



SKILLS FOR WORK — ENERGY
Intermediate 2

First edition — published April 2008



National Course Specification

Energy (Intermediate 2)

COURSE CODE C258 11

COURSE STRUCTURE

This course has 3.5 Units that are mandatory and a 0.5 Unit which is taken from three 0.5 optional Units.

The mandatory Units are:

F3FN 11	<i>Energy: An Introduction</i>	<i>1 credit (40 hours)</i>
F3FR 11	<i>Energy: Domestic Wind Turbines Systems</i>	<i>1 credit (40 hours)</i>
F3FS 11	<i>Energy: Domestic Solar Hot Water Systems</i>	<i>1 credit (40 hours)</i>
F3FP 11	<i>Energy: Employability and Careers</i>	<i>0.5 credit (20 hours)</i>

A choice of one from the following options:

F3FT 11	<i>Energy and the Individual</i>	<i>0.5 credit (20 hours)</i>
F3FW 11	<i>Energy: Oil/Gas Extraction</i>	<i>0.5 credit (20 hours)</i>
F3FV 11	<i>Energy: Conventional Technologies and the Grid</i>	<i>0.5 credit (20 hours)</i>

To achieve the Course award, the candidate must successfully achieve all the mandatory Units and one of the optional Units.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Course Specification: (cont)

COURSE Energy (Intermediate 2)

PROGRESSION

This Course, or its Units, may provide progression to:

- ◆ National Progression Award
- ◆ a National Certificate programme in Further Education
- ◆ training/employment

CREDIT VALUE

The Intermediate 2 Course in Energy is allocated 24 SCQF credit points at SCQF level 5*.

**SCQF points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills or Core Skills components in this Course.

Opportunities for developing aspects of Core Skills are highlighted in the Support Notes of the Unit Specifications for this Course.

LINKS TO NATIONAL OCCUPATIONAL STANDARDS

National Occupational Standards (NOS) are developed by the key employment sectors of the United Kingdom. These standards set the competences required for job roles within a particular employment sector.

The (NOS) for the energy sector (eg Occupational and Functional Map of the UK Renewable Energy Sector) reflect common requirements in the demonstration of competences across that sector.

Some of these competences, which are identified in the current NOS, are reflected to varying degrees in this Course. For example:

- ◆ general engineering skills
- ◆ a combination of integrated electrical installation and plumbing skills
- ◆ mechanical skills

Additionally, other generic skills included in the NOS are reflected throughout the Course including:

- ◆ communication skills
- ◆ using IT to exchange information
- ◆ team working skills
- ◆ ability to learn
- ◆ ability to follow instructions
- ◆ organising own learning and development

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

RATIONALE FOR SKILLS FOR WORK COURSES

Skills for Work Courses are designed to help candidates to develop:

- ◆ skills and knowledge in a broad vocational area
- ◆ Core Skills
- ◆ an understanding of the workplace
- ◆ positive attitudes to learning
- ◆ skills and attitudes for employability

A key feature of these Courses is the emphasis on *experiential learning*. This means learning through practical experience and learning by reflecting on experience.

Learning through practical experience

- ◆ Teaching/learning programmes should include some or all of the following:
 - learning in real or simulated workplace settings
 - learning through role play activities in vocational contexts
 - carrying out case study work
 - planning and carrying out practical tasks and assignments

Learning through reflecting at all stages of the experience

- ◆ Teaching/learning programmes should include some or all of the following:
 - preparing and planning for the experience
 - taking stock throughout the experience — reviewing and adapting as necessary
 - reflecting after the activity has been completed — evaluating and identifying learning points

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

The Skills for Work Courses are also designed to provide candidates with opportunities for developing *Core Skills* and enhancing skills and attitudes for *employability*.

Core Skills

The **five** Core Skills are:

- ◆ Communication
- ◆ Numeracy
- ◆ Information Technology
- ◆ Problem Solving
- ◆ Working with Others

Employability

The skills and attitudes for employability, including self-employment, are outlined below:

- ◆ *generic skills/attitudes valued by employers*
 - understanding of the workplace and the employee's responsibilities, for example time-keeping, appearance, customer care
 - self-evaluation skills
 - positive attitude to learning
 - flexible approaches to solving problems
 - adaptability and positive attitude to change
 - confidence to set goals, reflect and learn from experience
- ◆ *specific vocational skills/knowledge*
 - Course Specifications highlight the links to National Occupational Standards in the vocational area and identify progression opportunities

Opportunities for developing these skills and attitudes are highlighted in each of the Course and Unit Specifications. These opportunities include giving young people direct access to workplace experiences or, through partnership arrangements, providing different learning environments and experiences which simulate aspects of the workplace. These experiences might include visits, visiting speakers, role play and other practical activities.

A Curriculum for Excellence (Scottish Executive 2004) identifies aspirations for every young person. These are that they should become:

- ◆ successful learners
- ◆ confident individuals
- ◆ responsible citizens
- ◆ effective contributors

The learning environments, the focus on experiential learning and the opportunities to develop employability and Core Skills in these Courses contribute to meeting these aspirations.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

RATIONALE FOR INTERMEDIATE 2 ENERGY COURSE

This Course is intended to equip candidates with the necessary knowledge and skills which will enhance their prospects for employment in the wide range of opportunities within energy sectors. The Course will allow candidates to develop a range of employability skills which are of particular relevance to energy industries. Core Skills of *Information Technology* and *Problem Solving* will also be developed throughout the Course where opportunities arise. The Course will offer a variety of approaches to learning and teaching and will include a strong element of experiential learning. It is intended that some of the Course will be delivered and assessed in a different learning environment to that of the school through a partnership arrangement with a college, training provider, or employer.

There are many technologies used in the production of energy and this course has been designed to contain both an electrical generation practical/skills element using wind turbines and a heat generation practical/skills element using solar panels. These elements were selected to ensure candidates received a range of skills using different technologies that are involved in the generation of energy. Other systems used to generate energy from both the traditional/conventional and renewable systems will be discussed and evaluated during the Course.

The primary target group for this Course is school candidates in S3 and S4. However, the Course is also suitable for S5/S6 candidates and adult candidates who are seeking to enhance their employability and vocational skills in the energy sector.

The general aims of the Course are to:

- ◆ widen participation in vocationally-related learning for 14–16 year olds
- ◆ allow candidates to experience vocationally-related learning
- ◆ provide candidates with a broad introduction to the energy sector
- ◆ allow candidates the opportunity to develop skills relevant to the microgeneration energy sector
- ◆ develop the candidates' engineering skills
- ◆ encourage candidates to evaluate the impact of energy generation on the environment
- ◆ encourage candidates to foster a good work ethic, including timekeeping, a positive attitude and other relevant employability skills
- ◆ provide opportunities to develop a range of Core Skills in a realistic context
- ◆ encourage candidates to take charge of their own learning and development
- ◆ provide a range of teaching, learning, and assessment styles to motivate candidates to achieve their full potential
- ◆ facilitate progression to further education and/or training

In particular, the aims of the Course are to:

- ◆ encourage candidates to consider a career in the energy sector
- ◆ develop an awareness of the role of conventional and renewable energy systems in the UK
- ◆ develop an awareness of what opportunities there may be within the sector in terms of the types and range of career options
- ◆ provide candidates with knowledge and skills which are directly relevant to employment within the energy sector, eg solar hot water and wind turbines

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

- ◆ provide opportunities for the personal development of skills and attitudes which will improve the candidates' employment potential within the energy sector
- ◆ develop the candidates' awareness of their individual strengths and weaknesses in relation to the requirements of the sector, and to reflect on how this affects their employability potential
- ◆ raise awareness of the impact of the energy sector on the environment
- ◆ raise awareness of the responsibilities of the energy industry with regard to the environment

Rationale for Course content

The production and use of energy is important in everyone's life and is also an important area of study and work. It is central to how we reduce our impact on the environment when generating heat or electrical energy or power and to reducing our CO₂ emissions which are widely claimed to have an impact on climate change.

The generation of energy has traditionally been done through the use of fossil fuels; oil, gas, and coal, with some renewable energy produced from hydro power. Nuclear power was seen, and is still seen by some, as a method of generating energy with zero carbon emissions, but the disposal of the radioactive spent fuel is of major concern and this can counteract the advantages it has with zero carbon emissions.

The development of most renewable energy systems is a recent innovation where energy is generated from renewable energy sources, eg wind, solar, geothermal, bio-fuels, tidal, and wave. These systems have the advantage of generating power with virtually zero carbon emissions. The bio-fuels and geothermal systems can release power on demand, but most of the others depend on sources of energy outwith the control of human beings, and consequently, do not have a constant power output. For example, solar is not effective at night or when it is particularly cold and cloudy, wind is not effective at low wind speeds or very high wind speeds, and while tides are regular, they occur only a few times per week and wind is required to generate waves in our oceans or seas.

The main themes of the course are; conventional energy production, renewable energy production, converting energy from one form to another, industrial or domestic energy generation facilities, practical work with solar panels and wind turbines (integrating team work into the assembly process), and investigating careers within the energy sector.

Optional areas covered are the size of an individual's carbon footprint, oil and gas extraction or conventional energy systems; their contribution to the total energy generated in the UK and their environmental affects.

Candidates will study the overall status of energy in Scotland, and in the UK, in general. They will explore the conventional methods of production, including their efficiency levels, various energy conversion principles, and how energy can be conserved. They will also explore the more recent developments in energy production using renewable energy techniques and will develop practical skills in the areas of plumbing, electrical, and mechanical engineering. Careers within the energy sector have been integrated with employability skills which are developed through practical activities.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

The three optional Units offer different routes for candidates. They can opt for an individual investigation and evaluation of their own carbon footprint, investigate the size of the market segment taken up with conventional production techniques and their sustainability, and explore the use of the national grid as a means of transmitting electricity throughout the UK, or have an in-depth study into the formation and extraction of one type of fuel in its raw state which is particularly relevant to Scotland, ie offshore oil and gas.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

COURSE CONTENT

Summary of Course content

Candidates will explore a variety and range of industries and career opportunities which exist within the energy sector. Candidates will become familiar with key words and terms used in the sector, and will develop an awareness of the impact of the energy sector on the environment and individual lives. Personal development of employability skills will be the main focus across the Course with each Unit aiming to enhance such skills. The development of teamwork and practical skills and carrying out test procedures are also given high profile.

The mandatory Units in this Course introduce the various energy industries based in the UK, develop practical skills by building a small scale solar hot water system and wind turbine, and candidates will also review their employability skills and evaluate their strengths and weaknesses. There is an opportunity to specialise in one subject area by selecting one of the three optional Units, ie analyse their own carbon footprint or develop a deeper knowledge of oil and gas production in the North Sea or develop further knowledge on the conventional energy generation systems used in the UK.

Summary of Unit content

Energy: An Introduction — Mandatory (Intermediate 2) (1 credit)

The aim of the Unit is to provide candidates with an overview of where we get our energy from, the engineering systems that convert it into a more convenient form, and the energy conversion processes that take place from fuel being input to energy being generated.

