems. |
| Laboratory Technician | Work involves the sampling, testing and analysis of materials of any type and at any stage of the landfill process. Increasingly, materials are sampled, handled and tested remotely and there are many new processes being introduced to facilitate testing and analysis. |
| Maintenance Fitter | Responsible for the routine maintenance and repair of mechanical, electro-mechanical and hydraulic systems related to fixed and mobile plant on sites. |
| Level 2 | |
| Landfill Operative/Banksman | Responsible to the landfill chargehand for the control of vehicle movements and site vehicles discharging waste or cover materials in the active landfill cell. One key feature of this role is to ensure licence compliance for landfill operations. |
| Leachate Technician | Responsible for providing technical support in the day-to-day operation of gas and leachate plants on a landfill site. This includes operation performance, health and safety, licence compliance and environmental issues. |
| Gas Monitoring Technician | Responsible for providing technical support in the day-to-day operation of gas plants on a landfill site. This includes operation performance, health and safety and environmental issues. |
| Environmental Control Officer | Line responsibility for environmental compliance on landfill sites. The role will include the regular monitoring of operations and reviewing reports on sampling and testing of a range of environmental parameters. |

| Landfill | |
|--------------------------------|--|
| Visitor Centre Officer | A public information role that is concerned with promoting the benefits of recovering value from waste and minimising the impact on the environment. Will involve relations with the media and liaison with other interested organisations. |
| Clerk – Revenue, Credit Notes | Responsible for processing and maintaining clear and accurate records of all financial transactions on sites relating to material movements. |
| Operative Technician | This is a hands-on role involving the monitoring of materials being passed into the landfill process and making interventions where there is a real or potential problem. |
| Plant Operative – Mobile Plant | Responsible for vehicle and machine driving on the landfill site. Working as part of a team. Checking vehicles and machines are key considerations. Expected to work on shifts. |
| Weighbridge Operative/Clerk | Responsible for the operation of weighbridges and associated administrative duties. Works with the site supervisor to ensure the effective and efficient movement of vehicles on sites. |
| Landfill Compactor Driver | This involves the operation of specialist mobile plant. |
| Tractor Driver | This involves the operation of specialist mobile plant. |
| Dump Truck Driver | This involves the operation of specialist mobile plant. |
| Electrician/ Instrumentation | Responsible for the installation, checking and repair of electrical and electronic systems related to fixed and mobile plant on sites. |
| Welder | This role is generally concerned with making on-site repairs to damaged vehicles and equipment operating on disposal sites. A range of basic welding skills is required, but must also be able to work closely with mechanical fitters to assist in the dismantling and re-assembling of mechanical plant and equipment. |
| Level 1 | |
| Shift Operative | Work role primarily involves the monitoring of continuous process operations on sites. Likely to have some manual handling responsibilities. |
| Plant Cleaner | Responsible for cleaning all designated areas of plant and buildings. Working as part of a plant operations team. A key feature is conformity with statutory hygiene regulations. |
| Paper/Litter Picker | This is normally a manual occupation and involves keeping sites as free as possible from loose paper and plastic. |
| Products/Residue Operative | A task based role that includes providing physical assistance to crews on disposal sites. Also, maintaining the tidiness and cleanliness of the site. |
| Entry level | |
| Not defined | |

Annex Seven

Standard Industrial and Occupational
Classifications

Industrial Analysis

The “Standard Industrial Classification” (SIC) and “Standard Occupational Classification” (SOC) systems are the basis by which many skills and labour market surveys breakdown and analyse industrial and occupational data. Both systems are updated from time to time, the last time being in 2003 for the SIC and 2000 for the SOC. However, extreme caution needs to be taken when looking at sectoral and occupational data in this way as they can offer a misleading picture of the current structure and size of the renewable energy sector.

While most renewable energy sub-sectors identified within this report fit *within* existing SIC codes (primarily 40.11 “Production of Electricity”) it is not possible to separate jobs in these sectors from other jobs outside of the renewable energy sector but which result in the same output, for example coal fired power stations, nuclear power, etc. Unfortunately, biomass, geothermal/heat pumps and hydrogen fuel cells do not fit within any of the existing SIC codes.

The lists of renewable energy-specific SIC and SOC codes is listed in Tables 1 and 2 below.

Table 1- Standard Industrial Classification (SIC) - Codes of Relevance

| “Sub-sector” of renewable energy | SIC code (2003) | Comments |
|---|-----------------------------|---|
| Hydroelectric | Fits within 40.11 | <i>“Production of electricity”.</i> |
| Photovoltaic | Fits within 40.11 | <i>“Production of electricity”.</i> |
| Wave and Tidal | Fits within 40.11 | <i>“Production of electricity”.</i> |
| Wind | Fits within 40.11 | <i>“Production of electricity”.</i> |
| Waste-to-Energy | Fits within 90.02 and 40.11 | <i>“Collection and Treatment of Waste” (which includes incineration and landfill gas) and partly “Production of electricity”.</i> |
| Biomass | No relevant code exists | The current classification system is inadequate for analysis of this sub-sector. |
| Geothermal and Heat Pumps | No relevant code exists | The current classification system is inadequate for analysis of this sub-sector. |
| Hydrogen Fuel Cells | No relevant code exists | The current classification system is inadequate for analysis of this sub-sector. |
| Solar Thermal | No relevant code exists | The current classification system is inadequate for analysis of this sub-sector. |

SIC code 40.30, which covers the *production, collection and distribution of steam and hot water for heating, power and other purposes*, may also be of relevance to the renewable energy sector.

