# Group Award Specification for:

## Professional Development Award in Renewable Energy Systems

## Group Award code — GV3Y 48

**Publication date: March 2024**

**Version: 01**

# Contents

# 1 Introduction

This document was previously known as the Arrangements Document. The purpose of this document is to:

- assist centres to implement, deliver, and manage the qualification
- provide a guide for new staff involved in offering the qualification
- inform course managers, teaching staff, assessors, learners, employers, and Higher Education institutions of the aims and purpose of the qualification
- provide details of the range of learners that the qualification is suitable for and the progression opportunities

This new Professional Development Award (PDA) is a consortium-development involving a partnership between a group of educational institutions and the SQA. One of the key drivers for this development has been to fill a gap in the current SQA provision.

In broad terms, the PDA in Renewable Energy Systems has been designed to provide candidates with knowledge and understanding of current and future trends in energy production, sustainability and energy conservation issues, as well as the role that renewable energy systems technologies may play in meeting energy demands and in limiting global environmental damage. The PDA will also allow candidates to gain a broad knowledge and understanding of the physics and engineering of many renewable energy systems technologies so that they can make accurate, valid comparisons between renewable technologies when solving energy related problems. Candidates will also be able to specialise in at least two specialist areas of renewable energy systems by studying from optional units in biomass, geothermal energy, hydroelectricity, hydrogen, microgeneration, solar, wave and tidal power or wind power.

As a result of studying the PDA, candidates will also be provided with opportunities to enhance their Core Skills in Communication, Numeracy, Information Technology, Problem Solving and Working with Others. The PDA also provides candidates with opportunities to develop important transferable skills such as analytical, evaluation, investigation and research, learning and study and planning skills.

## 1.1 Rationale for the development of the awards

The development of a rationale to support the new PDA in Renewable Energy Systems has included the following processes:

- desk-based research involving an analysis of the political, skills and education, and technological and social-economic context for renewable energy systems technologies
- consultations with renewable energy systems technology stakeholders, including employers and educational institutions

Details of these two processes are presented in the following sections.

## 1.2 Desk-based research

### 1.2.1 The political context as of 2007

Renewable energy systems has risen high up on the agenda of many political parties and institutions. This is not surprising given that many experts now believe that the gases released when fossils fuels are burnt to produce energy contribute to changes in world climate and global warming.

Within a European context, the European Commission has adopted a target that 12% of total energy consumption across member states should come from renewable sources by 2010.(1) The commission has advised that all member states have policies in place to achieve this target.

At the United Kingdom level, if obligations placed on suppliers of electricity are met, then by 2010, 10% of electricity supplied in the UK will be derived from renewable sources.(2) The present UK government is currently involved in a major consultation on how UK energy demands should be met in the future. Its own view appears to be that energy supplies should be met from a mixture of energy sources including nuclear but with an increasing role for renewable energy systems generation.

In Scotland, which has a large potential in renewable energy systems sources, developments in renewable energy systems, particularly since 2000, have moved on rapidly. In their Programme for Government, the previous Scottish Executive set a target of 18% of electricity generation from renewables by 2010. This target has now been met. For example, the quantity of electricity generated by renewable sources as a percentage of total Scottish consumption rose from 14.3% in 2000 to 18.2% in 2005(3); although, it should be noted that the renewables share tends to fluctuate as hydroelectricity is highly dependent on levels of precipitation in catchment areas.

Most of this renewable energy systems still comes from hydroelectricity although it is interesting to note that the quantity of energy generated by wind and wave power increased by 60% between 2004 and 2005.(3)

In the Scottish Executive Paper, 'Securing a Renewable Future: Scotland's Renewable Energy', the aspirational target was set for 40% of electricity in Scotland being generated from renewable sources by 2020. The executive has taken various steps towards meeting this target. For example, they have introduced the Renewable Obligation (Scotland), or ROS, which places an obligation on electricity suppliers to provide an increasing amount of their electricity from renewable sources. In October 2003 the Executive also established the Forum for Renewable Energy Development in Scotland (FREDS) which has 'a key role in identifying, co-ordinating and facilitating actions to promote the development of Scotland's Renewable Energy Systems industry.'(2) FREDS is a partnership between industry, academia and government with the express aims of capitalising on Scotland's large natural energy resources and securing significant economic development opportunities for Scotland.

The forum has released a number of important publications on renewable energy. In the context of this document, the most important paper is 'Skills Group Report 2005: Developing

(1) *Securing a Renewable Future – Responses – Business (2004)*
(2) *Securing a Renewable Future: Scotland's Renewable Energy (2003)*
(3) *Sustainable Energy – Percentage of Scottish electricity consumption generated from renewable sources in Scotland – Scottish Executive paper (2007)*

Skills For Scotland's Renewable Energy Systems Workforce', which will be referred to extensively in the next section.