It gives a broad overview of traditional and renewable energy systems, energy conservation and includes an evaluation of an industrial or domestic energy generation facility. Investigation and presentation skills are developed in this Unit.

Energy: Domestic Solar Hot Water Systems — Mandatory (Intermediate 2) (1 credit)

The Unit introduces a microgeneration system which generates heat from solar energy and transfers this heat energy to a heat exchanger and on to other appliances, eg hot water tank or under-floor heating system suitable for use in a domestic or small scale industrial building. This is a practical skills based Unit which gives students the practical skills to manufacture some of the parts and assemble a small solar hot water panel through team working which is seen as an essential element in this Unit.

Energy: Domestic Wind Turbine Systems — Mandatory (Intermediate 2) (1 credit)

This Unit introduces residential or microgeneration wind turbine systems which generate electrical energy. This is a practical skills based Unit which will give students the ability to wire up an electrical circuit, manufacture parts, assemble, and test a small scale wind turbine. The candidates will use prepared components to build the turbine. Team working is seen as an essential element in this Unit.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

ASSESSMENT

To achieve the Course award the candidate must successfully achieve all the Units which make up the Course.

Assessment objectives

The aim of the assessment in this course is to provide opportunities to gather evidence of development in:

- ◆ practical skills
- ◆ review and evaluation skills
- ◆ investigation skills
- ◆ knowledge and understanding

Assessment Summary

Unit Title	Assessment
Mandatory Units	
Energy: An Introduction	Outcome 1, Outcome 2 and Outcome 3 — investigation Outcome 4 — group presentation
Energy: Domestic Solar Hot Water Systems	Outcome 1 individual practical exercises Outcome 2 and Outcome 3 — teamwork practical exercise Outcome 4 — presentation
Energy: Domestic Wind Turbine Systems	Outcome 1 and Outcome 2 — individual practical exercises Outcome 3 and Outcome 4 — teamwork practical exercise Outcome 5 — presentation
Energy: Employability and Careers	Outcome 1 — review and evaluation Outcome 2 — presentation
Optional Units	
Energy and the Individual	Outcome 1 and Outcome 2 — investigation Outcome 3 — presentation
Energy: Oil/Gas Extraction	Outcome 1 and Outcome 2 — investigation Outcome 3 — presentation
Energy: Conventional Production Technologies and the Grid	Outcome 1 and Outcome 2 — investigation Outcome 3 — presentation

It is the intention that the necessary skills and attitudes being developed in this Course are assessed through an involvement in a range of practical activities, although, there are also elements of knowledge and understanding which are important. An important element in the assessment process will be the ability of the candidate to review progress and development throughout the Course. Where possible, assessment should reflect current workplace practice, whether demonstrated through work placement, or simulated environments.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

Unit assessment

Further details about Unit assessment for this Course can be found in the Unit Specifications and the (NAB) materials.

Practical work

Within the skills-specific practical Units, the candidate will produce evidence as a natural part of the learning and teaching process. Candidates will first learn and practise the correct techniques and methods for each of the skills they undertake. Assessment of the various practical tasks will take place at appropriate points throughout the Course, allowing time for candidates to make quality checks of their finished products against the prescribed brief, before being submitted for assessment.

Each Unit will be supported by a (NAB) pack which will provide exemplar assessment instruments and exemplify national standards.

Health and Safety

Compliance with health and safety legislation is of paramount importance in this Course. Owing to the health and safety implications involved in working in science, engineering and construction, the practical Units have been designed so that they can be taught and assessed in a workshop or laboratory environment.

It is the centre's responsibility to produce risk assessments which set out the safe working/teaching and learning arrangements for teachers, support staff and candidates. Centres will need to be familiar with the requirements of the Health & Safety at Work Act, the Management of Health & Safety at Work Regulations, Control of Substances Hazardous to Health, Provision and Use of Work Equipment Regulations and other legislative requirements where risk assessments are required. (This list of statutes is not intended to be exhaustive, and centres must comply with all current relevant legislation whether listed or otherwise.)

QUALITY ASSURANCE

The Units of all National Courses are subject to internal verification and may also be chosen for external verification by SQA. This is to ensure that national standards are being applied across all subjects.

To assist centres, Senior Verifier reports are published on SQA's website www.sqa.org.uk

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

GUIDANCE ON LEARNING/TEACHING AND ASSESSMENT APPROACHES FOR THIS COURSE

Centres should ensure that an induction to the course is given which will enable candidates to understand fully what is required and the approaches to be adopted. It is important that employability skills, both generic and specific to the Energy industries, are stressed at this time.

While the sequence of delivery of the Units is for individual centres to decide, it is recommended that *Energy: An Introduction* Unit is offered first. This Unit sets the scene for the other Units to be delivered in the context of the energy sector and the energy people use. All teachers, lecturers and assessors involved in the delivery and assessment of this course should have an appreciation of the nature and content of the whole Course. This is particularly important in the delivery of the *Energy: Employability and Careers* Unit. It is intended that the Evidence Requirements for this Unit will be drawn from the other Units in the Course.

Candidates will be encouraged to learn through practical activity with workshop skills, and practical lab work, forming a main type of delivery. The development of Core Skills and employability skills should be uppermost in the minds of those considering how to plan lessons. Candidates should be encouraged to accept responsibility for learning and ownership of the review and self-evaluation process. The *Energy: Employability and Careers* Unit, in particular, will actively encourage candidates to analyse their strengths and weaknesses with regard to the employability skills identified within the Course Units and review their own performance through self-reflection and self-evaluation. Tasks involving investigations into energy systems and the effects these energy systems have on individuals or the environment should be incorporated throughout the Course. This approach will encourage development in the use of information technology as a tool for information gathering and analysis, independent working, and investigation skills.

Learning and Teaching

The Course has been designed to ensure that candidates learn through practical experiences where possible. The main focus in each of the skills specific Units is on practical work. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical engineering activities within the Units.

Energy: An Introduction Unit includes practical lab work where candidates will gain a greater understanding of the principles of energy conversion and how we can generate more useful forms of energy that can be used in a range of energy production processes.

Candidates should be encouraged to investigate energy related topics, including careers, within the energy sector and the effect energy production has on the environment or climate change.

Health and safety is integral to all practical tasks and should be emphasised at the start of, and throughout, each lesson. Brief lessons on workshop protocol should also be included at the start of the practical Units and at appropriate points during these Units.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

Teaching and learning approaches will include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practise the skill emphasised by the demonstration. Given the practical nature of teaching/learning and assessment, centres should ensure that teaching blocks are of sufficient time to allow a meaningful experience for candidates.

Reflecting on practical experiences and learning from them is an approach that is embedded in the Course. Throughout the learning experiences, the emphasis should be on helping candidates to develop an awareness of the employability skills and attitudes needed for the energy industry, for example, good timekeeping, co-operating with others, team working, taking instructions, and a positive attitude to learning. Opportunities to develop these skills and attitudes arise naturally in the work during the Course. Candidates should be aware that these generic skills are just as important as the practical skills they are developing. For example, it is important for workshop activities to be carried out to effective schedules; candidates will have opportunities to demonstrate good timekeeping in the context of these schedules. Candidates will have to co-operate with others regarding shared workspace, tools and equipment. They will have to co-operate and communicate regarding the transfer of materials, tools, and equipment safely around and across the workshop. Candidates will be encouraged to develop a positive attitude to reducing waste and reduce their impact on the environment with regard to the use of materials and the consumption of energy.

Opportunities to develop aspects of Core Skills should be used where they arise naturally. For example, in order to carry out activities in a workshop environment, candidates will develop aspects of numeracy when making calculations and taking measurements. They will also have to communicate simple science/engineering/construction terms with tutors and fellow candidates regarding skills practices, materials and tools, health and safety, and working together in the workplace. They will have to work in a team during the practical Units; it is important that they realise what the positive attitudes are to ensure good team working dynamics. Aspects of problem solving will arise through their participation in practical work.

Teaching and learning approaches should encourage candidates to take responsibility for their own learning and development. In the practical Units of the Course, candidates need to carry out quality checks on their own work. This provides a good opportunity to motivate candidates to take pride in their work. The integration of employability skills, in particular self-evaluation skills, will allow candidates to take responsibility for seeking feedback and identifying action points for improvement in their own performance. This should help to develop confidence in taking advice and in asking for direction and assistance where necessary.

Investigations are used throughout this course and lecturing staff should encourage candidates to use as many methods as possible to gain the information they need. Apart from the teaching notes provided, candidates should make full use of the internet, journals (on-line and paper based), books, national and local papers, friends or family who have knowledge or experience of the energy sector, site visits, practical demonstrations, and experimentation.

Presentations are also frequently used in this Course. Candidates should be encouraged to use their creativity skills to develop a range of skills in presenting information, this could include; a talk, flipcharts, whiteboard (electronic), computer software, practical demonstrations, digital pictures, video clips (using a mobile phone or camcorder).

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

Teaching staff should emphasise the need for candidates to try and develop their own ideas to solve problems or issues, these can then be used as points for discussion. Giving candidates the solution should not be seen as the first option. Candidates should be encouraged to play an active part in their own learning by discussing their views and thoughts on the technologies being used, the environment, careers and personal preferences with peers and teaching staff.

Preparation for practical activities, visiting speakers, visits

Throughout the Course, the need for correct preparation for practical activities should be stressed. However, such preparation should not take excessive time to complete. Teaching correct skills practice, effective and safe use of tools and equipment, and a positive view of health and safety should help to ensure that preparation for practical work is comprehensive.

Candidates will require supervision during practical work — both on a skills level and for health and safety reasons. The learning environment should be designed to minimise risks and provide a safe context for carrying out tasks. For example, when undertaking the task of soldering, candidates should be made aware of the risk from heat and fumes to themselves and others.

It is recommended that each practical session be preceded by a ‘tool box’ talk on an aspect of health and safety relevant to the work in hand. It is recommended that candidates be given regular but short practice sessions in the correct and safe working principles of the materials to be used in each session, as well as, coaching in the correct use of associated tools and equipment.

Centres are encouraged to establish links with local industry. Local engineering companies, trades associations, Sector Skills Councils (SSCs) and Engineering or Energy Institutes may be prepared to offer support, for example, in the form of visits from representatives of their organisations. Visitors from the energy industry will be able to give candidates a realistic view of jobs and conditions within the energy sector.

Centres should try and arrange a visit to an energy generation facility as part of the candidates’ learning experience and assessment. Visits to local sites are often particularly useful to give candidates a feel for the environment, equipment, and staff working and using energy generation systems.

Site visits should be carefully arranged, organised, and authorised. Due regard should be placed on insurance arrangements, necessary when taking students on these visits, particularly when going on to industrial sites.

Teaching and learning approaches should impart enthusiasm and help to inform candidates of realistic prospects in the energy industries. They should become aware of steps to employment or further training. Through their experiences of the various practical skills and knowledge of various energy systems in the Course, they should become better equipped to make valid personal choices regarding careers and further study.

