22453VIC

Course in New Energy Technology Systems

This course has been accredited under Parts 4.4 of the Education and Training Reform Act 2006.

Accredited for the period: 31/08/2017 – 30/08/2022

VICTORIA State Government | Education and Training

Section A: Copyright and course classification information

1. Copyright owner of the course	Copyright of this course is held by the Department of Education and Training, Victoria © State of Victoria (Department of Education and Training) 2017
2. Address	Executive Director Industry Engagement and VET Systems Higher Education and Skills Group Department of Education and Training (DET) GPO Box 4367 Melbourne Vic 3001 **Organisational Contact:** Manager Training Products Higher Education and Skills Group Telephone: (03) 9637 3092 Email: course.enquiry@edumail.vic.gov.au **Day-to-Day Contact:** Curriculum Maintenance Manager – Engineering Industries Box Hill Institute of TAFE Private Bag 2014 Box Hill, Victoria 3128 Telephone: (03) 92286 9880 Email: gadda@bhtafe.edu.au
3. Type of submission	Accreditation
4. Copyright acknowledgement	The following unit of competency: ○ UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems is from the UEE Electrotechnology Training Package. © Commonwealth of Australia Copy of this unit is available at: http://training.gov.au.

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6. Course accrediting body	**Victorian Registration and Qualifications Authority**
7. AVETMISS information	***ANZSCO code*** - 312312 Electrical Engineering Technician ***ASCED Code*** – 0399 Other Engineering and Related Technologies ***National course code*** 22453VIC
8. Period of accreditation	31/08/2017 – 30/08/2022

Section B: Course information

1. Nomenclature	Standard 1 AQTF Standards for Accredited Courses
1.1 Name of the qualification	Course in New Energy Technology Systems
1.2 Nominal duration of the course	90–110 hours
2. Vocational or educational outcomes	Standard 1 AQTF Standards for Accredited Courses
2.1 Purpose of the course	The purpose of this course is to provide the participant with the knowledge and skills to determine client energy needs, to safely undertake a site assessment, and to design or install a grid-connected new energy generating system to meet client requirements. The course is intended for electrical tradespersons, technicians, engineers or experienced persons who wish to operate as accredited service providers for the design or installation of grid-connected new energy generating and storage systems. Participants can select a design or installation elective unit, which will be indicated in the course title nomenclature (refer Item 5.1).
3. Development of the course	Standards 1 and 2 AQTF Standards for Accredited Courses
3.1 Industry/enterprise/ community needs	Over recent years clean energy sources have grown in popularity with the general public primarily due to environmental concerns associated with the burning of fossil fuels and Federal government sponsored incentive schemes introduced to encourage greater use of alternate energy sources. As a consequence the installation of grid-connected photovoltaic (PV) systems (commonly referred to as solar arrays) has expanded rapidly. Such systems can meet consumer energy needs a during high-sunlight periods but during low-sunlight and peak usage periods, reliance on the state-wide electricity grid is still necessary. More recently, state-wide black-outs in South Australia and the ongoing closure of coal-fired power generation stations have generated a renewed interest and urgency by consumers to explore alternate power generating sources with energy (battery) storage capability for both business and domestic applications. Demand for improved energy storage capability in a number of areas such as transport has seen a significant improvement in battery technology with a range of new chemistries being developed. Consequently, the application of battery storage technology is expanding. The use of modern battery technology in conjunction with a grid-connected photovoltaic system is providing a solution for many energy power consumers keen to be more independent of the state-wide electricity grid and the increasing cost of state-wide power. The Energy Storage Council CEO John Grimes, advised the Sector Advisory Group (EPIC ITB) that in 2016 approximately 7,000 battery storage units were installed nationally, and it is anticipated that 20,000

	will be installed in 2017. Consequently, training to expand the number of qualified people required to address the demand is urgent. Two units of competency have recently been endorsed by the Australian and Industry Skills Committee (AISC) as part of the UEE Electrotechnology Training Package to address the design and installation of battery storage systems for grid-connected PV systems. However, training to achieve these units does not qualify for State Government funding in Victoria because the units are not packaged in a qualification. Further, each unit has a prerequisite trail that is not required for the work covered by the proposed course. However, any person who is licensed to practice in accordance with the requirements of the Victorian Electricity Safety Act 1998 can install equipment that is fixed-wired to an electrical installation. To overcome these issues, the Office of the Victorian Skills Commissioner (OVSC) requested the development of a course to address the knowledge and skills requirements for both design and installation of grid-connected new energy and battery storage systems. The course will enable appropriately qualified and/or experienced persons such as electricians, electrical/mechanical technicians and engineers or persons with experience in PV installations to provide design and/or installation services to the public for both domestic and commercial applications. The actual connection/reconnection to the electricity grid for any new or retro energy generating and battery storage system installation continues to require the services of an appropriately licensed electrician. To determine the knowledge and skills required for the proposed course a workshop was conducted with key stakeholders drawn for an OVSC Sector Advisory Group (SAG); a summary of the outcomes is at Appendix 1. The outcomes of the proposed course relate to: • service provider responsibilities and site assessment • assessment of customer energy storage needs and the provision of advice • battery storage system hazards and safety requirements for installers and clients • relevant statutory Acts/Regulations, Industry Standards, Codes of Practice • system design options and configuration to meet client requirements • documenting design solutions • installation and commissioning of new energy generating and battery storage systems including maintenance and repair. This course does not duplicate by title or coverage, the outcomes of an endorsed training package qualification. Five RTOs entered into a partnership arrangement with EPIC ITB to guide the development of and pilot, blended learning resources and assessment tools, for the Course in New Energy Technology Systems. Initial enrolment numbers for the pilot program are expected to be between 60 and 70 participants (12–14 students per RTO). Course development has been guided by a Course Steering