It is important to briefly mention the renewable energy policies of the Scottish National Party (SNP) as they are now in control of the executive. The SNP has indicated a clear commitment to the building of no new nuclear power stations in Scotland. Instead they will meet much of Scotland's future energy needs by making use of 'Scotland's extensive renewable energy potential.'[4] Their Manifesto sets out the steps they will take to meet this approach. It is also understood that the new Executive will shortly engage in a major consultation exercise on renewable energy.

In conclusion, Scotland very much has a renewable energies future. Part of that future must involve the development of qualifications to educate and train personnel to work in the renewables industry.

### 1.2.2 The skills and education context

**Skills**

As noted in the previous section, FREDS commissioned a major study into the development of appropriate skills for Scotland's renewable energy systems workforce. This work was undertaken by a skills sub-group which included representatives from Scottish Enterprise, Highlands and Islands Enterprise, Careers Scotland, Higher and Further Education, relevant Sector Skills Councils, renewable energy suppliers and the SQA. The work of the group was encapsulated in the report 'Developing Skills for Scotland's Renewable Energy Workforce', which was published 2005.

With regard to demand for labour and skills in the renewable energy industry, the report identifies the following important points:

1 The labour requirements of the industry will be modest.
2 The evidence from the industry is that, to date, the supply of skills is not inhibiting growth.
3 Where there are currently recruitment difficulties or weaknesses in the skills of the workforce, they are not specific to the renewable sector and employers are addressing them through changes to recruitment practices and training.

With reference to point 1, the report identifies that while the gross number of jobs generated across Scotland in the renewable sector will be quite small, there is a regional dimension to job creation. For example, most activity in renewables is likely to take place in remote, rural areas of Scotland where a comparatively small number of 'high quality jobs can be of disproportionate significance.'[5]

While the report observes that skills gaps and skills shortages in the renewable sector will be modest, it does, nevertheless, identify some specific issues with regard to some renewable technologies. For example, the FREDs Biomass Group comments that 'the declining up take of engineering courses (such as degree and SVQ) may lead to a reduction in the available skills resources needed to support the supply chain infrastructure and development of the biomass industry.' Representatives from the FREDS Hydrogen Group' have suggested that skills gaps

[4] *Scottish National Party Manifesto page 2 (2007)*
[5] *Developing Skills for Scotland's Renewable Energy Future page 6 (2005)*

exist at all levels of the hydrogen and fuel cell industry — for example, from technicians to install fuel cells through to PhDs needed to develop hydrogen and fuel cell technology further.'

However, perhaps the greatest area of concern exists around the future availability of senior electrical engineers who keep Scotland's electrical network running with approximately 25% of these retiring in the next 5–10 years and little sign of them being replenished.

**Education**

The 'Developing Skills for Scotland's Renewable Energy Workforce' report comments in some detail with regard to the contribution different sectors of education are currently making and may make in the future to providing qualifications relevant to the renewable energy sector.

### 1.2.3 The technological and social context

**Technological**

Some renewable technologies are now well established (although new innovations are still being introduced into these technologies) whereas others are still under active research and development (for example, hydrogen/fuel cell technology, wave and tidal systems). This has been taken into account in the writing of the units. Units have been written in as generic a form as possible and writers have emphasised the need to take account of new technological developments as these emerge. It is recognised that both the units and the PDA will have to be kept under regular review to take account of technological developments and the changing political, economic and social context.

**Social-economic**

The social-economic aspects of renewable energy systems have not been neglected in the units or the PDA. For example, in the unit Renewable Energy Systems: Overview of Energy Use, candidates are encouraged to investigate the social-economic consequences of current energy supplies and trends not matching demand (with, for example, the quantity of fossil fuels predicted to drop over the next century). They will also be able to analyse how alternative, clean, sustainable sources of energy can be used to meet a significant part of the demand for energy while contributing to the reduction in climate change and global warming. The unit Renewable Energy Systems: Hydroelectricity includes a consideration of the social and economic benefits of existing hydroelectric schemes, including job creation and leisure opportunities. There is also scope to consider the benefits of renewable energy systems generation in small communities. For example, the formal assessment task for the unit Renewable Energy Systems: Microgeneration may be applied to a small community building.

## 1.3 Consultations with renewable energy technology stakeholders

Throughout the development of the units within the PDA, writers obtained helpful information and advice from various sources, including experts in the field, technical papers, relevant websites and so on.

In order to assess the demand for the Renewable Energy Systems Units and the PDA, the SQA undertook a major consultation exercise. A questionnaire was sent out to organisations that had an interest in the renewable energy technology area. From the analysis of the questionnaire showed a strong support (86%) for a specific award in renewable energy systems.

The questionnaire also asked respondents to express their views on the specific Renewable Energy Systems Units that make up the PDA. The highest level of support was given to the Renewable Energy Systems: Overview of Energy Use (73%) with the Renewable Energy Systems: Technology receiving only slightly less support. This was reassuring as both these units are core within the PDA.