A holistic approach to the Course delivery and assessment should be adopted. The types of energy generation methods and plant/systems contained within the *Energy: An Introduction* Unit should form the basis of the practical Units; *Energy: Domestic Wind Turbine System*, and *Energy: Domestic Solar Hot Water Systems* Units. *Energy: Employability and Careers* Unit should be central to the whole Course and delivered alongside the other Units.

National Course Specification: Course details (cont)

COURSE Energy (Intermediate 2)

Candidates should be made aware of what employability skills are, and should monitor their own development of these throughout the practical Units. Employability skills should not be seen as a separate type of assessment of this Course, they should be seen as an integral part where candidates should see the need for them and develop them to enhance career opportunities within or out with the energy sector.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for this Course. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

National Course Specification: Course details

COURSE: Energy (Intermediate 2)

Appendix: Employability Skills Profile

In addition to the specific, vocational skills developed and assessed in this Course, employability skills are addressed as detailed in the table below. For the purposes of the table, the Units are referred to as A, B, C and D as indicated.

Energy: Introduction — mandatory	= A
Energy: Domestic Solar Hot Water Systems — mandatory	= B
Domestic Energy Systems: Wind Turbine Systems — mandatory	= C
Energy: Employability and Careers — mandatory	= D
Energy and the Individual — optional	= E
Energy: Oil/Gas Extraction — optional	= F
Energy: Conventional Production Technologies and the Grid — optional	= G

Employability skill/attitude	Evidence
Maintaining good timekeeping and attendance	A, B, C, D, E/F/G
Maintaining a tidy work place	B, C
Seeking feedback and advice	A, B, C, D, E/F/G
Following instructions	B, C
Working co-operatively with others	A, B, C
Selecting and using tools correctly and for the purpose they were designed	B, C
Using Personal Protective Equipment correctly and working safely	A, B, C
Following basic drawings correctly	B, C
Checking quality of work	A, B, C, D, E/F/G
Working to agreed deadlines	A, B, C, D, E/F/G
Organising work effectively	A, B, C, D, E/F/G
Working confidently	A, B, C, D, E/F/G
Willingness to learn new skills or techniques	B, C
Working independently	A, B, C, D, E/F/G
Reflecting on own performance	B, C
Learning from past experiences	B, C
Awareness of a range of careers and job roles	D
Developing investigation skills	A, D, E/F/G
Developing presentation skills	A, B, C, D, E/F/G
Developing creativity skills	A, B, C, D, E/F/G



National Unit Specification: general information

UNIT Energy: An Introduction (Intermediate 2)

CODE F3FN 11

COURSE Energy (Intermediate 2)

SUMMARY

This Unit is mandatory in the Intermediate 2 Skills for Work Energy Course. It is intended for candidates who are interested in a career within the energy sector, or who wish to gain some practical skills and knowledge of how the energy sector operates and the resources it needs, to operate effectively. This Unit can also be taken as a stand-alone Unit.

The aim of the Unit is to provide candidates with an overview of traditional and renewable energy systems and explain where we get our energy from, including the systems that convert it into a more convenient form, and the energy conversion processes that take place. Industrial and domestic systems are investigated to ensure as wide a range as possible is undertaken.

This Unit has been designed with secondary school candidates in mind but may be also be suitable for other candidate groups.

OUTCOMES

- 1 Investigate energy power systems in accordance with a given brief.
- 2 Investigate energy conservation and conversion processes in accordance with a given brief.
- 3 Investigate an installed energy system according to a given brief.
- 4 Contribute to a group presentation on a specified energy system in accordance with a given brief.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: An Introduction (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: An Introduction (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Investigate energy power systems in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the subsystems used in conventional and renewable electricity power generation systems.
- (c) Gather information on the efficiency of conventional and renewable electrical power generation systems.
- (d) Organise information gathered to produce clear summary information of subsystems and efficiency of conventional and renewable electricity power generation systems.
- (e) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 2

Investigate energy conservation and conversion processes in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on energy conservation techniques used in buildings.
- (c) Gather information on types of energy used in the production of heat and electricity.
- (d) Gather information on methods of energy conversion processes used in generating power.
- (e) Organise information gathered to produce summary information on energy conservation, types of energy and energy conversion processes.
- (f) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 3

Investigate an installed energy system according to a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the sub-systems used in the energy system.
- (c) Gather information on the impact of the energy system on the environment.
- (d) Organise information gathered to produce evaluations of its energy sub-systems and the effect the system has on the environment.
- (e) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

National Unit Specification: statement of standards (cont)

UNIT Energy: An Introduction (Intermediate 2)

OUTCOME 4

Contribute to a group presentation on a specified energy system in accordance with a given brief.

- (a) Contribute constructively to a group discussion to agree roles, tasks, and timescales to meet the brief.
- (b) Carry out agreed role and tasks within the timescales set.
- (c) Contribute to the selection of relevant information on the functions of components used in the specified energy system.
- (d) Contribute to the selection of relevant information on the impact which the energy system has on the environment.
- (e) Contribute to the production of the final group presentation.
- (f) Carry out a quality check of the final presentation and feed back comments to the group.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Performance and product evidence is required for this Unit. The evidence should be gathered at appropriate points throughout the Unit, in open-book conditions, in response to a given brief.

Performance and product evidence for Outcomes 1, 2, and 3

Candidates will carry out an individual investigation according to the instructions in a given brief which covers all Outcomes and Performance Criteria. Findings will be gathered in a folio which the assessor will discuss with the candidate to check that all steps have been carried out as specified. The assessor will then complete and retain checklists for each candidate as evidence that all steps have been carried out as specified in the brief.

Energy generation systems should be investigated in terms of inputs, outputs, sub-systems, components, efficiency, and environmental effects.

The investigation should include three from the five Conventional Energy Generation Systems listed below:

- ◆ coal power system
- ◆ oil power system
- ◆ gas power system
- ◆ hydro power system
- ◆ nuclear power system

National Unit Specification: statement of standards (cont)

UNIT Energy: An Introduction (Intermediate 2)

The investigation should include two from the four Renewable Energy Generation Systems listed below:

- ◆ heat system — solar hot water system
- ◆ heat system — ground source heat pump
- ◆ electrical system — solar photovoltaic
- ◆ electrical system — wind turbine

Energy conservation techniques should include loft, wall and floor insulation, double glazing, and draft proofing.

The investigation should include four from eight practical demonstrations — energy conversion processes listed below:

- ◆ solar energy to electrical energy — photovoltaic
- ◆ electrical energy to light energy — bulb
- ◆ electrical energy to rotational energy — motor
- ◆ rotational energy to electrical energy — generator
- ◆ potential energy to kinetic energy — hydro
- ◆ solar energy to heat energy — solar hot water
- ◆ wind energy to rotational energy to electrical energy — wind turbine
- ◆ steam energy to rotational — turbine

Product evidence for Outcome 4

In response to a given brief, candidates will work in groups on an energy system specified by the assessor and participate in a group presentation on that system. The group will select an appropriate method of communication — written, oral, electronic, diagrammatic, pictorial — are all acceptable. The group may also choose the form of the presentation — poster, leaflet, short PowerPoint presentation, short group talk — are all acceptable provided the Performance Criteria are met. The Criteria focus on the candidate's team working skills and individual contribution, rather than on the quality of the final group presentation. The assessor will complete an observation checklist to confirm and record the candidate's achievement.

The National Assessment Bank (NAB) item for this Unit contains an appropriate brief which covers the investigation and presentation requirements of the Unit and an assessor observation checklist. Centres wishing to devise their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: An Introduction (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The *Energy: An Introduction* Unit has been designed to provide candidates with an introduction to power generation systems that produce heat or electricity as an output. The focus of this Unit is on the investigation skills that the candidate will use to access and organise relevant information, and finally, to present their findings in a clear format.

Conservation of energy in domestic buildings will be investigated to ensure candidates realise the need to get maximum value from energy generated.

Candidates will be introduced to a range of energy systems where they will study the sub-systems or components which make up the system and how these sub-systems or components function to generate energy. Candidates will develop an understanding of energy, the technology used to convert it into more useful forms and how these conversion technologies can be used to give out heat or electrical power which is essential for our homes, industry, and businesses.

Sub-systems should be taken to mean smaller systems, eg a wind turbine has the following sub-systems turbine blades, generator, and column; components are single parts within the system or sub-system, eg the turbine blades sub-system would include the blades, hub, and main shaft.

The principles involved in this Unit are best demonstrated in a practical environment where students can be involved in the setting up and running of demonstrations. Where practical demonstrations cannot be provided, video or computer simulations should be used.

Candidates will be introduced to a large range of energy systems, from large power stations/systems which feed into the national grid to small renewable energy systems (microgeneration systems) which mostly give energy to domestic buildings. These systems would ideally be introduced by a series of site visits, video, computer simulations, or internet sites.

National Unit Specification: support notes (cont)

UNIT Energy: An Introduction (Intermediate 2)

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ seeking feedback and advice
- ◆ working co-operatively with others
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ working independently
- ◆ developing investigation skills
- ◆ developing presentation skills
- ◆ developing creativity skills

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that a thorough induction is given to candidates at the start of this Unit so that they understand that the main learning approach will be candidate-centred. Candidates should work independently on a given investigation brief and should develop and use skills in accessing and organising information from a variety of sources. Sources might include:

- ◆ family and friends
- ◆ manufacturer's instructions
- ◆ internet
- ◆ reference books
- ◆ laboratory exercises
- ◆ visiting speakers

It is envisaged that some tutor support is given to candidates in the initial stages and at regular intervals throughout this Unit. However, the intention is to encourage candidates to work as independently as possible.

Candidates will be given responsibility, following lecturer/teacher support, for making choices on the format and style of the presentation of their key findings.

The candidate will be central to the learning and teaching of this Unit. They should be proactive in detailing the energy systems under investigation, the types of energy used, and how they are used in power generation, and in engineering systems. The investigation in Outcome 3 into an installed energy generation system would be best done through a site visit where they would see the system in its real environment. This would allow candidates an opportunity to visualise the system's impact on the environment as well the size of the components or sub-systems involved.

An important part of the learning and teaching in this Unit will be on the generic employability skills which are developed. Candidates should be aware that these skills are transferable and are valued by employers in the workplace.

National Unit Specification: support notes (cont)

UNIT Energy: An Introduction (Intermediate 2)

When candidates are presenting their findings in this Unit, there are good learning opportunities for the whole class group. The sharing of information and the different methods used for presentations provide useful opportunities for reflection and discussion. The assessment process itself can be used as a valuable part of the learning in the Unit.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of *Information Technology*:

- ◆ in the investigation of energy power generation systems
- ◆ in the use of ICT to present findings

There are opportunities to develop aspects of the Core Skill of *Communication* both in the investigation and presentation of findings.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Formative assessment exercises involving candidates in identifying energy sub-systems, components and efficiencies, types of energy used and energy conversion processes, energy conservation techniques and environmental effects, will play an important part in building up the candidate's knowledge, understanding and confidence in relation to this Unit.