	Committee of key industry stakeholders drawn from the OVSC Sector Advisory Group (SAG) responsible for initiating this project. Members of the Course Steering Committee are: • Sandy Atkins – Clean Energy Council • John Grimes – Energy Storage Council • Michael Collins – Electrical Trades Union • Michael D'Costa – National Electrical & Communications Assoc. • Neil Fraser – Energy Safe Victoria. • Peter Boicovitis – Country Fire Authority • Shayne Clayton – Gippsland Solar • David Tolliday – VET Electrical Senate • Maurice Graham – EPIC – Industry Training Board. In attendance: • George Adda – CMM – Engineering Industries • Trevor Lange – CMM – Engineering Industries • Andrew Donnison – OVSC • Carmel Veenstra – EPIC ITB • Steve Attard – Metropolitan Fire Brigade.
3.2 Review for re-accreditation	Not applicable.
4. Course outcomes	Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses
4.1 Qualification level	*Standards 1, 2 and 3 AQTF Standards for Accredited Courses* This course does not align with any specific Australian Qualifications Framework (AQF) level.
4.2 Employability skills	*Standard 4 AQTF Standards for Accredited Courses* Not applicable.
4.3 Recognition given to the course	*Standard 5 AQTF Standards for Accredited Courses* Successful attainment of this course will enable a graduate to apply to the Clean Energy Council (CEC) for solar accreditation as a designer and/or installer of renewable energy generating systems. Successful attainment of VU22124 Design a grid-connected photovoltaic energy generation system to meet client requirements will enable a graduate to apply for CEC Grid-Connect Design Accreditation. Successful attainment of unit VU22125 Design a grid-connected battery storage system to meet client requirements will enable a graduate to apply for the Battery Storage endorsement to CEC Grid-Connect Design Accreditation. Successful attainment of UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems will enable a graduate to apply for the Battery Storage endorsement to CEC Grid-Connect Installation Accreditation.

	For further information on CEC accreditation refer to the website: www.solaraccreditation.com.au/installers/why-become-accredited.html.
4.4 Licensing/regulatory requirements	*Standard 5 AQTF Standards for Accredited Courses* Not applicable.

5. Course rules Standards 2, 6,7 and 9 AQTF Standards for Accredited Courses

5.1 Course structure

A Statement of Attainment for the Course in New Energy Technology Systems includes:

- one (1) core unit *plus*
- one (1) elective unit (taken from the elective units table below).

Note:

Successful attainment of the core unit and the elective unit VU22124 Design a grid-connected photovoltaic energy generation system to meet client requirements or the elective unit VU22125 Design a grid-connected battery storage system to meet client requirements will result in the following Statement of Attainment: ***Course in New Energy Technology Systems (Design)***.

Successful attainment of the core unit and the elective unit UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems will result in the following Statement of Attainment: ***Course in New Energy Technology Systems (Installation)***.

Participants who do not complete the full course will be awarded a Statement of Attainment listing the unit successfully attained.

Refer Course Structure Table below:

Unit of competency code	Field of Education code (six-digit)	Unit of competency title	Pre-requisite	Nominal hours
Core unit				
VU22123	031399	Undertake site assessment for installation of a grid-connected renewable energy generation system	Nil	30
Elective units				
VU22124	031399	Design a grid-connected photovoltaic energy generation system to meet client requirements	VU22123	80
VU22125	031399	Design a grid-connected battery storage system to meet client requirements	VU22123	80
UEERE4001		Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems	UEENEEK148A	60
			Total nominal hours =	**90–110**

5.2 Entry requirements	*Standard 9 AQTF Standards for Accredited Courses* To enter this course applicants are required to have at least one of the following requirements: • electrical trade/post trade qualification or • diploma/advance diploma or degree in engineering or • minimum of 1 year experience in the installation of PV systems. To undertake the elective unit UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems, a learner must meet the prerequisite requirements. *It should also be noted that any person who is required to install equipment that is fixed-wired into an electrical installation must be licenced to practice in accordance with the requirements of the Victorian Electricity Safety Act 1998.* It is also recommended that learners have language, literacy and numeracy skills equivalent to Level 3 of the Australian Core Skills Framework (ACSF) Information about the ACSF can be found on the website https://www.education.gov.au/australian-core-skills-framework. Learners who have lower levels of language and literacy may require additional support to undertake the course.
6. Assessment	Standards 10 and 12 AQTF Standards for Accredited Courses