## 1.4 Market demand for the PDA in renewable energy systems

Based on the positive responses to the questionnaire survey and the wide range of jobs that are currently being advertised in the paper-based and electronic media, the QDT anticipate a significant candidate uptake for the PDA. The QDT are aware that at least one centre will be offering the PDA from August 2007, with other centres likely to follow on once the existence of the new PDA in Renewable Energy Systems is more widely known. The QDT would estimate that there will be between 100 and 150 candidates per year for the PDA over time, with significant numbers of other candidates taking individual units within the PDA to support, for example, their CPD.

# 2 Qualification structure

The PDA in Renewable Energy Systems has been levelled at SCQF level 8. The reason is that at least half the credits in the PDA are at SCQF level 8, and this satisfies the SQA design principles that at least half the SCQF credit points in a PDA must be at the level of the Group Award.

A candidate will be awarded a PDA in Renewable Energy Systems on successful completion of 6 unit credits based on the framework shown in section 2.1. More specifically, this award structure requires that candidates achieve the following:

- the 4 unit credits from the mandatory section of the award structure
- 2 unit credits from the optional section of the award structure

## 2.1 Structure

**Mandatory section (4 credits)**

| 4 code | 2 code | Unit title | SQA credit | SCQF credit points | SCQF level |
|---|---|---|---|---|---|
| HV48 | 47 | Renewable Energy Systems: Overview of Energy Use | 2 | 16 | 7 |
| HV5N | 48 | Renewable Energy Systems: Technology | 2 | 16 | 8 |

**Optional section (2 credits)**

| 4 code | 2 code | Unit title | SQA credit | SCQF credit points | SCQF level |
|---|---|---|---|---|---|
| HV5J | 48 | Renewable Energy Systems: Biomass | 1 | 8 | 8 |
| HV5K | 48 | Renewable Energy Systems: Geothermal Energy | 1 | 8 | 8 |
| HV5L | 48 | Renewable Energy Systems: Hydroelectricity | 1 | 8 | 8 |
| HV5H | 48 | Renewable Energy Store: Hydrogen | 1 | 8 | 8 |
| HR49 | 47 | Renewable Energy Systems: Microgeneration Systems | 1 | 8 | 7 |
| HV5M | 48 | Renewable Energy Systems: Solar | 1 | 8 | 8 |
| HV5P | 48 | Renewable Energy Systems: Wave and Tidal Energy | 1 | 8 | 8 |
| HV5R | 48 | Renewable Energy Systems: Wind Power | 1 | 8 | 8 |

# 3 Aims of the qualification

## 3.1 General aims of the qualification

The general aims of the PDA award are to:

1 enhance candidates' employment prospects
2 enhance the prospects of local economies
3 support candidates' continuing professional development (CPD) and career development
4 enable progression within the SCQF
5 develop candidates' Core Skills
6 develop candidates' transferable skills

## 3.2 Specific aims of the qualification

The specific aims of the PDA award are to:

1 provide candidates with an opportunity to develop knowledge and understanding of the broad issues that are impacting on energy production and use now and in the future
2 provide candidates with a knowledge and understanding of the physics and engineering of a wide range of equipment designed to extract energy from renewable sources with a view to allowing candidates to make accurate, valid comparisons between renewable technologies when solving energy related problems
3 allow candidates opportunities to specialise in two areas of renewable energy systems

# 4 Recommended entry to the qualification

## 4.1 Access requirements

Entry to this qualification is at the discretion of the centre. The following information on prior knowledge, skills, experience, or qualifications that provide suitable preparation for this qualification has been provided by the Qualification Design Team as guidance only.

Admission to the PDA in Renewable Energy Systems should be based on a broad approach to candidate selection, but at the same time, should ensure that candidates have the potential and ability to complete the awards successfully. In this regard, candidates would normally have a general knowledge and understanding of engineering systems and mechanical, electrical and electronic principles and technologies on entry to the PDA. The qualifications which best meet this requirement are as follows:

- SQA Advanced Certificate or Diploma in Engineering Systems
- a suitable multi-disciplinary degree
- other awards deemed equivalent to the above

Other SQA Advanced engineering qualifications in such areas as electronics, electrical engineering, mechanical engineering and manufacturing engineering may partially meet the requirements, but candidates may have to undertake an additional bridging programme to fill in gaps in their technical education prior to starting the PDA (for example, a mechanical technician or engineer may find it beneficial to study electrical and electronic units prior to studying the PDA).

Entry to the PDA for candidates with other technical and/or scientific qualifications should be considered on the basis of whether their knowledge and understanding of engineering is sufficiently well developed to allow direct access to the award or whether they need to do studies in engineering prior to entering the PDA.

## 4.2 Alternative access arrangements

The presenting centre may operate alternative access arrangements in cases where the candidate is convinced that they already have the required competences in a given area. These arrangements are as follows:

- assessment on demand
- credit transfer
- accreditation of prior learning
- relevant work experience

Individual presenting centres need to outline their systems for each of these as a part of any approval procedure.