The recommended approach to summative assessment in this Unit is as follows:

Outcome 1

Candidates will carry out an investigation according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

National Unit Specification: support notes (cont)

UNIT Energy: An Introduction (Intermediate 2)

Outcome 2

Candidates will carry out practical investigations according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcome 3

Candidates could carry out a practical investigation during a site visit according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Environmental effects investigated could include, noise, emissions, aesthetics, effect on wildlife, effect on the countryside or waterways, health, etc.

Outcome 4

The assessment is based on the end product of the Outcome which will be a presentation in a form of the candidate's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

CODE F3FR 11

COURSE Energy (Intermediate 2)

SUMMARY

This Unit is a mandatory Unit of the Intermediate 2 Skills for Work Energy Course. It is intended for candidates who are interested in a career in the energy sector, or who wish to gain some practical skills and knowledge of how the wind turbine energy sector operates. This Unit can also be taken as a stand-alone Unit.

This Unit introduces domestic or microgeneration wind turbine systems which generate electricity. This Unit will provide an opportunity to develop practical skills which will give candidates the ability to wire up an electrical circuit, manufacture parts, assemble, and test a small scale domestic wind turbine. The candidates will use existing components, eg generator and blade, and manufacture others to complete the wind turbine system.

This Unit has been designed with secondary school candidates in mind but is also suitable for a wide range of candidate groups.

The development of generic employability skills valued by employers will be an important part of this Unit.

OUTCOMES

- 1 Connect an electrical circuit from a wiring diagram.
- 2 Manufacture a metal part for a wind turbine system from a component drawing.
- 3 Produce a team plan for the production and testing of a small scale domestic wind turbine system to a given specification.
- 4 Contribute as a member of a team to the assembly and testing of a small scale domestic wind turbine system to a given specification.
- 5 Evaluate the wind turbine and the team working process.

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Connect an electrical circuit from a wiring diagram.

- (a) Appropriate tools are selected for the task.
- (b) Tools and materials are used correctly for the intended purpose.
- (c) All steps to complete the task are followed in the correct sequence.
- (d) Health and safety requirements are adhered to throughout the activity.
- (e) A quality check is carried out on the completed work.

OUTCOME 2

Manufacture a metal part for a wind turbine system from a component drawing.

- (a) Appropriate tools are selected for the task.
- (b) Tools and materials are used correctly for the intended purpose.
- (c) All steps to complete the task are followed in the correct sequence.
- (d) Health and safety requirements are adhered to throughout the activity.
- (e) A quality check is carried out on the completed work.

OUTCOME 3

Produce a team plan for the production and testing of a small scale domestic wind turbine system to a given specification.

- (a) Contribute constructively to team discussions to establish roles and realistic timescales.
- (b) Contribute constructively to team discussions on resources.
- (c) Contribute constructively to team discussions on tasks.
- (d) Co-operate with others to finalise a comprehensive plan of roles, resources required, and tasks set out in sequence.

OUTCOME 4

Contribute as a member of a team to the assembly and testing of a small scale domestic wind turbine system to a given specification.

- (a) Co-operate with others in the organising, sharing, and safe use of tools and materials.
- (b) Co-operate with others in maintaining a safe, tidy working area.
- (c) Adhere to the agreed plan and work positively to complete tasks in the agreed timescale.
- (d) In an agreed role, carry out practical tasks which contribute to the assembly of the wind turbine system.
- (e) In an agreed role, carry out practical tasks which contribute to the testing of the system.
- (f) Participate in a quality check of the finished work against the given specification.

National Unit Specification: statement of standards (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

OUTCOME 5

Evaluate the wind turbine and the team working process.

- (a) Evaluate the strengths and weaknesses of the planning, assembly, and testing of the wind turbine.
- (b) Evaluate the advantages and disadvantages of team working.
- (c) Evaluate own contribution to work of the team.
- (d) Identify action points for improvement in the production of the product and the team working process.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria. Performance and written/oral evidence is required for this Unit, the evidence should be gathered at appropriate points throughout the Unit in supervised, open-book conditions, in response to a given brief.

Performance evidence — Outcomes 1 and 2

Performance evidence will be generated in response to an assignment consisting of practical activities carried out in supervised workshop conditions. An assessor observation checklist must be completed and signed for each candidate. The practical activities will involve two separate tasks: connecting a wire circuit from a wiring drawing, and manufacturing a metal part for a small scale wind turbine system from a component drawing. In each task, candidates must demonstrate that they can:

- ◆ select appropriate tools for the task
- ◆ use tools and materials correctly for the intended purpose
- ◆ complete all steps for the task in the correct sequence
- ◆ adhere to health and safety requirements throughout the activity
- ◆ carry out a quality check on the completed work

Performance and product evidence — Outcomes 3 and 4

Performance evidence will be generated in response to a group assignment which will involve the planning, assembly, and testing of a small scale domestic wind turbine system. Practical activities must be carried out in supervised workshop conditions. An assessor observation checklist must be completed and signed for each candidate to confirm achievement. A completed group plan and the finished product should be retained by each group and used by the assessor in discussions with each candidate. The achievement of each candidate is based on his/her individual contribution to the process and not on the final group products. The assessor checklist should be based clearly on the Performance Criteria for Outcomes 3 and 4.

National Unit Specification: statement of standards (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

Written/oral evidence — Outcome 5

Each candidate must evaluate the effectiveness of the product and process of team working. The evaluation will take the form of a presentation, which could be written, oral, diagrammatical, or electronic. It may be an individual evaluation or a contribution to a group evaluation, provided that all Performance Criteria are met by each candidate. The evidence will be a completed and signed observation checklist for each candidate.

The National Assessment Bank (NAB) pack for this Unit contains appropriate assignment briefs and assessor checklists. Centres wishing to produce their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit has been developed to provide candidates with a range of practical skills focused within the areas of mechanical and electrical engineering.

The candidates will gain knowledge on using wind energy to generate a source of electricity suitable for use in a domestic building and will test and evaluate a wind turbine's efficiency.

This Unit has a strong focus on individual and team working skills, where candidates will work in small groups to manufacture, assemble, and test a wind turbine.

Outcomes 1 and 2 have been developed to ensure each candidate has the opportunity to demonstrate competence in the skills required for this Unit. This should prepare them for the team working exercises in Outcomes 3 and 4 when assembling and testing a wind turbine. Testing should include the use of a voltmeter to measure the output voltage over a set time.

Practical skills and team working employability skills are essential for this Unit and candidates are required to evaluate their contribution to the Outcome of the group exercise. Team roles and task functions will be evaluated, ie their role within the team and the tasks the team has to do, and how the team went about doing it.

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ maintaining a tidy work place
- ◆ seeking feedback and advice
- ◆ following instructions
- ◆ working co-operatively with others
- ◆ selecting and using tools correctly and for the purpose they were designed
- ◆ using Personal Protective Equipment correctly and working safely
- ◆ following basic drawings correctly
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ willingness to learn new skills or techniques
- ◆ working independently
- ◆ reflecting on own performance
- ◆ learning from past experiences
- ◆ developing presentation skills
- ◆ developing creativity skills

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important that there is an induction to the Unit that will include employability skills and health and safety awareness. This Unit involves experiential learning through the various practical experiences and activities. Candidates should experience workshop conditions and should be encouraged to perform tasks and conduct themselves in a manner appropriate to the workplace. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical domestic energy engineering activities within the Unit. As well as carrying out practical tasks, candidates will also learn from brief lessons on health and safety and workshop protocol. Teaching and learning approaches will also include demonstrations of practical work by tutors. Short lessons on specific aspects of industrial practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practice the skill emphasised by the demonstration. Integrated into the Unit are the employability skills that employers value. It should be stressed that all the employability skills are developed in this Unit but only specified employability skills will be assessed. Employability skills are a focus of this Unit and should be promoted from Unit induction to Unit completion.

In order to raise the candidates' awareness of local industries and the realities of the workplace, visits to local energy installations or companies could be arranged, if appropriate. Equally, visiting speakers from local domestic energy firms should be encouraged. Additional useful material and employment opportunities can be resourced by researching local domestic energy firms or from the internet.

This Unit should be delivered in a workshop environment. Practical demonstrations and practical exercises should be used to ensure candidates have the necessary skills and knowledge to carry out the tasks in the assessment.

It is essential that all candidates have the opportunity to develop a full range of the necessary domestic wind turbine skills; this can be more difficult when candidates are working in teams. It is recommended that all candidates work on small individual exercises in the first instance (Outcomes 1 and 2). This will ensure all candidates can play a full role in the team working part of this project based practical element (Outcomes 3 and 4).

Candidates could investigate the wind available at their site through the internet or from tables. This could help inform the evaluations they will make on the effectiveness of the domestic wind turbine in operation. Where this information is not available on the internet, candidates should be given it in a tabular form.

Individual exercises could include the following:

- ◆ cutting, filing, and drilling
- ◆ use of standard parts
- ◆ wiring up a light circuit

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

The assembly of the domestic wind turbine should start with the team members drawing up a plan which lists the tasks to be undertaken to assemble the wind turbine, along with the names of the individuals who have agreed to carry out the tasks. All the components for the wind turbine will be prepared and ready for assembly, although a limited amount of mechanical and electrical work will be needed. Once the wind turbine has been assembled, it will be ready for testing. Initial testing can be carried out in the workshop using two mobile electric fans. Switching between them will test the turbine's ability to alter direction for a change in wind direction and also its electrical output. Testing in an outside environment should supplement the initial testing where the actual wind available will give a more realistic idea of the effectiveness of the assembled wind turbine.

Technical evaluations of the assembled wind turbine should include a comparison of completed work against the criteria given in the brief.

Personal and team working evaluations should be included to highlight the advantages and disadvantages of working in a team and comparing this against the advantages and disadvantages of working as an individual.

Team working tasks and roles within the team that candidates should consider during the assembly of the wind turbine are:

- ◆ Roles:
 - leader
 - worker
 - finisher
 - problem solver

- ◆ Tasks:
 - completing the assembly within time
 - working co-operatively with others
 - building up relationships between team members
 - getting encouragement from team members
 - giving encouragement to other team members

Teams should ideally be made up of two candidates, but teams of three candidates would be acceptable.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of Team Working during the assembly of the domestic wind turbine and *Problem Solving* in the use of drawings and specifications to solve the build sequence, method, and tools to be used.

There are opportunities to develop aspects of the Core Skill of *Communication*, both in the investigation and presentation, of findings.

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

The assessment of the mechanical/electrical skills will be evidenced by practical assignments involving the manufacture of a small artefact and the wiring up of a simple electrical circuit. These will be supported by assessor observation checklists.

It is anticipated that candidates will be given as much practice as possible in mechanical/electrical techniques prior to assessment. The assessment activities should also make an important contribution to the learning process.

The practical skills and team working skills are assessed in different Outcomes; Outcomes 1 and 2 are where candidates are assessed on their individual practical skills, and Outcomes 3, 4, and 5 are for assessing their team working skills. The team working skills will be assessed as they work in teams producing a wind turbine.