Occupational Analysis

A similar situation exists with matching renewable energy-specific occupations against Standard Occupational Classifications. As can be seen from Table 2 below, less than half of the occupations identified can be exactly matched to an existing SOC code.

Table 2 - Standard Occupational Classification (SOC) - Codes of Relevance

| Sub-sector | Occupation | SOC (2000) | SOC (2000) title | Extent of fit |
|----------------------|--|-------------------|--|----------------------|
| Biomass | Professional Engineers, Scientists and Technologists | 2112 | Biological scientists and biochemists | Partial |
| | | 2129 | Engineering professionals n.e.c. | |
| | Rate of Burn Technologists | 2127 | Production and Process Engineers | Partial |
| | Ash/Wheel Loader | 9235 | Refuse and salvage occupations | Partial |
| | Tipping Hall Supervisor | 9235 | Refuse and salvage occupations | Partial |
| | Products/Residue Operative | 9235 | Refuse and salvage occupations | Partial |
| Hydroelectric | Mechanical Engineers | 2122 | Mechanical Engineer | Exact |
| | Civil Engineers (Construction) | 2121 | Civil Engineer | Exact |
| Photovoltaic | Electricians with design skills | 2126 | Design and Development Engineers | Partial |
| | | 5241 | Electricians, Electrical fitter | Partial |
| | Project Engineers | 2129 | Engineering professionals n.e.c. | Partial |
| Solar | Installation Depot Managers | 1121 | Production, Works and Maintenance Managers | Partial |
| | Solar Technicians | 3112 | Electrical/Electronic Technicians | Partial |
| | Design Technicians | 3113 | Engineering Technicians | Partial |
| | Carpenters | 5315 | Carpenters and Joiners | Exact |
| | Pipe Fitters | 5216 | Pipe Fitter | Exact |
| Geothermal | Surveyors | 2434 | Chartered Surveyors (not Quantity Surveyors) | Exact |
| | Electrical Engineers | 2123 | Electrical Engineer | Exact |

| Sub-sector | Occupation | SOC (2000) | SOC (2000) title | Extent of fit |
|---|---|----------------------------------|--|---------------|
| Heat Pumps | Technologists | 2129 | Engineering professionals n.e.c. | Partial |
| | Heat Pump Installers | 3113 | Engineering Technicians | Partial |
| | Plumbers | 5314 | Plumbers, Heating and Ventilating Engineers | Exact |
| | Electricians | 5241 | Electricians, Electrical fitter | Exact |
| Wind | Electrical/Mechanical Engineers | 2122 | Mechanical Engineer | Exact |
| | | 2123 | Electrical Engineer | Exact |
| | Installation Engineers | 2122 | Mechanical Engineer | Partial |
| | Service Engineers | 2122 | Mechanical Engineer | Partial |
| | Technicians Level 1 and 2 (Wind Operator Company) | 3113 | Engineering Technicians | Partial |
| | Technicians Level 4 (Wind Operator Company) | 3113 | Engineering Technicians | Partial |
| | Divers | 5319 | Construction trades n.e.c. | Partial |
| | Fabrication Engineers | 5223 | Metal working Production and Maintenance Fitters | Exact |
| | Site Wardens | 3552 | Countryside and Park Rangers | Partial |
| | Operations Supervisors | 2127 | Production and Process Engineers | Partial |
| | Wind Turbine Technicians (Client Company) | 3113 | Engineering Technicians | Partial |
| Senior Wind Turbine Technician (Client Company) | 2129 | Engineering professionals n.e.c. | Partial | |

Therefore, the main issue is the inability to disaggregate official data sources that are based on SIC/SOC code into the key elements of the renewable energy process(es) – there being no distinction within either classifications between the various activities or inputs related to the production of electricity, heat or power through renewable means and its supporting activities (monitoring, maintenance, etc.). It is also not possible to identify the size and structure of the supply chain (manufacturers, contractors, consultants, etc.) that are employed solely on renewable energy activities but which are classified by their primary purpose.

Further information on the mapping of renewable energy sub-sectors and occupations against Standard Industrial Classification and Standard Occupational Classification codes can be found in “*A review of the potential of SIC SOC codes for the categorisation of jobs in the environment*”, Forward Scotland, 2005 (<http://www.ejscotland.info/sic-soc.htm>).

Energy & Utility Skills is the Sector Skills Council for the electricity, gas, waste management and water industries. Employer-led, our purpose is to identify employers' skills needs and provide effective solutions to improve business performance.

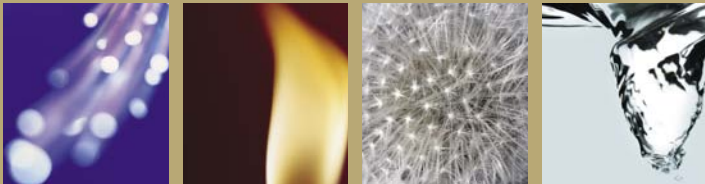
The government's national skills strategy aims to ensure that employers of all sizes have people with the right skills and qualifications to support the success of their businesses.

Of equal importance is ensuring that individual employees have the skills and qualifications that they need to be both employable and personally fulfilled.

Central to the government's skills strategy is the idea that the employer's voice should be significant in choosing the provision of training and skills development, and the related systems of qualifications. Energy & Utility Skills is actively seeking to establish itself as a focal point for industry

and government working together, and would welcome your input and support, whatever the size of your business.

To help shape the future of your industry visit our website at www.euskills.co.uk or contact: Energy & Utility Skills on 0845 077 99 22.



The Sector Skills Council for electricity, gas, waste management and water.

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