# 5 Additional benefits of the qualification in meeting employer needs

This qualification was designed to meet a specific purpose and what follows are details on how that purpose has been met through mapping of the units to the aims of the qualification. In addition, significant opportunities exist for learners to develop more generic skills, known as Core Skills, through this qualification.

## 5.1 How aims are met in the qualification structure and content

### 5.1.1 General aims

| Aim | How it is met |
|---|---|
| 1 | A review of paper based and electronic media advertising jobs in the renewable energy industry suggests that candidates successfully achieving the PDA may be able to find employment as electricians, instrument engineers, maintenance engineers, service engineers, technicians, health and safety officers/engineers, development officers, development managers, project officers, renewable energy consultants, lecturers and marketing co-ordinators. |
| 2 | Even a comparatively small number of high quality jobs can be of disproportionate significance for a small local economy. Such jobs can bring much needed income into a small economy. There may also be the additional 'spin offs' of creating new employment opportunities as those in the high quality jobs employ local people in various capacities. On a social level, new high quality jobs can help to raise the status, confidence and self-esteem of people living in the local community. It may also encourage people in the local community to use renewable energy technologies, instead of more traditional energy generation methods, to meet their energy requirements. |
| 3 | It is anticipated that the PDA may be used by some employers as a way of delivering CPD to their employees (a few employers indicated that this may be the case in their responses to the SQA questionnaire consultation). The PDA would certainly lend itself to being a CPD award. It can be delivered in a notional time length of 240 hours by various modes of delivery (for example, on a part-time basis, partly in college and partly in the workplace). Over time, it may also be possible that large parts of the PDA may be delivered by open and distance learning and/or online learning. |
| 4 | All units within the new PDA in Renewable Energy Systems have been levelled at SCQF levels 7 or 8. The new award also conforms to the SQA levelling requirements for PDA awards.<br><br>It is worth emphasising that the new PDA will allow for vertical progression within the SCQF progressing to the PDA (for example, someone studying at SCQF level 7 progressing to level 8). Alternatively, the PDA also allows for lateral progression within the SCQF (for example, someone who has passed an SQA Advanced Diploma at SCQF level 8 or an ordinary degree at SCQF level 9) progressing to the PDA as a way of expanding their knowledge and understanding of renewable energy systems. |

| Aim | How it is met |
|---|---|
| 5 | There are many opportunities for candidates to develop a number of Core Skills and/or Core Skills components. For example, candidates will have opportunities to develop their Reading Communication Skills while reading materials on various forms of renewable energy technologies from paper-based or electronic sources. Written Communication skills may be enhanced while candidates are providing written responses to questions in assessment papers or when writing reports.<br><br>The Core Skill component Using Number may be developed while performing calculations in a number of the units (for example, when calculating future energy usage trends, energy balance, new energy sources, evaluating the practicality and effectiveness of carbon sequestration methods or efficiencies in buildings/transportation/power generation in the unit Renewable Energy Systems: Overview of Energy Use). The Core Skill component Using Graphical Information may be developed while representing various forms of data in graphical format.<br><br>The Core Skill Using Information Technology may be developed while candidates use Internet search facilities to access information on renewable energy issues and technologies. This Core Skill may also be enhanced while candidates use Excel to process data or produce word processed reports which include appropriate diagrams, drawings etc. produced by the candidates.<br><br>Opportunities to develop aspects of the Core Skill Problem Solving exist in nearly all units in the PDA. For example, the Core Skill component Critical Thinking may be developed when evaluating options for solving a problem (for example, in the Renewable Energy Systems: Microgeneration unit evaluating the advantages and drawbacks of different microgeneration systems before selecting an appropriate system to meet a specified need). Planning and Organisation skills may be developed while candidates reflect on the best way to gather data, organise their arguments and structure their reports for different formal assignments in units. Review and Evaluation skills may be developed while candidates evaluate the advantages and disadvantages of introducing a proposed system (for example, a microgeneration system).<br><br>While opportunities to develop the Core Skill Working with Others may be limited, there may be occasions when candidates can enhance these skills when, for example, engaging in group discussions or doing laboratory work. |

| Aim | How it is met |
|---|---|
| 6 | Opportunities also exist for candidates to develop important transferable skills. For example, as a result of studying the units in the PDA, candidates will learn new technology skills (for example, hydrogen/fuel cell technology, wave and tidal systems, P-V technology).<br><br>Candidates will also learn analysis skills as they breakdown problems and issues into their various elements. As noted in the previous section, candidates will also learn to develop both planning and evaluative skills.<br><br>As a result of studying units in the PDA, candidates may also develop investigation and research skills. At this level, candidates may well need advice and support in structuring their investigations so that they derive the maximum benefit from undertaking such work.<br><br>It is anticipated that as a result of studying the PDA, all candidates will develop and enhance their learning and study skills. |

