22601VIC Course in Design Stand-alone Power Systems

22600VIC Course in Install Stand-alone Power Systems

Version 1.1 September 2023

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

Accredited for the period: 1 July 2022 to 30 June 2027

VICTORIA State Government | Jobs, Skills, Industry and Regions

Version History:		Date
Version 1.1	Department of Education and Training (DET) details and contact information updated with Department of Jobs, Skills Industries and Regions (DJSIR) details in Section A	September 2023

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Section A: Applicant and course classification information

1. Person in respect of whom the course is being accredited	Copyright of this material is reserved to the Crown in the right of the State of Victoria on behalf of the Department of Jobs, Skills, Industries and Regions (DJSIR) Victoria. © State of Victoria (DJSIR) 2022
2. Address	Executive Director Higher Education and Workforce Skills and Employment Department of Jobs, Skills, Industries and Regions (DJSIR) GPO Box 4509 MELBOURNE VIC 3001 **Organisational Contact:** Manager, Training and Learning Products Unit Higher Education and Workforce Skills and Employment Telephone: 131 823 Email: *course.enquiry@djsir.vic.gov.au* **Day-to-day contact:** Curriculum Maintenance Manager – Engineering/Electrical Industries Box Hill Institute of TAFE Private Bag 2014 Box Hill Victoria 3128 Ph:(03) 9286 9880 Email: *cmmei@boxhill.edu.au*
3. Type of submission	This submission is for accreditation.
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6. Course accrediting body	Victorian Registration and Qualifications Authority
7. AVETMISS information	**ANZSCO code** *Australian and New Zealand Standard Classification of Occupations* 399999 Technicians and Trades Workers nec. **ASCED code** *Field of Education* 0313 Electrical and Electronic Engineering and Technology **National course code** 22601VIC 22600VIC
8. Period of accreditation	1 July 2022 to 30 June 2027

Section B: Course information

1 Nomenclature	
1.1 Name of the qualification	Standard 4.1 AQTF 2021 Standards for Accredited Courses Course in Design Stand-alone Power Systems Course in Install Stand-alone Power Systems
1.2 Nominal duration of the course	Standard 5.8 AQTF 2021 Standards for Accredited Courses Course in Design Stand-alone Power Systems 80 nominal hours Course in Install Stand-alone Power Systems 60 nominal hours
2 Vocational or educational outcomes of the course	
2.1 Outcome(s) of the course	Standard 5.1 AQTF 2021 Standards for Accredited Courses The 22601VIC Course in Design Stand-alone Power Systems is designed to provide graduates with the skills and knowledge to design a stand-alone power system that meets client energy needs. The 22600VIC Course in Install Stand-alone Power Systems is designed to provide graduates with the skills and knowledge to install a stand-alone power system based on a client approved design.
2.2 Course description	Standard 5.1 AQTF 2021 Standards for Accredited Courses The 22601VIC Course in Design Stand-alone Power Systems provides training for those wanting to develop skills in the design of stand-alone power systems, for households, communities and businesses across a range of industries. It involves client liaison, assessment of client energy needs, site analysis, research and problem solving to determine an appropriate energy solution, and system documentation. The 22600VIC Course in Install Stand-alone Power Systems provides training for those wanting to develop skills in the installation of client approved stand-alone power systems with battery storage. It involves confirmation of job requirements, installation of energy system components and the finalisation of work processes.

3 Development of the course	
3.1 Industry, education, legislative, enterprise or community needs	Standards 4.1, 5.1, 5.2, 5.3 and 5.4 AQTF 2021 Standards for Accredited Courses Industry need There is an industry/community need for personnel who have the skills and knowledge or ability to consult with potential clients regarding energy usage, design and install a customised stand-alone power system. The growth in uptake of 'green' energy in the last decade is attributed to the success of various Federal / State government incentive schemes. .For example, the Morrison government Technology Investment Roadmap and allocation of $1.62 billion to extend the life of the Australian Renewable Energy Agency, the Victorian government established Solar Victoria within the Department of Environment, Water, Land and Planning to deliver the Solar Homes Program , to encourage eligible Victorian households to install a solar battery as an energy source . This was recently expanded to offer interest free loans to landlords to install solar on the rental properties, in addition to the rebate they already receive. This and other schemes were introduced to encourage greater use of alternate energy sources. Public concern for the health of the planet due to the negative impact of burning fossil fuels has also contributed to the growth in uptake of 'green' energy. As a percentage of Australia's total electricity generation, clean energy sources continue to increase. The industry passed a significant milestone in 2020, with more than 27% of the country's total electricity generation coming from renewable sources for the first time[1]. This represents an increase of 3.7% on 2019. Much of this increase is due to the small-scale solar sector which accounts for 23.5% of Australia's renewable energy generation and enjoyed a 'fourth straight record-breaking year' of consumer uptake[2]. In household terms, this equates to 378,451 small-scale solar / photovoltaic (PV) rooftop installations. Demand for improved energy storage capability 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.