Formative assessment may include practical exercises in metal cutting, drilling, assembly, and electrical wiring.

These practical exercises will develop the candidate's skills to a level suitable for progressing to summative assessment.

The recommended approach to summative assessment in this Unit is as follows:

Outcomes 1 and 2

Candidates will carry out practical exercises according to a given brief. In doing this, they will produce artefacts which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor observation checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcomes 3 and 4

Teams will carry out a practical exercise according to a given brief. In doing this, they will produce and test a small wind turbine which will be used as the basis for a discussion between the assessor and the team. The assessment evidence will be the completed signed assessor observation checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Wind Turbines Systems (Intermediate 2)

Outcome 5

The assessment is based on the end product of the Outcome which will be a presentation in a form of the team's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

A self build or pre-manufactured wind turbine can be used in the planning, assembly, and testing sequence in Outcomes 3, 4, and 5.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

CODE F3FS 11

COURSE Energy (Intermediate 2)

SUMMARY

This Unit is a mandatory Unit of the Intermediate 2 Skills for Work Energy Course. It is intended for candidates who are interested in a career in the energy sector, or who wish to gain some practical skills and knowledge of how the solar hot water energy sector operates. This Unit can also be taken as a stand-alone Unit.

The Unit will introduce a microgeneration heating system which generates heat from solar energy and transfers this heat energy to other appliances through a heat exchanger. The solar panel will be suitable for use in domestic or small scale industrial installations. The learning will take place through a strong focus on practical tasks which will give candidates the opportunity to develop manufacturing, assembly, and testing skills required to build a small domestic solar hot water system.

The development of generic employability skills valued by employers will be an important part of this Unit.

OUTCOMES

- 1 Connect copper pipes from a pipe work diagram.
- 2 Produce a team plan for the production and testing of a small scale domestic solar hot water system to a given specification.
- 3 Contribute as a member of a team to the assembly and testing of a small scale domestic solar hot water system to a given specification.
- 4 Evaluate the solar hot water panel and the team working process.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

CREDIT VALUE

1 credit at Intermediate 2 (6 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Connect copper pipes from a pipe work diagram.

- (a) Appropriate tools are selected for the task.
- (b) Tools and materials are used correctly for the intended purpose.
- (c) All steps to complete the task are followed in the correct sequence.
- (d) Health and safety requirements are adhered to throughout the activity.
- (e) A quality check is carried out on the completed work.

OUTCOME 2

Produce a team plan for the production and testing of a small scale domestic solar hot water system to a given specification.

- (a) Contribute constructively to team discussions to establish roles and realistic timescales.
- (b) Contribute constructively to team discussions on resources.
- (c) Contribute constructively to team discussions on tasks.
- (d) Co-operate with others to finalise a comprehensive plan of roles, resources required, and tasks set out in sequence.

OUTCOME 3

Contribute as a member of a team to the assembly and testing of a small scale domestic solar hot water system to a given specification.

- (a) Co-operate with others in the organising, sharing, and safe use of tools and materials.
- (b) Co-operate with others in maintaining a safe, tidy working area.
- (c) Adhere to the agreed plan and work positively to complete tasks in the agreed timescale.
- (d) In an agreed role, carry out practical tasks which contribute to the assembly of the solar hot water system.
- (e) In an agreed role, carry out practical tasks which contribute to the testing of the system.
- (f) Participate in a quality check of the finished work against the given specification.

OUTCOME 4

Evaluate the solar hot water panel and the team working process.

- (a) Evaluate the strengths and weaknesses of the planning, assembly, and testing of the solar hot water panel.
- (b) Evaluate the advantages and disadvantages of team working.
- (c) Evaluate own contribution to work of the team.
- (d) Identify action points for improvement in the production of the product and the team working process.

National Unit Specification: statement of standards (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria. Performance and written/oral evidence is required for this Unit. The evidence should be gathered at appropriate points throughout the Unit in supervised, open-book conditions, in response to a given brief.

Performance evidence — Outcome 1

Performance evidence will be generated in response to an assignment consisting of practical activities carried out in supervised workshop conditions. An assessor observation checklist must be completed and signed for each candidate. The practical activities will involve bending and joining of copper pipe for a small scale solar hot water panel from a component drawing. In each task, candidates must demonstrate that they can:

- ◆ select appropriate tools for the task
- ◆ use tools and materials correctly for the intended purpose
- ◆ complete all steps for the task in the correct sequence
- ◆ adhere to health and safety requirements throughout the activity
- ◆ carry out a quality check on the completed work

Performance and product evidence — Outcomes 2 and 3

Performance evidence will be generated in response to a group assignment which will involve the planning, assembly, and testing of a small scale domestic solar hot water system. Practical activities must be carried out in supervised workshop conditions. An assessor observation checklist must be completed and signed for each candidate to confirm achievement. A completed group plan and the finished product should be retained by each group and used by the assessor in discussions with each candidate. The achievement of each candidate is based on his/her individual contribution to the process and not on the final group products. The assessor checklist should be based clearly on the Performance Criteria for Outcomes 2 and 3.

Written/oral evidence — Outcome 4

Each candidate must evaluate the product and process of team working. The evaluation will take the form of a presentation, which could be written, oral, diagrammatical, and electronic. It may be an individual evaluation or a contribution to a group evaluation, provided that all Performance Criteria are met by each candidate. The evidence will be a completed and signed observation checklist for each candidate.

The National Assessment Bank (NAB) item for this Unit contains an appropriate brief which covers the investigation and presentation requirements of the Unit and an assessor observation checklist. Centres wishing to devise their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The *Energy: Domestic Hot Water Systems* Unit has been designed to provide candidates with a range of practical skills focused within plumbing technology. Other engineering based skills will also be developed during the assembly of the solar hot water panel. The focus of this Unit is on practical skills and team working skills that the candidate will use to access and organise relevant information, and finally, to present their findings in a clear format.

Candidates will gain knowledge and understanding of using solar energy to generate a source of heat suitable for use in domestic buildings to give hot water, or to provide heat for an underfloor heating system.

Candidates will perform short practical exercises which will demonstrate their competence in joining and bending of copper pipe.

The assembly of a flat plate solar collector panel will consist of pre-prepared parts ready for use in the assembly. Candidates, working in teams, will follow drawings and instructions to produce the solar panel, and test and evaluate, the assembled solar panel's effectiveness.

Candidates will measure any increase in water temperature and draw conclusions on the system's effectiveness.

This solar panel will be a flat plate collector system where the components consist of a frame, flat plate collector, heating pipe/coil, small tank/reservoir, insulation, and clear cover. A small pump to give pressurised fluid flow around the system may be used to simulate a complete installation and to allow the panel to have a greater variety of positions.

Outcome 1 has been developed to ensure each candidate has the opportunity to demonstrate competence in the practical skills required for this Unit. This is good preparation for the team working exercise in Outcomes 2 and 3, ie when building, assembling, and testing the solar panel. Testing of the system should include the use of a thermometer to measure the rise in temperature over a set time.

Technical evaluations should include a comparison of completed work against the criteria given in the brief.

Personal and team working evaluations should be included to highlight the advantages and disadvantages of working in a team and comparing this against the advantages and disadvantages of working as an individual.

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

Team working tasks and roles within the team that candidates should consider during the assembly of the solar hot water panel are:

- ◆ Roles:
 - leader
 - worker
 - finisher
 - problem solver

- ◆ Tasks:
 - completing the assembly within time
 - working co-operatively with others
 - building up relationships between team members
 - getting encouragement from team members
 - giving encouragement to other team members

Teams should ideally be made up of two candidates, but teams of three candidates would be acceptable.

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ maintaining a tidy work place
- ◆ seeking feedback and advice
- ◆ following instructions
- ◆ working co-operatively with others
- ◆ selecting and using tools correctly and for the purpose they were designed
- ◆ using Personal Protective Equipment correctly and working safely
- ◆ following basic drawings correctly
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ willingness to learn new skills or techniques
- ◆ working independently
- ◆ reflecting on own performance
- ◆ learning from past experiences
- ◆ developing presentation skills
- ◆ developing creativity skills

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important that there is an induction to the Unit that will include employability skills and health and safety awareness. This Unit involves experiential learning through the various practical experiences and activities. Candidates should experience workshop conditions and should be encouraged to perform tasks and conduct themselves in a manner appropriate to the workplace. General vocational skills, such as selecting and maintaining tools and equipment, are integrated with practical activities within the Unit.

As well as carrying out practical tasks, candidates will also learn from brief lessons on health and safety and workshop protocol. Teaching and learning approaches will also include demonstrations of practical work by lecturers. Short lessons on specific aspects of domestic energy related practice and the correct use of tools will prove invaluable at intervals throughout the learning experience. These may be followed by brief practical sessions in which the candidates practice the skill emphasised in the demonstration.

Integrated into the Unit are the employability skills that employers value. It should be stressed that all the employability skills are developed in this Unit, but only specified employability skills will be assessed. Employability skills are a focus of this Unit and should be promoted from Unit induction to Unit completion.

In order to raise the candidate's awareness of local industries and the realities of the workplace, visits to local energy related companies could be arranged, if appropriate. Equally, visiting speakers from local energy related firms should be encouraged. Additional useful material and employment opportunities can be resourced by researching local domestic energy related companies, manufacturer's literature, or from the internet.

This Unit should be delivered in a workshop environment. Practical demonstrations and practical exercises should be used to ensure candidates have the necessary skills and knowledge to carry out the practical tasks.

It is essential that all candidates have the opportunity to develop the full range of skills. This can be more difficult when candidates are working in teams. It is recommended that all candidates work on small individual exercises in the first instance. This will ensure all candidates can play a full role in this project based Unit. The team working tasks which should be included in the learning and teaching are:

- ◆ Compression joints — tools: pipe grips, spanner, jointing compound, pipe cutter
- ◆ Solder joints — tools: wire wool, flux, and heating torch
- ◆ Pipe cutting and bending — equipment: bend template/former or pipe bender
- ◆ The main solar panel elements and their functions — frame, glass, back plate, heating tube, insulation, installation system elements, and their functions — pump, hot water tank, under floor heating, both types of systems — evacuated tube and flat plate collector.

The assembly and testing of the solar panel could include a 12v pump powered by a wind turbine or PV solar panel. This would demonstrate the importance of energy integration and the design of a self sustaining energy system.

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

The assembly of the domestic hot water panel should start with the team members drawing up a plan which lists the tasks to be undertaken to assemble the solar panel, along with the names of the individuals who have agreed to carry out the set tasks. All the components for the solar panel will be prepared and ready for assembly, although a limited amount of plumbing work will be needed. Once the solar panel has been assembled it will be ready for testing. Initial testing can be carried out in the workshop by placing it by a window and checking for any increase in water temperature. Testing in an outside environment should supplement the initial testing where the actual solar heat available will give a more realistic idea of the effectiveness of the assembled solar panel.