### 5.1.2 Specific aims

| Aim | How it is met |
|---|---|
| 1 | From the outset of the PDA development, the QDT was keen that renewable energy systems are not taught in isolation but rather set within a broader context of global energy use and trends, the negative impact of current energy production methods and energy efficiency and sustainability issues. In this way, the QDT believes that candidates will gain a better understanding of the way in which renewable energy systems fit into current and future energy generation and use. The mandatory unit Renewable Energy Systems: Overview of Energy Use has been designed to meet this requirement. It contains outcomes on energy usage and trends, environmental impact of current energy production methods (including climate change and global warming), an analysis of the costs of different sources of energy, advantages and disadvantages of alternative sources of energy, and efficiency and energy savings in buildings, transport systems and power generation. |
| 2 | As well as providing candidates with an overview of current energy uses, trends and issues, it is important that candidates are provided with an overview of many of the renewable energy technologies currently in use. The mandatory unit Renewable Energy Systems: Technology has been designed to fulfil this task. The approach taken in the unit is to introduce candidates to a wide range of technologies either individually or by reference to common or shared properties; this way, candidates will gain a level of technical knowledge and understanding that will allow them to make accurate, valid comparisons between different technologies; they will also gain the ability to determine the potential effectiveness of a particular system or solution. Basic physics and engineering principles underpin descriptions of how equipment works and how energy transfer processes impact on efficiency and cost. |

| Aim | How it is met |
|---|---|
| 3 | Within the 2 credit optional section of the PDA, candidates are provided with opportunities to study two types of renewable energy systems in greater depth. Candidates can choose from the following technologies: biomass, geothermal, hydroelectric, hydrogen, microgeneration, solar, wave and tidal energy, and wind power. It is recommended that candidates select the optional units they wish to study on the basis of their own professional and career aspirations and on the requirements of local employers. |

## 5.2 National Occupational Standards (NOS) and/or trade standards

At the time of preparing this document, the QDT were not aware of any National Occupation Standards that aligned with the PDA in Renewable Energy Systems. However, in the fast moving field of renewable energy systems, it is possible that standards may emerge in the future. If this is the case, the PDA can be mapped into the relevant standards.

## 5.3 Mapping of Core Skills development opportunities across the qualification

The table below shows opportunities to develop Core Skills in individual units in the PDA.

| Unit code | Unit title | Communication | | | Numeracy | | ICT | Problem solving | | | Working with others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Written (reading) | Written (writing) | Oral | Using number | Using graphical information | | Critical thinking | Planning and organising | Reviewing and evaluating | |
| HV4847 | Renewable Energy Systems: Overview of Energy Use | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5N48 | Renewable Energy Systems: Technology | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5J48 | Renewable Energy Systems: Biomass | SCQF level 6 | SCQF level 6 | SCQF level 6 | | | | | | | |
| HV5K48 | Renewable Energy Systems: Geothermal Energy | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5L48 | Renewable Energy Systems: Hydroelectricity | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5H48 | Renewable Energy Store: Hydrogen | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HR4947 | Renewable Energy Systems: Microgeneration Systems | SCQF level 6 | SCQF level 6 | SCQF level 6 | | | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 |
| HV5M48 | Renewable Energy Systems: Solar | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5P48 | Renewable Energy Systems: Wave and Tidal Energy | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |
| HV5R48 | Renewable Energy Systems: Wind Power | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | SCQF level 6 | |

In general terms, the Communication Core Skill component Reading may be developed while candidates are reading materials on energy issues and renewable energy systems from various paper-based and electronic sources. Lecturers may wish to ask candidates questions to check their understanding of the materials they have read. The Written Communication Core Skills component may be developed while candidates write extended response answers to assessment questions and when writing reports. Practical work can provide an environment in which to discuss, review and evaluate solutions, and enhance skills in oral communication of technical data using appropriate terminology and techniques.

The Core Skill component Using Number may be enhanced while candidates perform various calculations associated with energy use and renewable energy systems (for example, when performing calculations involving future energy trends, evaluating the practicality and effectiveness of carbon sequestration methods and efficiencies and energy savings in building in the unit Renewable Energy Systems: Overview of Energy Use). The Core Skill component Using Graphical Information may be developed while representing energy and other data in various graphical formats.

The Core Skill Using Information Technology may be developed while candidates undertake Internet searches, use a spreadsheet to process and analyse data and when word processing reports including the production of graphs, diagrams and so on produced by the candidates.

The Core Skill component Critical Thinking may be developed while candidates undertake formative and summative assessment involving interpreting problems and developing proposals for resolving problems. The Core Skill component Planning and Organisation may be enhanced while candidates plan approaches to resolving assignment problems and when preparing written reports. The Core Skill component Review and Evaluation may be developed when, for example, candidates evaluate the benefits and drawbacks of a renewable technology over a conventional one.

While opportunities to develop the Core Skill component Oral Communication and the Working with Other Core Skill may be limited, there may be opportunities to develop these while candidates discuss issues and problems in group work and when doing laboratory work.