6.1 Assessment strategy	*Standard 10 AQTF Standards for Accredited Courses*
	• All assessments, including Recognition of Prior Learning (RPL) must be consistent with:
	  • Standard 1.2/1.5 of the Australian Quality Training Framework(AQTF): *Essential Conditions and Standards for Initial/Continuing Registration*
	  or
	  • Standard 1, Clauses 1.1 and 1.8 of the *Standards for Registered Training Organisation (RTOs) 2015*
	  or
	  • the relevant Standards for Registered Training Organisations in effect at the time of assessment.
	• Assessment strategies must therefore ensure that:
	  • all assessments are valid, reliable, flexible and fair
	  • learners are informed of the context and purpose of the assessment and the assessment process
	  • feedback is provided to learners about the outcomes of the assessment process and guidance given for future options
	  • time allowance to complete a task is reasonable and specified to reflect the context in which the task takes place.

	• Assessment strategies should be designed to:
	  • cover a range of skills and knowledge required to demonstrate achievement of the course aims
	  • collect evidence on a number of occasions to suit a variety of contexts and situations
	  • be appropriate to the knowledge, skills, methods of delivery, and needs and characteristics of learners
	  • assist assessors to interpret evidence consistently
	  • recognise existing skills
	  • be equitable to all learners.
	• Assessment methods are included in each unit of competency and may include:
	  • direct observation of processes and procedures
	  • oral and/or written questioning
	  • testimony from a competent person e.g. supervisor
	  • inspection of final process outcomes
	  • documented work-based evidence
	  • demonstration of practical skills.
	A holistic approach to assessment, by combining the assessment of more than one unit of competency, is encouraged to better replicate working practice and to reduce the potential for over assessment.
	Units of competency maybe assessed on-the-job, off-the-job or a combination of both. Where assessment occurs off-the-job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.
	Assessment of the imported unit must reflect the requirements of the Assessment Guidelines in the UEE Electrotechnology Training Package.

6.2 Assessor competencies	*Standard 12 AQTF Standards for Accredited Courses* Assessment must be undertaken by a person with competencies compliant with: • Standard 1.4 of the AQTF*: Essential Conditions and Standards for Initial/Continuing Registration* or • Standard1, Clauses 1.13, 1.14, 1.15, 1.16 and 1.17 of the Standards for Registered Training Organisation 2015 (RTOs) or • the relevant Standards for Registered Training Organisations in effect at the time of assessment. Assessors assessing the imported unit must reflect the requirements of the Assessment Guidelines in the UEE Electrotechnology Training Package.

7. Delivery	Standards 11 and 12 AQTF Standards for Accredited Courses
7.1 Delivery modes	*Standard 12 AQTF Standards for Accredited Courses* This course is available for full- or part-time study. Providers should endeavor to be flexible in the way the training is delivered to ensure they meet the needs of the client group. Units of competency maybe delivered on-the-job, off-the-job or a combination of both. Where delivery occurs off-the-job, conditions should reflect realistic workplace situations. The course aims to develop competence within the battery storage industry setting. Practical demonstrations and opportunity for application provide the most suitable strategy to reflect the objectives of the course. Other delivery methods may include: • classroom presentation • case study analyses • practical exercises • projects. Program delivery should allow for self-directed learning and development together with independent judgement and accountability for outputs. Some areas of content may be common to more than one unit of competency, and therefore some integration of delivery may be appropriate.
7.2 Resources	*Standard 12 AQTF Standards for Accredited Courses* General facilities, equipment and other resources required to deliver the proposed Course in New Energy Technology Systems include: • training facilities and equipment • relevant texts and references • occupational health and safety facilities and equipment • occupational health and safety policy and work procedures/instructions • access to relevant legislation, service installation information, standards and codes of practice • access to relevant equipment, tools, machines, materials and consumables • access to plans, drawings and instructions • manufacturer specifications/manuals • workplace environment or simulated workplace environment appropriate to the assessment tasks. Training must be undertaken by a person or persons compliant with: • Standard 1.4 of the *AQTF: Essential Conditions and Standards for Initial/Continuing Registration* or • Standard 1, Clauses 1.13, 1.14, 1.15, 1.16 and 1.17 of the *Standards for Registered Training Organisations 2015* (SRTOs) or • the relevant SRTOs in effect at the time of assessment.

	UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems imported from UEE Electrotechnology Training Package must reflect the requirements of trainers specified in that training package.
8. Pathways and articulation	Standard 8 AQTF Standards for Accredited Courses
	There is no formal articulation or credit transfer arrangements from this course into other VET or higher education qualifications. When arranging articulation providers should refer to the: *AQF Second Edition 2013 Pathways Policy.* Providers must negotiate individual pathway arrangements directly. Graduates of the course who have attained the imported unit of competency UEERE4001 Install, maintain and fault find battery storage systems for grid-connected photovoltaic systems will gain credit in any future studies that include this unit. Likewise, participants who have already attained the imported unit of competency will be granted a credit for the unit.
9. Ongoing monitoring and evaluation	Standard 13 AQTF Standards for Accredited Courses
	Ongoing evaluation and validation of this course is the responsibility of the Curriculum Maintenance Manager, Engineering Industries. A course advisory committee will be established for the ongoing monitoring and evaluation of the course. It will include: • Curriculum Maintenance Manager, Engineering Industries • course providers • industry representatives. The committee will: • review the implementation of the course • provide advice about changing program requirements • monitor and evaluate course standards, delivery and assessment • assess the continuing need for the course should appropriate units of competency be incorporated into a national endorsed training package qualification. The course advisory committee will meet at least once during the accreditation period for a mid-term review. Additional meetings may be scheduled on an as needs basis. Recommendations for significant changes will be reported through the Curriculum Maintenance Manager, Engineering Industries to the VRQA.

Section C: Units of competency

Victorian Units of Competency

VU22123	Undertake site assessment for installation of a grid-connected renewable energy generation system
VU22124	Design a grid-connected photovoltaic energy generation system to meet client requirements
VU22125	Design a grid-connected battery storage system to meet client requirements

Imported Units of Competency: (Copy of this unit is available at: http://training.gov.au)

UEERE4001	Install, maintain and fault find battery storage systems for grid–connected photovoltaic systems

VU22123 Undertake site assessment for installation of a grid-connected renewable energy generation system

Unit Descriptor

This unit describe the skills and knowledge required to safely undertake a site assessment and provide initial advice to the client for the installation of a grid-connected renewable energy generation system. The units includes service provider responsibilities, analysis of client energy demand requirements, site inspections and the provision of advice on energy storage standards, codes of practices and government/utilities incentive schemes.
No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains employability skills.

Application of the Unit

This unit is applicable to an accredited technician working as an advisor/installer of renewable energy generation systems such as photovoltaic (PV) arrays.

Element	Performance Criteria
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1 Clarify client energy requirements and expectations	1.1 Scope of responsibilities is clarified and discussed with client
	1.2 General information about ***industry standards,*** building/electrical regulations and codes, and risk minimisation is provided to client
	1.3 Advice on the benefits of renewable energy generation systems and energy management is provided to client including any current incentive schemes
	1.4 Client energy generation needs are assessed and expectations are clarified
2 Inspect site and provide initial advice	2.1 ***Site inspection*** for the proposed installation is safely undertaken and any ***restrictions or issues of concern*** are noted
	2.2 Work health and safety/occupational health and safety (WHS/OHS) risks and control measures are identified and noted
	2.3 Client current energy usage data is collected and assessed
	2.4 Placement of ***system components*** is considered and options are discussed with client
	2.5 Client is provided with advice on suitable renewable generating system/s to meet client requirements

3	Document advice for the client	3.1 Summary of the recommended system is recorded together with ongoing maintenance requirements and safety advice
		3.2 A ***report*** is prepared and forwarded to client
		3.3 Client understanding of advice is checked and confirmed

Required Knowledge and Skills

This describes the essential skills and knowledge and their level required for this unit.

Required Knowledge:

- Customer service responsibilities
- Renewable energy generating systems and componentry
- Installation considerations and requirements for renewable energy generation systems
- Methods for collecting and analysing energy usage
- Energy ratings systems for domestic and commercial buildings
- Electrical principles
- Electricity network requirements and restrictions
- Relevant standards, building regulations and codes of practice
- Relevant WHS/OHS risks include fire risk and control measures
- Government/utilities incentive schemes
- Safety considerations and requirements for roof access and working at heights

Required Skills:

- Listen to and communicate effectively with clients
- Collect, read and interpret energy data
- Identify installation problem/s and recommend solutions
- Carry out a site inspection safely
- Identify WHS/OHS risks and recommend safety control systems
- Read and interpret relevant Australian Standards, Clean Energy Council (CEC) guidelines, and building and fire codes of practice
- Make recommendations to client based on analysis and evidence
- Document recommendations

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold / italicised wording in the Performance Criteria is detailed below.