Candidates will be given responsibility, following lecturer/teacher support, for making choices on the format and style of the presentation of their key findings.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are opportunities for candidates to develop the Core Skill of *Problem Solving* during the assembly of the solar hot water panel and in the use of drawings and specifications to solve the build sequence, method, and tools to be used.

There are opportunities to develop aspects of the Core Skill of *Communication*, both in the investigation and presentation, of findings.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Formative assessment exercises involving candidates in identifying solar hot water systems, sub-systems, and components, including their functions. Practical exercises, including the testing of the assembled solar panel, will play an important part in building up the candidate's knowledge, understanding, and confidence in relation to this Unit.

National Unit Specification: support notes (cont)

UNIT Energy: Domestic Solar Hot Water Systems (Intermediate 2)

The recommended approach to summative assessment in this Unit is as follows:

Outcome 1

Candidates will carry out practical exercises according to a given brief. In doing this they will produce artefacts which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor observation checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcomes 2 and 3

Teams will carry out a practical exercise according to a given brief. In doing this, they will produce and test a small solar hot water panel which will be used as the basis for a discussion between the assessor and the individual. The assessment evidence will be the completed signed assessor observation checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcome 4

The assessment is based on the end product of the Outcome which will be a presentation in a form of the team's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy: Employability and Careers (Intermediate 2)

CODE F3FP 11

COURSE Energy (Intermediate 2)

SUMMARY

This Unit is a mandatory Unit in the Intermediate 2 Skills for Work Energy Course and has been designed to be integrated with the other Units of that Course.

It is intended for candidates who are interested in a career in the energy sector. Candidates will review their performance in specified employability skills undertaken throughout the Course and evaluate their own strengths and weaknesses. Candidates will also be involved in investigating careers in the energy sector. This Unit has been designed with secondary school candidates in mind, but may be also be suitable for other candidate groups.

OUTCOMES

- 1 Review and evaluate own performance in specified employability skills.
- 2 Investigate careers within the energy sector according to a given brief.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

CREDIT VALUE

0.5 credit at Intermediate 2 (3 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: Employability and Careers (Intermediate 2)

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: Employability and Careers (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Review and evaluate own performance in specified employability skills.

Performance Criteria

- (a) Identify and review own strengths and weaknesses in relation to specified employability skills.
- (b) Seek feedback on own performance in specified employability skills.
- (c) Identify action points for improvement of own performance taking account of review and feedback.

OUTCOME 2

Investigate careers within the energy sector according to a given brief.

Performance Criteria

- (a) Gather information from a variety of sources on specified careers within the energy sector.
- (b) Use information gathered to evaluate a selected career in relation to own employability skills and attitudes.
- (c) Check that all steps have been completed in accordance with the given brief.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that the candidate has achieved all Outcomes and Performance Criteria.

The evidence for this Unit will be generated from candidate reviews and a folio.

Candidate reviews

Candidates must complete a review of their employability skills on **four** occasions. The reviews should be completed at regular intervals which allow the candidates to demonstrate progress between reviews. The reviews should be completed in supervised, open-book conditions and should be signed by both the candidate and the assessor.

Folio

Each candidate should compile a folio to provide evidence that they have:

- ◆ gathered information from a variety of sources
- ◆ gathered information on three selected careers in the energy sector
- ◆ used the information to evaluate a selected career against own employability skills

National Unit Specification: statement of standards (cont)

UNIT Energy: Employability and Careers (Intermediate 2)

Evidence for the folio should be gathered at appropriate points throughout the Unit in supervised, open-book conditions.

The National Assessment Bank (NAB) pack for this Unit provides candidate review sheets and an investigation brief. Centres wishing to develop their own assessments should refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: Employability and Careers (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit has been prepared to provide candidates with an introduction to identifying their own strengths and weaknesses with respect to employability skills and matching this information with possible careers within the energy sector. Candidates will develop an understanding of the employability skills required for a career in the energy sector and the technical skills and knowledge required for these careers. They will also develop self-evaluation skills through the process of reviewing their own strengths and weaknesses throughout the Unit. The reviews should take place in the context of appropriate practical activities. Where this Unit is taken as part of the Intermediate 2 Energy Course, suitable practical activities can be found in the other Units.

Examples of careers which candidates might investigate are:

- ◆ electrician allowing progression onto a PV solar panel system installer
- ◆ high voltage engineer — power distribution
- ◆ plumber allowing progression onto solar hot water system installer or ground source heat pump system installer
- ◆ hydro engineer
- ◆ oil/gas engineer
- ◆ nuclear engineer
- ◆ electrical engineer
- ◆ control engineer
- ◆ maintenance engineer — various energy systems
- ◆ systems design

The generic employability skills which are developed or used in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ maintaining a tidy work place
- ◆ seeking feedback and advice
- ◆ following instructions
- ◆ working co-operatively with others
- ◆ selecting and using tools correctly and for the purpose they were designed
- ◆ using Personal Protective Equipment correctly and working safely
- ◆ following basic drawings correctly
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ willingness to learn new skills or techniques
- ◆ working independently
- ◆ reflecting on own performance

National Unit Specification: support notes (cont)

UNIT Energy: Employability and Careers (Intermediate 2)

- ◆ learning from past experiences
- ◆ awareness of a range of careers and job roles
- ◆ developing investigation skills
- ◆ developing presentation skills
- ◆ developing creativity skills

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is important to stress in the induction to this Unit that the employability skills listed above are generic and valued by employers. Candidates will be provided with an opportunity to review how well they have progressed in developing work practices by comparing their own evaluations with that of their assessors. They will also be asked to demonstrate that they have made progress in their performance after taking account of their own evaluations and the feedback from their assessor. Candidates will have a significant degree of ownership in this process. They should be positively encouraged to develop the habit of seeking feedback from their tutors and engaging in discussion about their progress and aspects of their performance that they can, or should, improve. Assessors/tutors should give constructive feedback and support to candidates in making improvements.

If a candidate's attendance and timekeeping are already very good, positive feedback can be given and the tutor and candidate can concentrate on other aspects of the candidate's work or performance.

Teachers/lecturers could help to build candidates' confidence by giving regular, constructive feedback on generic skills such as: working co-operatively with others, carrying out instructions, and working in accordance with workshop protocols. Such preparatory work will help candidates when they come to carry out their formal reviews.

Candidates should have easy access to information on careers within the energy sector. The careers should span the complete range of opportunities available, eg vocational (installation, manufacture), technician (control, installation design), engineer (equipment design, management).

Visits, visiting speakers, videos, and the internet are all good sources of information on careers.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of *Communication* when completing their folio and researching appropriate careers. The Core Skill of *Information Technology* could also be developed if candidates make use of the internet and ICT when researching possible careers and presenting their folio in a word processed format.

National Unit Specification: support notes (cont)

UNIT Energy: Employability and Careers (Intermediate 2)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

The process of review and evaluation using the Candidate Review Sheet provided in the (NAB) should take place at regular intervals throughout the learning and teaching process to demonstrate progression and development. The reviews should be carried out in the context of different workshop activities, integrated with practical Units. The initial review should be undertaken after a few weeks when the candidate will be able to comment on his/her development of employability skills with a degree of understanding as to what these mean and how to evaluate them.

Formative assessment exercises involving candidates in identifying their strengths and weaknesses and career opportunities will play an important part in building up the candidate's knowledge, understanding, and confidence in relation to this Unit.

Visiting speakers or video would be seen as a strong support within this Unit, as would a list of useful internet sites.

The suggested approach to summative assessment in this Unit is as follows:

Folio

Section 1

On four occasions:

- 1 Candidate will complete relevant sections of the review sheet.
- 2 Candidate will seek and record feedback on own performance.
- 3 Candidate will identify action points.
- 4 The assessor and candidate will sign and date each review sheet.

Section 2

- 1 Candidate will identify a minimum of three careers within the energy sector.
- 2 Candidate will gather information on the three careers identified.
- 3 Candidate will evaluate a selected career against own employability skills.
- 4 Candidate will check that all steps in the brief have been carried out.

National Unit Specification: support notes (cont)

UNIT Energy: Employability and Careers (Intermediate 2)

Employability skills used in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ maintaining a tidy work place
- ◆ seeking advice and following instructions
- ◆ working co-operatively with others
- ◆ sources tools correctly and uses tools correctly and for the purpose they were designed
- ◆ uses Personal Protective Equipment correctly and works in a safe manner
- ◆ follows basic drawings correctly
- ◆ attention to quality
- ◆ works to agreed deadlines
- ◆ organises work effectively
- ◆ works in a confident manner
- ◆ willing to learn new skills or techniques
- ◆ works as an individual
- ◆ reflects on own performance
- ◆ learning from past experiences
- ◆ selects appropriate career

A NAB item is available to support assessment of this Unit. If centres wish to develop their own assessment instruments these should be of a comparable standard.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy and the Individual (Intermediate 2)

CODE F3FT 11

COURSE Energy (Intermediate 2)

SUMMARY

This is an optional Unit of the Intermediate 2 Skills for Work Energy Course. This Unit can also be taken as a stand-alone Unit.

Candidates will investigate the energy they use annually. This will include producing their own Carbon Footprint, where candidates will use Energy and CO₂ calculators to gauge what impact they are having on the environment. Using the data gained they will review and evaluate their lifestyles to try and reduce the energy they consume and thereby reduce the size of their carbon footprint.

This Unit has been designed with secondary school candidates in mind but is also suitable for a wide range of candidate groups.

OUTCOMES

- 1 Investigate and determine own energy consumption in accordance with a given brief.
- 2 Investigate changes to lifestyle that will reduce own energy consumption in accordance with a given brief.
- 3 Present findings on own energy consumption according to a given brief.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy and the Individual (Intermediate 2)

CREDIT VALUE

0.5 credit at Intermediate 2 (3 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy and the Individual (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Investigate and determine own energy consumption in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the forms and quantities of own energy consumption.
- (c) Organise information gathered to produce own carbon footprint based on identified energy consumption.
- (d) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 2

Investigate changes to lifestyle that will reduce own energy consumption in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on possible ways of reducing own energy consumption.
- (c) Organise information gathered to produce a revised carbon footprint which reduces energy consumption.
- (d) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 3

Present findings on own energy consumption according to a given brief.

Performance Criteria

- (a) Present clear summary information on own existing carbon footprint.
- (b) Present clear summary information on own revised carbon footprint.
- (c) Identify clearly the impact of the changes on own energy consumption.

National Unit Specification: statement of standards (cont)

UNIT Energy and the Individual (Intermediate 2)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate the candidates have achieved all Outcomes and Performance Criteria.

Performance and product evidence is required for this Unit. The evidence should be gathered at appropriate points throughout the Unit, in open-book conditions, in response to a given brief.

Performance and product evidence

Candidates will carry out an individual investigation according to the instructions in a given brief which covers all Outcomes and Performance Criteria. Findings will be gathered in a folio which the assessor will discuss with the candidate to check that all steps have been carried out as specified. The assessor will then complete and retain a checklist for each candidate as evidence that all steps have been carried out as specified in the brief.