## 5.4 Assessment strategy for the qualification

From the outset of development, the need to have an appropriate assessment strategy in place for the PDA in Renewable Energy Systems was recognised. This strategy is detailed below:

### 5.4.1 Aims

The aims of the strategy are to ensure the following:

1 Consistent, rigorous and efficient approaches are adopted to the development and administration of PDA assessment instruments which satisfy nationally agreed standards.
2 The assessment load on candidates and staff is sensible and that assessment does not unduly detract from teaching and learning.
3 As far as possible, reliable and rigorous verification processes are put in place in order to ensure that consistent national standards are achieved for all PDA assessments.

### 5.4.2 Objectives

Listed below are the measures that have been put in place to meet the aims:

1 Plan to develop nationally at least one assessment exemplar pack for the two mandatory units in the PDA in Renewable Energy Systems.
2 Adopt a holistic approach to unit assessment. The implications of this are as follows:
   (a) Assessment instruments will normally be designed only to sample knowledge and skills in a unit.
   (b) A unit assessment strategy will be adopted, where possible, to produce a single assessment instrument for the whole unit. Where this is not possible, the assessment strategy will seek to ensure that the minimum number of assessment instruments are required consistent with maintaining agreed national standards.
3 Actively encourage centres to work in partnership in producing unit assessment materials, which meet nationally agreed standards, reducing the workload on staff in individual centres.
4 Ensure that consistent and rigorous internal and external verification procedures operate through the assessment processes. This places a clear responsibility on both centres and the SQA.

**Integration of assessment**

It may be possible to integrate assessments across units. For example, outcome 3 in the Renewable Energy Systems: Technology unit may be integrated with assessments in the Hydroelectricity, Wave and Tidal Energy and Wind Power units. Likewise, outcome 5 in the Technology unit may be integrated with assessments in the Solar unit. It is likely that lecturers will identify further opportunities to integrate assessment when they become more familiar with the units.

**Formative assessment**

Formative assessment should be used throughout the delivery of units to reinforce learning, build candidates' confidence and prepare candidates for summative assessment.

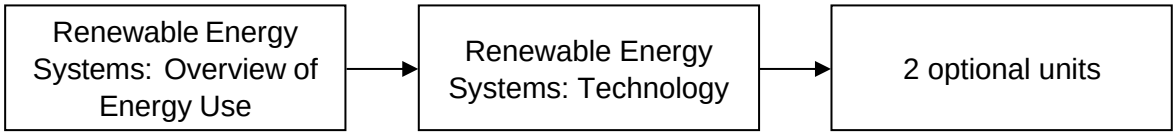
# 6 Guidance on approaches to delivery and assessment

The PDA in Renewable Energy Systems has been designed principally for candidates employed in the renewable energy systems industry or who are seeking employment in this industry. As such, the PDA can be delivered by modes of attendance that best suit the employment circumstances of such candidates and their employers. For example, the PDA may be delivered by a variety of part-time modes, which can include day-release, block-release or evening class delivery. It would also be possible to deliver some or all parts of the PDA in a workplace environment, providing, of course, that suitable accommodation (such as classrooms and laboratories) are available for the delivery of the award.

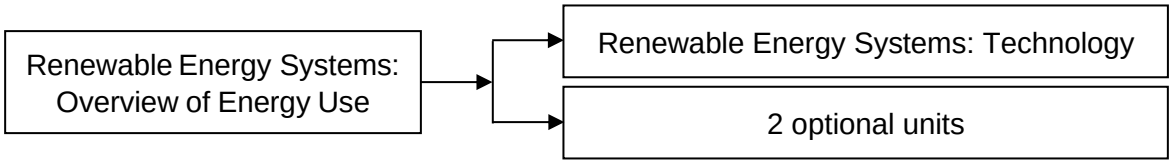
## 6.1 Sequencing/integration of units

Centres have discretion to the order in which they deliver the units. However, it is recommended that one of the following two options is used for delivering the award:

**Option 1**




**Option 2**




Option 1 has the possible attraction of being easier to timetable, whereas using Option 2 may allow for easier integration of course content.

Centres are encouraged to integrate course content wherever possible so that units are not delivered in isolation but as part of an integrated award. To this end, the QDT have included in most units the following two paragraphs:

This 2 credit unit, Renewable Energy Systems: Overview of Energy Use, provides an introduction to the subjects of energy usage and trends, environmental impact of energy use, and renewable energy systems sources from both a global and local perspective.

The 2 credit unit Renewable Energy Systems: Technology describes the basic technology associated with renewable energy systems devices. The remaining 1 credit units take a specialised look at each of the technologies currently believed to be significant, and, as such, provides an opportunity for candidates to specialise in some of these technologies. It is important that all these units are seen as providing an integrated programme of study covering energy issues with a focus on renewable energy systems. Every opportunity should be sought to combine the delivery and assessment of the units.

A few examples of the way in which different topics can be integrated across units are shown in the table below. Lecturers are likely to identify other opportunities to integrate subject content and learning and teaching as they gain more familiarity with the units.