Industry standards include but are not limited to:	• Building Code of Australia • AS/NZS 3000 Electrical installations (known as the Australia/New Zealand Wring Rules) • National Australian Built Environment Rating System (NABERS) • Green star environmental rating system • Clean Energy Council (CEC) guidelines
Site inspection includes but is not limited to:	• Solar access, shading • Available array area • Array orientation

	• Tilt/solar azimuth angle • Temperature min/max • Wind zone • Site height • Environment and hazards • Fire consideration • Inverter location • Cable runs • Electrical installation requirements • Building classification
Restrictions or issues of concern include but are not limited to:	• Shading • Available roof area • Wind zone • Cable runs • Existing electrical installations • Site access and hazards
System components include but are not limited to***:***	• Solar array • Mountings • Cabling and wiring • Tracker • Inverter • Controller • Isolators • Monitoring and metering
Report includes but is not limited to:	• Written information • Graphs and charts e.g. energy usage data • Layout drawings and sketches • Photographs

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessment must confirm on more than one occasion the ability to: • assess client energy demand requirements • undertake a site inspection for the installation of a renewable energy generating system • apply all relevant safety requirements when working at heights

- demonstrate a working knowledge of relevant standards, CEC guidelines, building regulations and industry codes of practices
- document findings and provide advice to a client.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

This unit may be assessed on-the-job, off-the-job or a combination of both. Where assessment occurs off-the-job, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone.

Methods of assessment

The following suggested assessment methods are suitable for this unit:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- testimony from a competent person e.g. supervisor
- inspection of the final product or outcome
- portfolio of documented evidence
- demonstration of practical skills.

VU22124 Design a grid-connected photovoltaic energy generation system to meet client requirements

Unit Descriptor

This unit describes the skills and knowledge required to design a grid-connected photovoltaic (PV) power supply system to meet a client energy generation requirements.
The unit includes assessment of client energy needs, site assessment issues, system design principles, preparing and working from a design brief, design documentation and energy storage standards, regulations and building codes.

No licensing or certification requirements apply to this unit at the time of accreditation.

Employability Skills

This unit contains employability skills.

Prerequisite unit

VU22123 Undertake site assessment for installation of a grid-connected renewable energy generation system

Application of the Unit

This unit is applicable to an accredited designer and/or installer of renewable energy generation systems such as photovoltaic (PV) arrays.

Element Elements describe the essential outcomes of a unit of competency	Performance Criteria Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.	
1 Confirm client energy requirement needs	1.1	Client energy needs, budget and expectations are reviewed and clarified
	1.2	***Site assessment information*** is examined and potential hazards and limitations are assessed and confirmed
	1.3	Additional data or information required for the design brief is accessed
	1.4	***Design brief*** is prepared and discussed with client
2 Prepare design solution	2.1	Relevant standards, Clean Energy Council (CEC) guidelines, network requirements and building codes are sourced
	2.2	Type of photovoltaic material, size and number of modules for the array, and architectural considerations are determined
	2.3	Tracking and/or mounting system is selected
	2.4	Type and capacity of ***system components*** are determined
	2.5	Specific location and fixing of all system components is determined in the context of potential or real hazards and work health and safety/occupational health and safety (WHS/OHS) requirements
3 Document the design	3.1	Detailed layout drawing of the proposed system is prepared with relevant specifications including authority requirements

	3.2	Potential energy output calculations are included together with installation advice
	3.3	Design layout and specification documentation is checked against relevant standards, guidelines and building codes, and WHS/OHS requirements
4 Present design solution to client	4.1	***Design solution*** is presented and explained to client and other relevant persons
	4.2	Requested alterations are clarified and design is amended
	4.3	Final design and specification are presented to client for approval

Required Knowledge and Skills

This describes the essential skills and knowledge and their level required for this unit.

Required Knowledge:

- Photovoltaic (PV) material
- Solar module sizes
- Mounting and tilting systems for solar arrays
- Grid-connected photovoltaic (PV) power supply systems and components
- System installation considerations and requirements
- Methods for collecting and analysing energy use data
- Energy rating systems for domestic and commercial buildings
- Basic electrical principles
- Electricity network requirements and restrictions
- Relevant standards, building regulations and codes of practice
- Relevant WHS/OHS hazards, risks include fire risk and control measures
- Government/utilities incentive schemes
- Client service responsibilities
- Design brief content
- Design documentation

Required Skills:

- Listen to and communicate effectively with clients
- Collect, read and interpret energy data
- Access and interpret site assessment information
- Identify PV installation problems
- Identify and deal with WHS/OHS issues and potential hazards
- Read and interpret relevant Australian Standards, Clean Energy Council (CEC) guidelines, and building and fire codes of practice
- Prepare a design brief that reflects client budget, energy needs and expectations
- Develop a grid-connected PV power supply system according to a design brief
- Document and present a design solution

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold/italicised wording in the Performance Criteria is detailed below.