Product evidence

Each candidate will produce a presentation which meets the Performance Criteria in Outcome 3. The method of communication in the presentation may be chosen by the candidate — written/oral, diagrammatic, graphical, and electronic — are all acceptable. The candidate may also choose different forms of communication — poster, leaflet, short talk, PowerPoint presentation — are all acceptable, provided the Performance Criteria are met.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate. The critical aspects are:

- ◆ summary information must be clear
- ◆ summary information must cover both own existing carbon footprint and own revised carbon footprint
- ◆ impact of changes on energy consumption must be clearly identified

The National Assessment Bank (NAB) item for this Unit contains an appropriate brief which covers the investigation and presentation requirements of the Unit and an assessor observation checklist. Centres wishing to devise their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy and the Individual (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The *Energy and the Individual* Unit has been designed to provide candidates with an introduction to the amount of energy they use or consume and hence the size of their primary carbon footprint¹. The focus of this Unit is on the investigation skills that the candidate will use to access and organise relevant information, and finally, to present their findings in a clear format.

The candidates could use an online energy/carbon footprint calculator to determine the size of their carbon footprint. This will normally state how this value compares with the average person in the UK. Candidates will review their initial details to try and reduce the amount of energy they consume and draw up new ones. This new data can be input into the energy calculator and a new carbon footprint produced. The new carbon footprint is then evaluated to monitor the differences made by altering the energy they now propose to use.

¹ A Carbon Footprint is made up of the sum of two parts, the primary carbon footprint and the secondary carbon footprint.

The primary carbon footprint is a measure of our direct emissions of CO₂ from the burning of fossil fuels including domestic energy consumption and transportation (eg car and plane).

The secondary carbon footprint is a measure of the indirect CO₂ emissions from the whole lifecycle of products we use — those associated with their manufacture and eventual disposal or decommissioning.

Candidates will only deal with the primary carbon footprint, although it would be beneficial to at least explain what the secondary carbon footprint is.

When candidates are exploring possible ways to reduce energy consumption, changes in the energy used could come from some of the following:

- ◆ walk more
- ◆ cycle more
- ◆ share a lift
- ◆ use 'park and ride' schemes
- ◆ use public transport
- ◆ use a smaller or electric car
- ◆ boil only the water needed
- ◆ reduce the house central heating temperature
- ◆ turn down radiator thermostatic valves
- ◆ use less electricity: playstation/games, heating, tumble drier, washer, music player, hair drier, shower, dishwasher, video/DVD players, lights, etc
- ◆ use energy efficient light bulbs

National Unit Specification: support notes (cont)

UNIT Energy and the Individual (Intermediate 2)

- ◆ increase the amount of insulation in the home: wall, ceiling, floor
- ◆ fit an efficient condensing gas boiler
- ◆ switch off or don't use 'standby'
- ◆ reduce fly or fly and stay holidays
- ◆ use food grown locally
- ◆ recycle waste
- ◆ use microgeneration systems on your home: solar hot water panels, solar photovoltaic panels, wind turbines, or ground source heat pumps

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ seeking feedback and advice
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ working independently
- ◆ developing investigation skills
- ◆ developing presentation skills
- ◆ developing creativity skills

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that a thorough induction is given to candidates at the start of this Unit so that they understand that the main learning approach will be candidate-centred. Candidates should work independently on a given investigation brief and should develop and use skills in accessing and organising information from a variety of sources. Sources might include:

- ◆ family and friends
- ◆ manufacturer's instructions
- ◆ internet
- ◆ reference books
- ◆ visiting speakers

It is envisaged that some tutor support is given to candidates in the initial stages, and at regular intervals, throughout this Unit. However, the intention is to encourage candidates to work as independently as possible.

Candidates will be given responsibility, following lecturer/teacher support, for making choices on the format and style of the presentation of their key findings.

The candidate will be central to the learning and teaching of this Unit. They should be proactive in detailing the energy they initially use, and draw up changes to their lifestyle which would reduce this energy consumption and the size of their carbon footprint. They will reflect on the effect these changes have to their lifestyle and size of their carbon footprint.

National Unit Specification: support notes (cont)

UNIT Energy and the Individual (Intermediate 2)

When candidates are presenting their findings in this Unit, there are good learning opportunities for the whole class group. The sharing of information and the different methods used for presentations provide useful opportunities for reflection and discussion. The assessment process itself can be used as a valuable part of the learning in the Unit.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of *Information Technology*:

- ◆ in the investigation and calculation of their carbon footprint
- ◆ in the use of ICT to present findings

There are opportunities to develop aspects of the Core Skill of *Communication* both in the investigation and presentation of findings.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Formative assessment exercises involving candidates in identifying their energy consumption will play an important part in building up the candidate's knowledge, understanding, and confidence in relation to this Unit.

The recommended approach to summative assessment in this Unit is as follows:

Outcomes 1 and 2

Candidates will carry out an investigation according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor checklist which will detail the essential steps in the process, as expressed in the Performance Criteria.

National Unit Specification: support notes (cont)

UNIT Energy and the Individual (Intermediate 2)

Outcome 3

The assessment is based on the end product of the Outcome which will be a presentation in a form of the candidate's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

CODE F3FW 11

COURSE Energy (Intermediate 2)

SUMMARY

This is an optional Unit of the Intermediate 2 Skills for Work Energy Course. It can also be taken as a stand-alone Unit.

The purpose of this Unit is to give candidates an understanding of how oil/gas fields are formed, how they are extracted, and the equipment used in controlling the flow process. Candidates will be introduced to the types of platform used on off-shore installations, the methods used to drill and extract oil and gas, including fluid control, and also the methods used to transport the oil and gas to the mainland.

This Unit has been designed with secondary school candidates in mind, but is also suitable for a wide range of candidate groups.

OUTCOMES

- 1 Investigate and determine the formation and sustainability of oil and gas fields to a given brief.
- 2 Investigate off-shore oil and gas installations and extraction in accordance with a given brief.
- 3 Present findings on formation, extraction, platform types, and fluid control of oil and gas from off-shore installations.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: YB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

CREDIT VALUE

0.5 credit at Intermediate 2 (3 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Investigate and determine the formation and sustainability of oil and gas fields to a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the formation and geological structure of oil and gas fields.
- (c) Gather information on the sustainability of offshore oil and gas production.
- (d) Organise information gathered to produce clear summary information of the formation of oil and gas fields and an evaluation of its sustainability.
- (e) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 2

Investigate off-shore oil and gas installations and extraction in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the purpose and the layout of platforms/rigs.
- (c) Gather information on the equipment and methods used in extracting oil and gas.
- (d) Organise information gathered to produce clear summaries on oil and gas platforms/rigs and extraction, equipment, and methods.
- (e) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 3

Present findings on formation, extraction, platform types, and fluid control of oil and gas from off-shore installations.

Performance Criteria

- (a) Present clear summary information on the formation and structure of oil/gas fields.
- (b) Present clear summary information on platforms used on off-shore installations.
- (c) Present clear summary information on the extraction of oil/gas.
- (d) Present clear summary information on the sustainability of oil/gas fields in the UK.

National Unit Specification: statement of standards (cont)

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate the candidates have achieved all Outcomes and Performance Criteria.

Performance and product evidence is required for this Unit. The evidence should be gathered at appropriate points throughout the Unit, in open-book conditions, in response to a given brief.

Performance and product evidence

Candidates will carry out an individual investigation according to the instructions in a given brief which covers all Outcomes and Performance Criteria. Findings will be gathered in a folio which the assessor will discuss with the candidate to check that all steps have been carried out as specified. The assessor will then complete and retain a checklist for each candidate as evidence that all steps have been carried out as specified in the brief.

Product evidence

Each candidate will produce a presentation which meets the Performance Criteria in Outcome 3. The method of communication in the presentation may be chosen by the candidate — written/oral, diagrammatic, graphical, and electronic — are all acceptable. The candidate may also choose different forms of communication — poster, leaflet, short talk, PowerPoint presentation — are all acceptable provided the Performance Criteria are met.

An assessor checklist identifying the critical aspects of the presentation regardless of form should be completed and retained for each candidate. The critical aspects are:

- ◆ summary information must be clear
- ◆ summary information must cover both the formation and structure of oil/gas fields
- ◆ summary information must cover the purpose of oil/gas platforms, including mobile and fixed platforms
- ◆ summary information must cover the equipment used in drilling and natural and forced extraction methods
- ◆ impact of the sustainability of oil/gas extraction in the UK

The National Assessment Bank (NAB) item for this Unit contains an appropriate brief which covers the investigation and presentation requirements of the Unit and an assessor observation checklist. Centres wishing to devise their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Evidence is required to demonstrate the candidates have achieved all Outcomes and Performance Criteria.

The *Energy: Oil/Gas Extraction* Unit has been designed to provide candidates with an in-depth understanding of an energy source which is important to the UK economy. It introduces the history of how the raw fuel is formed, the equipment required to extract it, and how it is controlled from the platform into the pipelines. The focus of this Unit is on the investigation skills that the candidate will use to access and organise relevant information, and finally, to present their findings in a clear format.

This Unit will provide candidates with an understanding of the oil and gas extraction industry. It will introduce candidates to the formation of and geological formation of oil/gas fields and the sustainability of oil/gas production.

Candidates will investigate the types of platforms or rigs used in the North Sea. They will gain an understanding of the systems used on a platform, and the function they perform.

They will gain an understanding of how oil and gas is extracted using natural and pressurised methods and the equipment used to control its flow.

The following information gives an indication of what should be involved in this Unit:

- ◆ oil and gas field formation — plants/animals, converted into carbon rich compounds, pressure and heat — crude oil and gas
- ◆ oil and gas field geology — porous and impermeable rock, reservoir
- ◆ sustainability of oil and gas — reduction of available UK oil and gas
- ◆ platform types and uses — drilling, mobile (semi submersible, jack up, drill ship), and fixed
- ◆ drilling — drill, sleeves, mud
- ◆ extraction methods — natural and forced
- ◆ control — casing and Christmas tree

National Unit Specification: support notes (cont)

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ seeking feedback and advice
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ working independently
- ◆ developing investigation skills
- ◆ developing presentation skills
- ◆ developing creativity skills

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that a thorough induction is given to candidates at the start of this Unit so that they understand that the main learning approach will be candidate-centred. Candidates should work independently on a given investigation brief and should develop and use skills in accessing and organising information from a variety of sources. Sources might include:

- ◆ family and friends
- ◆ manufacturer's instructions
- ◆ internet
- ◆ reference books
- ◆ visiting speakers

It is envisaged that some tutor support is given to candidates in the initial stages and at regular intervals throughout this Unit. However, the intention is to encourage candidates to work as independently as possible.

Candidates will be given responsibility, following lecturer/teacher support, for making choices on the format and style of the presentation of their key findings.

The candidate will be central to the learning and teaching of this Unit. They should be proactive in detailing the role of a major energy sector within the UK. They should investigate how the raw fuel is formed and extracted and transported, the platforms used and the methods used, to extract the oil and gas from oil and gas fields using various techniques to ensure the maximum fuel removal.