The units in the PDA may be delivered by a combination of lectures, group work, investigations (including the use of the Internet), laboratory work and case studies. Centres may invite guest speakers from the renewable energy systems industry to give lectures on the technology they are involved in and the work they do.

Laboratory work can be particularly important in reinforcing theory, acquainting candidates with some of the equipment involved in a particular technology and in some of the issues involved in operating a technology. For example, in the unit Renewable Energy Store: Hydrogen, the following advice is given on practical work: there should be a strong emphasis on practical work and the centre should ideally provide the equipment that will enable the candidate to become familiar with the production, storage, handling, distribution and consumption of hydrogen. A fully commissioned hydrogen laboratory with the necessary safety measures and safeguards in place would be ideal (with a variety of fuel cells featuring a wide range of power output), although the unit requirements could be met using small reversible electrolysers or fuel cells connected to 1W PV cells and driving small dc motors. Safety issues must be emphasised and supported by the use of hydrogen detection devices for the detection of leaks. However, it is important that the dangers associated with the use of hydrogen are not exaggerated.'

Field visits to renewable energy systems sites can be very useful in allowing candidates to relate theory to practice and in seeing 'live' systems in operation.

Where possible, such field visits should be structured with clear objectives for the visit. During the visit, candidates should be allowed to observe the plant in operation and speak to staff. Candidates should report back either orally or in writing on their findings.

**Opportunities to integrate teaching and learning across units in the PDA**

| Topic | Units | Outcome |
|---|---|---|
| 1 Environmental impact associated with energy production methods | Overview of Energy Use | 2 Explain environmental effects associated with energy production and use. |
| | Hydroelectricity | 3 Explain the socio-economic and environmental impact of existing hydroelectric plant. |
| | Microgeneration Systems | 3 Evaluate the effects and benefits of microgeneration from a financial and environmental point of view. |
| | Wind Power | 2 Evaluate the economic performance and environmental impact of a turbine in a variety of locations. |
| 2 Efficiency and energy savings in buildings | Overview of Energy Use | 5 Explain the concepts of efficiency and energy saving in buildings. |
| | Technology | 6 Analyse the heating requirements of buildings to reduce energy end-use. |
| | Microgeneration Systems | 1 Evaluate the results from an energy review (of a building). |

| Topic | Units | Outcome |
|---|---|---|
| 3 Grid integration issues | Wind Power | 2 Evaluate the economic performance and environmental impact of a turbine in a variety of locations. |
| | Wave and Tidal Power | 1 Identify and describe tidal power generation systems.<br>2 Identify and describe wave power generation technology. |
| | Geothermal Energy | 2 Explain the ways in which electricity can be generated from geothermal energy sources. |

## 6.2 Recognition of prior learning

SQA recognises that learners gain knowledge and skills acquired through formal, non-formal, and informal learning contexts.

In some instances, a full group award may be achieved through the recognition of prior learning. However, it is unlikely that a learner would have the appropriate prior learning and experience to meet all the requirements of a full group award.

The recognition of prior learning may not be used as a method of assessing in the following types of units and assessments:

- course and/or external assessments
- other integrative assessment units (which may or not be graded)
- certain types of assessment instruments where the standard may be compromised by not using the same assessment method outlined in the unit
- where there is an existing requirement for a license to practice
- where there are specific health and safety requirements
- where there are regulatory, professional, or other statutory requirements
- where otherwise specified in an assessment strategy

More information and guidance on the recognition of prior learning may be found on our website: www.sqa.org.uk.

The following sub-sections outline how existing SQA units may contribute to this group award. Additionally, they also outline how this group award may be recognised for professional and articulation purposes.

### 6.2.1 Articulation and/or progression

The PDA in Renewable Energy Systems articulates with the UHI Millennium Institute's BSc Engineering: Renewable Energy Systems. The advice has been given that the exact point at which a candidate will be able to enter this BSc will not only depend on successful achievement of the PDA but on what other qualifications the candidate possesses. This same advice is likely also to apply to any other degrees in renewable energy systems that may be currently available, or be available in the future, in the United Kingdom. The QDT do anticipate that overtime, the PDA may act as a stepping stone along an education route which might start with candidates doing the PDA followed by a degree in the renewable energy systems area,

followed by a postgraduate degree in the same area. This would be wholly consistent with candidates progressing between SCQF levels 8 and 11.

Candidates may also wish to study individual units in the PDA as part of, for example, a CPD programme to enhance their own specialist knowledge and understanding of a specialist area of renewable energy systems. Such studies may be done in conjunction with other qualifications the candidate may be studying, such as a degree in engineering plus specialist studies in an area of renewable energy systems.

## 6.3 Open and distance learning

Advice on the use of open and distance learning is given in individual unit specifications. However, where it is used with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangement would be required to be put in place to ensure that the assessment or assessments were conducted under the conditions specified in the unit specification. For example, in the case of a unit which involved assessment papers, a centre would have to make arrangements for the assessments to be conducted under controlled, supervised conditions. Likewise, where a unit involves a practical based assessment, a centre would have to make arrangements for candidates to come into the centre to undertake the assessment under the conditions specified in the unit specification.