Site assessment information includes but is not limited to***:***

- Solar access, shading
- Available area for solar panels
- Array orientation and tilt for maximum solar exposure
- Mounting methods
- Access considerations
- Temperature min/max
- Type of roofing material
- Potential hazards and recommended mitigation options
- Inverter location
- Cable runs
- Location of switchboard and meter
- Building classification

Design brief includes but is not limited to:

- Client energy needs
- Client budget
- Client expectations and instructions
- Agreed timelines for design solution
- Client current energy usage data
- Site assessment information
- Installer contact details (if available)
- Site photographs

System components include but are not limited to:

- Solar array
- Mountings
- Cabling and wiring
- Tracker
- Inverter
- Controller
- Isolators
- Monitoring and metering devices

Design solution includes but is not limited to:

- Schematic drawing and specifications of proposed grid-connected PV system layout which will include:
  - selection, size and orientation of PV array based on annual energy demand, budget constraints and architectural limitations
  - mounting and azimuth angle details for maximum solar access for the site
  - selection and specification of the balance of the system components e.g. cabling, junction box, circuit protection and isolation equipment
  - inverter type and specifications

- metering box location
- potential energy output data
- installation advice
- labelling and signage

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessment must confirm on more than one occasion the ability to:

- prepare a design brief for a grid-connected photovoltaic (PV) system that specifies client budget, energy requirements and site assessment details
- develop, document and present a grid-connected photovoltaic (PV) system design solution that meets the requirements of a design brief and complies with relevant standards, guidelines and codes of practice.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

This unit may be assessed on-the-job, off-the-job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflect realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone.

Methods of assessment

The following suggested assessment methods are suitable for this unit:

- observation of processes and procedures
- oral and/or written questioning on required knowledge and skills
- testimony from a competent person e.g. supervisor
- inspection of the final product or outcome
- portfolio of documented evidence
- demonstration of practical skills.

VU22125 Design a grid-connected battery storage system to meet client requirements

Unit Descriptor

This unit describes the knowledge and skills required to plan, design and document a grid-connected battery storage system to meet a client's energy requirements.

The unit includes a detailed knowledge of the components, different system configurations of battery storage systems, calculations and selections of the correct equipment to meet required output/performance, knowledge of industry guidelines, standards and work health and safety considerations.

No licensing, legislation or certification requirements apply to this unit at the time of publication.

The development of this unit has been guided by the following:

- Clean Energy Council (CEC) *Battery Install Guidelines for Accredited Installers* August 2017 and *Grid-Connected Energy Systems with Battery Storage* April 2016
- Energy Storage Council (ESC) *The Australian Battery Guide* ESC 5000.2016
- AS/NZS 4509.2 (2010) *Stand-alone power systems Part 2: System design*

Employability Skills

This unit contains employability skills.

Prerequisite unit

VU22123 Undertake site assessment for installation of a grid-connected renewable energy generation system

Application of the Unit

This unit is applicable to a person who is seeking accreditation as a designer of renewable energy generation systems with battery storage.

Element	**Performance Criteria**
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information or explanation is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.
1 Establish the scope of a grid-connected battery storage system project	1.1 ***Client requirement, budget and desired outcome*** are clarified
	1.2 Proposed area and location for grid-connected battery storage system are assessed
	1.3 Potential issues are identified and modifications to address identified issues are developed
	1.4 Potential grid-connected battery storage system ***hazards*** are identified, risks are assessed and risk controls are proposed
	1.5 Project scope is documented and confirmed with client

2 Plan the configuration of a battery storage system for a grid-connection to meet client requirement	2.1	Current relevant industry guidelines, standard, building codes/regulations and manufacturer requirements are used as the basis to plan a grid-connected battery storage system design
	2.2	***Suitable grid-connected battery storage system configurations are considered*** and the required ***components*** are identified and assessed
	2.3	Grid-connected battery storage system electrical load is determined
	2.4	***Energy assessment*** is determined using data logging and energy assessment tools
	2.5	Component manufacturer requirements and relevant tariffs are assessed and documented
3 Design a grid-connected battery storage system	3.1	Most appropriate grid-connected battery storage system configuration is selected and confirmed with client, based on information provided in the plan
	3.2	System efficiencies are applied to client confirmed grid-connected battery storage system configuration
	3.3	Components are evaluated, selected and documented based on client confirmed grid-connected battery storage system configuration
	3.4	Grid-connected battery storage system capability, capacity and indicative costs are calculated and documented
	3.5	Location and design of grid-connected battery storage system is documented
	3.6	Potential modifications to grid-connected battery storage system are recommended as required
	3.7	Grid-connected battery storage system location and design are reviewed with client, amended as required and approved by client
4 Finalise grid-connected battery storage system design documentation	4.1	Approved client design plan is documented
	4.2	Risk controls are listed based on hazards and risks associated with client approved grid-connected battery storage system configuration
	4.3	Components required for the design are listed and relevant manufacturer documentation is supplied
	4.4	Potential performance of grid-connected battery storage system is estimated and documented
	4.5	Installation and maintenance requirements of components are identified, assessed and documented
	4.6	***Final documentation*** is presented and explained to the client

Required Knowledge and Skills

This describes the essential skills and knowledge and their level required for this unit.