When candidates are presenting their findings in this Unit, there are good learning opportunities for the whole class group. The sharing of information and the different methods used for presentations provide useful opportunities for reflection and discussion. The assessment process itself can be used as a valuable part of the learning in the Unit.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

National Unit Specification: support notes (cont)

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of *Information Technology*:

- ◆ in the investigation of the formation and extraction of oil and gas
- ◆ in the use of ICT to present findings

There are opportunities to develop aspects of the Core Skill of *Communication* both in the investigation and presentation of findings.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

Formative assessment exercises involving candidates in identifying how oil and gas fields are formed and the geological structure they have, the platforms and the systems used to extract the raw fuel, will play an important part in building up the candidate's knowledge, understanding, and confidence in relation to this Unit.

The recommended approach to summative assessment in this Unit is as follows:

Outcomes 1 and 2

Candidates will carry out an investigation according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcome 3

The assessment is based on the end product of the Outcome which will be a presentation in a form of the candidate's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

National Unit Specification: support notes (cont)

UNIT Energy: Oil/Gas Extraction (Intermediate 2)

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).



National Unit Specification: general information

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

CODE F3FV 11

COURSE Energy (Intermediate 2)

SUMMARY

This is an optional Unit of the Intermediate 2 Skills for Work Energy Course. This Unit can also be taken as a stand-alone Unit.

Candidates will investigate how conventional energy generation plants support the UK's total energy needs, and review the effect each of them has on the environment. They will investigate systems used to generate electricity using coal, oil, gas, hydro, and nuclear energy as a power source. The national grid and the distribution of energy/power will be investigated from both present and projected future needs.

This Unit has been designed with secondary school candidates in mind but is also suitable for a wide range of candidate groups.

OUTCOMES

- 1 Investigate conventional energy systems in accordance with a given brief.
- 2 Investigate electricity transmission and distribution through the national grid system in accordance with a given brief.
- 3 Present findings on own energy consumption according to a given brief.

RECOMMENDED ENTRY

Entry is at the discretion of the centre.

Administrative Information

Superclass: QB

Publication date: April 2008

Source: Scottish Qualifications Authority

Version: 01

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National Unit Specification: general information (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

CREDIT VALUE

0.5 credit at Intermediate 2 (3 SCQF credit points at SCQF level 5*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

Opportunities for developing aspects of Core Skills are highlighted in *Guidance on Learning and Teaching Approaches for this Unit*.

National Unit Specification: statement of standards

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Investigate conventional energy systems in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on the contribution of selected energy systems to the UK.
- (c) Gather information on the environmental effects of selected energy systems.
- (d) Organise information gathered to produce clear summaries on the energy contribution and environmental effects of conventional energy systems.
- (e) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 2

Investigate electricity transmission and distribution through the national grid system in accordance with a given brief.

Performance Criteria

- (a) Gather relevant information from a variety of sources according to the given brief.
- (b) Gather information on ways of transmitting electricity through the national grid.
- (c) Gather information on ways of distributing electricity to the consumer.
- (d) Gather information on the environmental issues raised when using a national grid system.
- (e) Organise information gathered to produce clear summaries on the transmission and distribution of electricity, including environmental effects.
- (f) Check that all steps have been completed in accordance with the given brief, including completing the work to the agreed timescale.

OUTCOME 3

Present findings on own energy consumption according to a given brief.

Performance Criteria

- (a) Present clear summary information on the contribution of conventional energy systems.
- (b) Present clear summary information on the environmental effects of conventional energy systems.
- (c) Present clear summary information on the transmission and distribution of electricity.
- (d) Present clear summary information on the environmental issues of the national grid.

National Unit Specification: statement of standards (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate the candidates have achieved all Outcomes and Performance Criteria.

Performance and product evidence is required for this Unit. The evidence should be gathered at appropriate points throughout the Unit, in open-book conditions, in response to a given brief.

Performance and product evidence

Candidates will carry out an individual investigation according to the instructions in a given brief which covers all Outcomes and Performance Criteria. Findings will be gathered in a folio which the assessor will discuss with the candidate to check that all steps have been carried out as specified. The assessor will then complete and retain an observation checklist for each candidate as evidence that all steps have been carried out as specified in the brief.

Product evidence

Each candidate will produce a presentation which meets the Performance Criteria in Outcome 3. The method of communication in the presentation may be chosen by the candidate — written/oral, diagrammatic, graphical, and electronic — are all acceptable. The candidate may also choose different forms of communication — poster, leaflet, short talk, PowerPoint presentation — are all acceptable, provided the Performance Criteria are met.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate. The critical aspects are:

- ◆ summary information must be clear
- ◆ summary information of the contribution of convention energy systems to the UK
- ◆ summary information on the environmental effects of conventional energy systems
- ◆ summary information on the transmission of electricity
- ◆ summary information on electricity distribution systems
- ◆ summary information on the environmental effects of the national grid

Summary information of the contribution of convention energy systems must cover three of the following; coal power, oil power, gas power, hydro power or nuclear power.

Summary information on the environmental effects for conventional energy systems should include, where appropriate; carbon emissions, sustainability of fuel, fuel pipe lines, waste products, radiation, wildlife, climate change, or health.

Summary information on transmission lines should include; cables, pylons, underground cables, efficiencies, and high voltages.

Summary information on distribution systems should include; supply transformer stations, step down voltages (133kV or 110kV), distribution to consumers (230V), and domestic uses.

National Unit Specification: statement of standards (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

The National Assessment Bank (NAB) item for this Unit contains an appropriate brief which covers the investigation and presentation requirements of the Unit and an assessor observation checklist. Centres wishing to devise their own assessments must refer to the NAB to ensure a comparable standard.

National Unit Specification: support notes

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 20 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The *Energy: Conventional Energy Production and the Grid* Unit has been designed to provide candidates with an introduction to the size and relevance of the conventional energy power generation sector in the UK, and how the national grid is used to transmit this electrical power to the domestic market. Issues that arise from these generation and transmission technologies are also investigated. The focus of this Unit is on the investigation skills that the candidate will use to access and organise relevant information, and finally, to present their findings in a clear format.

This Unit should give candidates the opportunity to determine the importance of conventional power systems to the total energy used in the UK. They will also gain an understanding of the environmental issues linked to each of the energy systems, from CO₂ emissions to the disposal of waste products.

The transmission and distribution of electricity using the national grid will be investigated to give candidates an understanding of how domestic electricity is distributed to the consumer.

The national grid should be evaluated in terms of it meeting the needs of the UK today and in the future. Renewable energy systems will come into consideration when looking at the future of the national grid, ie generating large amounts of electrical power in remote locations, eg off-shore wind farms, and not having power lines to transmit the power to where the main population in Scotland is. Candidates will also consider the environmental effects of the national grid and investigate the effect of any changes anticipated for it.

The following is a guide to the content in this Unit:

- ◆ Total UK energy produced:
 - individual technologies
 - energy produced for:
 - coal power
 - oil power
 - gas power
 - hydro power
 - nuclear power

- ◆ Environmental issues:
 - carbon emissions
 - depletion of fuel available
 - fuel pipe lines
 - electricity power lines
 - waste products
 - radiation
 - wildlife
 - climate change
 - health

National Unit Specification: support notes (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

- ◆ The national grid:
 - aluminium cables
 - steel cores
 - pylons
 - underground cables
 - efficiencies
 - high voltages
- ◆ Transmission and distribution:
 - supply transformer stations
 - step down voltage (132kV or 110kV)
 - distributed to consumers
 - step down voltage (230V)
 - domestic uses
- ◆ Grid environmental issues:
 - overhead power lines, pylons, large pylons, cost, maintenance, aesthetics
 - underground cables, insulation, cost, maintenance, aesthetics

The generic employability skills which are developed in this Unit are:

- ◆ maintaining good timekeeping and attendance
- ◆ seeking feedback and advice
- ◆ checking quality of work
- ◆ working to agreed deadlines
- ◆ organising work effectively
- ◆ working confidently
- ◆ working independently
- ◆ developing investigation skills
- ◆ developing presentation skills
- ◆ developing creativity skills

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that a thorough induction is given to candidates at the start of this Unit so that they understand that the main learning approach will be candidate-centred. Candidates should work independently on a given investigation brief and should develop and use skills in accessing and organising information from a variety of sources. Sources might include:

- ◆ family and friends
- ◆ manufacturer's instructions
- ◆ internet
- ◆ reference books
- ◆ visiting speakers

National Unit Specification: support notes (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

It is envisaged that some tutor support is given to candidates in the initial stages and at regular intervals throughout this Unit. However, the intention is to encourage candidates to work as independently as possible.

Candidates will be given responsibility, following lecturer/teacher support, for making choices on the format and style of the presentation of their key findings.

The candidate will be central to the learning and teaching of this Unit. They should be proactive in detailing the raw fuels/materials used to generate power and the refining processes they may need to undergo to make them suitable for use. Also in the size of the total power generated by conventional power stations, comparing these values, and evaluating how dependent we are on each of these technologies, and gaining an understanding of the environmental issues connected to each of the energy generation technologies.

They will also be proactive in investigating why a national grid is used to distribute power around the UK, and investigate the environmental issues connected with having a national grid, and any effects that a future national grid could have.

When candidates are presenting their findings in this Unit, there are good learning opportunities for the whole class group. The sharing of information and the different methods used for presentations provide useful opportunities for reflection and discussion. The assessment process itself can be used as a valuable part of the learning in the Unit.

Where this Unit is delivered as part of the Intermediate 2 Energy Course, there are good opportunities to integrate the practical skills with the development and assessment of generic employability skills in the *Energy: Employability and Careers* Unit. The candidate's review of progress in employability skills could be based on the practical activities carried out in this Unit.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

In this Unit there are good opportunities for candidates to develop the Core Skill of *Information Technology*:

- ◆ in the investigation of the size and value of conventional power and using a national grid system
- ◆ in the use of ICT to present findings

There are opportunities to develop aspects of the Core Skill of *Communication* both in the investigation and presentation of findings.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

National Unit Specification: support notes (cont)

UNIT Energy: Conventional Technologies and the Grid (Intermediate 2)

Formative assessment exercises involving candidates in identifying the size and value of the energy produced through conventional power stations and the use of a national grid system, will play an important part in building up the candidate's knowledge, understanding, and confidence in relation to this Unit.

The recommended approach to summative assessment in this Unit is as follows:

Outcomes 1 and 2

Candidates will carry out an investigation according to a given brief. In doing this, they will gather their findings in a folio which will be used as the basis for a discussion between the assessor and the candidate. The assessment evidence will be the completed signed assessor observation checklist which will detail the essential steps in the process as expressed in the Performance Criteria.

Outcome 3

The assessment is based on the end product of the Outcome which will be a presentation in a form of the candidate's choosing. Forms of presentation might include, for example, a short talk, poster, leaflet, diagram, or PowerPoint presentation.

An assessor checklist identifying the critical aspects of the presentation, regardless of form, should be completed and retained for each candidate.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).