It should be noted that the same requirements as specified in the previous paragraph apply where part or all of a Unit is delivered on-line.

## 6.4 Supporting materials

A **list of exiting ASPs** is available to view on SQA's website:
https://www.sqa.org.uk/sqa/90557.10883.html

# 7 General information for centres

## Equality and inclusion

The unit specifications making up this group award have been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners will be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

## Internal and external verification

All instruments of assessment used within these group awards should be internally verified using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment* (www.sqa.org.uk).

# 8 History of changes

It is anticipated that changes will take place during the life of the qualification, and this section will record these changes. This document is the latest version and incorporates the changes summarised below. Centres are advised to check SQA Connect to confirm that they are using the most up-to-date qualification structure.

**NOTE:** Where a unit is revised by another unit:

- No new centres may be approved to offer the unit which has been revised.
- Centres should only enter candidates for the unit which has been revised where they are expected to complete the unit before its finish date.

| Version number | Description | Date |
|---|---|---|
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## Acknowledgements

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

## Further information

Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

# 9 General information for learners

This section will help you to decide whether this is the qualification for you by explaining: what the qualification is about; what you should know or what you should be able to do before you start; what you will need to do during the qualification; and opportunities for further learning and employment.

**Introduction**

Most experts believe that the gases released when fossil fuels are burnt to produce energy are contributing towards changes in world climate and global warming. One way of reducing dependency on fossil fuels is to make greater use of renewable energy systems technologies such as wind farms, hydroelectric schemes, and wave and tidal barriers. Such technologies are certainly making a greater contribution to energy production across the world and in Scotland. However, renewable energy systems is certainly not without its detractors. Some doubt that such technologies can supply base energy loads, believing instead that nuclear power stations are required for this purpose. Furthermore, while renewable energy systems technologies are clean (that is, they do not contribute to carbon dioxide emissions), they are not without their environment problems (for example, noise from wind turbine generators, dangers to wild life from hydroelectric schemes and wave and tidal energy schemes).

**Content**

In the PDA in Renewable Energy Systems, you will be provided with an opportunity to study world energy uses and trends, the harmful effects of current fossil fuel energy production methods on climate and the steps that are being taken to reduce these harmful effects, including the use of renewable energy systems technologies, energy conservation in buildings, transport and power generation and carbon sequestration schemes. You will also have an opportunity to learn about the physics and engineering of a range of renewable energy systems technologies so that you can make accurate, valid comparisons between renewable technologies when solving energy related problems. You will also be able to specialise in any two of the following technologies: biomass, geothermal energy, hydroelectricity, hydrogen, microgeneration, solar, wave and tidal energy, and wind power.

**Teaching and learning**

The PDA is likely to be delivered by a combination of lectures, class discussions or debates, group work, case studies, investigations (including the use of the Internet) and laboratory work. As part of your course, you may also be taken on field visits to renewable energy systems sites to see systems in operation and to talk to staff about renewable energy systems technologies and the work they are involved in.

**Assessment**

The assessments in the PDA have been designed to meet national standards. The award has been designed to optimise assessment so that sufficient time is available for you to learn about the issues surrounding renewable energy systems technologies.

Unit assessment will normally consist of assessment papers and/or assignments. The latter will include the preparation of reports. Your lecturer should tell you at the start of the unit what form unit assessment will take.

**Entry requirements**

No artificial barriers should be placed in the way of candidates wishing to study the PDA in Renewable Energy Systems. However, it would be unfair to enrol a candidate into the PDA who did not have a realistic chance of successfully achieving the award. The following qualifications are recommended for entry into the PDA:

- SQA Advanced Certificate or Diploma in Engineering Systems
- a suitable multi-disciplinary degree
- other awards deemed equivalent to the above

If you have another SQA Advanced engineering qualifications in an area such as electronics, electrical engineering, mechanical engineering or manufacturing engineering, you may partially meet the requirements but you may have to undertake an additional bridging programme in order to fill in gaps in your technical education before starting the PDA (for example, if you have an SQA Advanced Certificate in Mechanical Engineering, you may find it beneficial to study electrical and electronic units prior to taking the PDA).

If you have other qualifications, you may be considered for entry to the PDA on the basis of whether your knowledge and understanding of engineering is sufficiently well developed to allow you direct access to the award, or whether you need to do studies in engineering prior to entering the PDA.

**Progression**

On completion of the PDA, you can progress to the UHI Millennium Institutes degree entitled BSc Engineering: Renewable Energy Systems. The exact point at which you are able to enter the BSc will not only depend on successful achievement of the PDA but on what other qualifications you possess. Candidates who successfully achieve the PDA may also have opportunities to enter other degree programmes in the renewable energy systems area.