Required Knowledge:

- WHS/OHS requirements and procedures
- Relevant Australian Standards and energy and battery storage system guidelines
- Customer service responsibilities and client engagement
- Energy rating systems
- Methods of collecting energy usage data and analysis of energy data
- Factors to consider when assessing energy usage/demand
- Electrical principles and electrical grid connection requirements
- Battery storage systems:
  - Battery:
    - Terminology ie. amp hour capacity, depth of discharge (DOD), charge and discharge rate, nominal voltage, state of charge (SOC)
    - Types and classification
    - Storage capacity and demand ie. watt hour capacity
    - Battery life cycle
    - Battery faults ie. sulphation and stratification in lead acid batteries
    - Hazards associated with batteries ie. risk control measures
    - Battery accommodation and enclosure requirements
    - Battery handling and installation considerations
    - Battery labelling requirements
    - Battery storage energy demand load profile ie. average demand, maximum demand
  - Types of inverters and associated programming requirements ie. multi-mode inverters, PV grid-connected inverters
  - Inverter connections ie. for back up to dedicated loads during grid failure
  - Charge controllers types, configurations and specifications ie. for PV arrays or direct current (DC) coupling for PV array and battery
  - Metering and control systems
  - Switching and protection systems
  - Signage and labelling
- System design configuration factors:
  - Performance requirements ie. energy demand, grid outage duration
  - System component costs verses budget constraints
  - System components and their relationships
  - Battery storage capacity and size vs. performance requirements
  - System wiring requirements including earthing, isolation, switching devices and protection device

- Energy management strategies based on load profile analysis ie reduced maximum and surge demand
- Maintenance and installation requirements ie. schedules, manufactures' specifications, safety considerations and relevant standards
- Government incentives schemes and energy tariffs
- Documentation:
  - Electrical diagrams and symbols
  - Schematic layouts of system
  - Site diagrams

Required Skills:

- Determining and applying relevant WHS/OHS requirements and procedures
- Determining and clarifying clients energy needs and desired outcomes
- Accessing and interpreting technical information such as Australian Standards energy guidelines and regulations, building regulations, equipment manufacturer's brochures etc.
- Planning and configuring a grid-connected energy system with battery storage
- Costing a grid-connected energy system with battery storage
- Documenting a grid-connected energy system with battery storage for installation
- Preparation of supporting documentation such cost break down for client, installer instructions, ongoing maintenance requirements, hazards and risk controls.

Range Statement

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold/italicised wording in the Performance Criteria is detailed below.

Client requirement, budget and desired outcome include but are not limited to:

- Client objectives for the proposed system
- Client budget
- Energy profile of the site where the system will be connected and producing an energy management report
- Energy management strategies
- Hazards related to the system and the site
- Relevant electricity tariffs and utility requirements
- Site inspection including existing electrical installation to meet client objectives

Hazards include but are not limited to:

- Corrosion
- Spills
- High temperature exposure
- Chemicals
- Manual handling
- Storage
- Electrical shock

- Electrical interference
- Transportation
- Ventilation

Suitable grid-connected battery storage system configurations are considered includes but is not limited to:

- Analysing, reviewing and selecting configuration to meet performance requirements
- Assessing energy generating system capacity to meet performance requirements
- Determining location of equipment
- Determining sub-system efficiencies
- Selecting and sizing cables, protection and isolation devices
- Selecting type and capacity of inverter/s, including programming parameters to meet performance requirements
- Selecting type and capacity of battery storage to meet performance requirements
- Selecting type and capacity of charge controller, including programming parameters to meet performance requirements

Components include but are not limited to:

- Cabling and wiring
- Inverter
- Controller
- Isolators
- Battery
- Battery enclosure
- Monitoring and metering
- Signage
- Energy generation systems:
    - Photovoltaic (PV) array
    - Wind generator
    - Microhydro generator
    - Grid hybrid system

Energy assessment includes but is not limited to:

- Usable energy
- Maximum power output (kW)
- Operating power factors (pf) range
- Battery system life
- Energy storage system (ESS) max. surge load
- ESS power output/time period
- Max recharge power available
- Battery total energy throughput
- Standby System Operating Conditions (SOC) for storage device
- Response time in milliseconds (ms)
- Storage device self-discharge rate

- Energy storage device maximum prospective fault current and protective device capability
- Energy storage device operating DC voltage range
- Days of autonomy

Final documentation includes but is not limited to:

- Client documentation
- Installer documentation
- Electrical system schematic drawings and equipment location plan
- Specifying equipment including signage
- Specifying system budget and performance including battery storage and energy generating system capacity
- Specifying maintenance requirements

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the Elements, Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Accreditation Submission.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessment must confirm on more than one occasion the ability to:

- plan, design and document a grid-connected battery storage system that meets the specific requirements of the client, relevant industry guidelines, standard, building regulations and codes of practice.

Context of and specific resources for assessment

Evidence should show competency working in a realistic environment and a variety of conditions. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.

The competencies covered by this unit would be demonstrated by an individual working alone.

The assessment environment should not disadvantage the candidate.

Methods of assessment

Evidence can be gathered through a variety of ways including:

- observation of processes and procedures
- oral and/or written questioning about required knowledge
- testimony from a competent person such as a supervisor
- inspection of the final product or outcome

- portfolio of documented evidence
- demonstration of practical skills.

Where performance is not directly observed and/or is required to be demonstrated over time and/or in a number of locations, evidence should be authenticated by colleagues, supervisors, clients or other appropriate people.

Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency and the workplace.

Appendix 1

Key Stakeholder Meeting for the Proposed Course in New Energy Technology Systems

A workshop attended by key stakeholders was held on the 15th May 2017 and chaired by the CMM. Attendees were:

- James Keeghan – National Electrical & Communications Association (NECA)
- Michael D'Costa – National Electrical & Communications Association (NECA)
- Allen Burrows - National Electrical & Communications Association (NECA) Education & Careers
- David Tolliday – VET Electrical Senate
- Steve Blume – Energy Storage Council
- Sandy Atkins – Clean Energy Council (CEC)
- Michael Collins – Electrical Trades Union (ETU).

The purpose of the workshop was to review the knowledge and skills required by a designer and installer of a renewable energy technology and battery storage system and to map out a Victorian training pathway program that will inform the structure of a proposed accredited course.

Summary of Knowledge and Skills required

Required Knowledge:

- battery terminology
- major features of commercially available types of batteries suitable for grid-connected battery storage systems
- factors affecting the life of commercially available types of batteries including the estimation of battery life
- common processes leading to battery failure in commercially available batteries including sulphation and stratification in lead acid batteries
- charging regimes suitable for commercially available types of batteries
- hazards associated with handling, installing or maintaining commercially available types of batteries and risk control measures
- procedures for safe disposal of commercially available types of batteries
- battery storage energy demand including load profiles illustrating average demand and maximum demand, based on appliances required during grid outages or during periods of high tariffs
- total energy demand including energy required during periods of high tariffs
- length of time of typical or expected grid outage
- battery storage systems for grid-connected system
- applications for battery storage including electrical energy supply direct to loads during periods of high tariffs and electrical energy supply during grid outages
- drivers of grid-connected battery storage system
- purpose of each component in a battery storage system for grid-connected system
- functional block diagrams for typical configurations of battery storage systems for grid-connected systems
- types of inverters comprising, photovoltaic grid-connected inverters and multimode inverters
- charge controllers including types and applications of charge controllers within the various system configurations
- specifications of a charge controller
- electrical schematics of battery storage systems for grid-connected systems including modifications to switchboard to cater for specified loads
- site diagrams to show the locations of equipment, fittings and cable runs
- energy management strategies and/or energy source switching options to reduce the maximum and surge demand, based on load profile analysis
- inverters including the differences between multimode and grid-connected inverters

- output rating of a multimode inverter in relation to:
    - capacity for battery charging
    - required maximum demand
- program parameters for a multimode inverter, for the correct operation of the system
- maintenance and installation requirements grid-connected battery storage systems including prevention and intervention safety systems
- system design including:
    - determining the system yield/performance, equipment costs, maintenance requirements, budget and overall life-cycle costs
    - relationship between the system components:
    - battery storage and inverters/controllers and the system design criteria
    - size and selection of the battery storage to meet the system performance requirements
    - selecting and sizing the balance of system components including:
- earthing
- isolation and switching devices
- protection devices
- WHS/OHS policy, workplace procedures and instructions.

Required Skills:

Design:

- listening and communicating effectively with clients
- collecting, reading and interpreting energy data
- identifying WHS/OHS risks and recommended safety control systems
- carrying out a site inspection safely
- identifying installation problem and recommending solutions
- reading and interpreting relevant Australian Standards, Clean Energy Council (CEC) guidelines building and fire codes of practice
- making recommendations to client based on analysis and evidence
- applying WHS/OHS policy, work procedures and instructions
- ascertaining and documenting system requirements to meet client needs
- planning and designing the system to meet clients requirements
- documenting the system design for both client and installer
- specifying maintenance and risk control and safety requirements.

Installation:

- installing battery storage systems for grid-connected PV systems:
- installing battery storage components
- installing inverter/s
- installing charge controller/s
- installing the balance of system equipment including cables, protection and isolating devices, and signage
- programing inverter/s and charge controller/s
- modifying electrical installation as required
- maintaining battery storage systems for grid-connected PV systems
- preparing for the installation of a battery storage system:
- interpreting system design documentation that specifies the quantity and location of all equipment in compliance with relevant industry standards, building codes and regulations
- testing and commissioning PV system:
- testing operation of each piece of equipment
- testing operation of complete system
- commissioning the system
- briefing client on safe and correct system operation and recommended maintenance.