[1] Clean Energy Council, 2021. Clean Energy Australia Report (p.4)

[2] Ibid.(p.17)

	During 2020, the household battery sector continued to grow with 23,796 batteries installed nationally[3]. Currently the industry employs more than 7,500 solar and battery installers[4]. The use of modern battery technology in conjunction with a 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. In response to consumer need, a skill gap emerged for appropriately trained technicians to undertake this focussed type of work. The accredited course 22453VIC Course in New Energy Technology Systems was therefore developed in 2016 /2017 and piloted soon after. During the pilot phase, Victorian industry stakeholders determined the course required further refining to fully meet its intended need. The 22601VIC Course in Design Stand-alone Power Systems and 22600VIC Course in Install Stand-alone Power Systems represents the second and third courses in the suite of new energy technology accredited training, providing further vocational depth for personnel within the renewable energy industry. Upon completion of the 22601VIC Course in Design Stand-alone Power Systems, participants will have the skills and knowledge to: • consult with potential clients regarding energy usage • assess options for appropriate stand-alone power systems • design and propose a customised stand-alone power system to the client Upon completion of the 22600VIC Course in Install Stand-alone Power Systems, participants will have the skills and knowledge to: • safely install the approved stand-alone power system. **Target group/cohort** The cohort targeted for entry into the Course in Design Stand-alone Power Systems are graduates of the 22453VIC Course in New Energy Technology Systems or equivalent competencies. The cohort could be those wanting to design stand-alone power systems. To undertake the VU23206 Design a stand-alone power system the participant does not need to be a licensed electrician.

[3] Clean Energy Council, 2021. Clean Energy Australia Report, (p.17)

[4] Ibid (p.5)

	The cohort targeted for entry into the 22600VIC Course in Install Stand-alone Power Systems are graduates of the 22601VIC Course in Design Stand-alone Power Systems. The cohort could be those wanting to install stand-alone power systems. To undertake the unit VU23207 Install a stand-alone power system the participant must be a holder of an electrician licence (A grade). It is important to note that the actual connection / reconnection to the electricity grid for any new or retrofitted energy generating and battery storage system installation requires the services of a holder of an electrician licence (A grade). **Course consultation and validation process** The need for the courses was originally validated by the former Office of the Victorian Skills Commissioners' Sector Advisory Group for battery storage technology training. The Battery Storage Sector Advisory group industry members comprised: • Clean Energy Council (CEC) • Energy Storage Council (now Smart Energy Council) • Electrical Trades Union (ETU) • National Electrical & Communications Assoc.(NECA) • Energy Safe Victoria (ESV) • Country Fire Authority (CFA) • Metropolitan Fire Brigade (MFB) • Gippsland Solar • VET Electrical Senate • EPIC – Industry Training Board (now Future Energy Skills) A number of activities were undertaken by course developers to support drafting of course content for Project Steering Committee (PSC) validation purposes, these included: • desktop review of relevant reports and publications • consultation with OVSC, VRQA, HES, CMM Engineering, CEC representatives • project steering committee (PSC) meetings • analysis of training product data base **Project steering committee**

	Project steering committee (PSC) members represented the major stakeholders invested in the course and included the following: Shane Clayton (Chair)- - Technical Manager Special Projects – RACV Solar Mick Cullen Executive Officer – Future Energy Skills Alex Newman- Chief Executive Officer – The Centre for U, ETU Sue Sizer- Head of Electrical licensing and training, Energy Safe Victoria Louise Munday- Team Leader, Accreditation and Compliance, Clean Energy Council Robbie Nichols- Technical Team Lead -Installation Integrity, Clean Energy Council Peter Boicovitis- Senior Operational Project Officer – Structural Planning, Country Fire Authority, CFA Steve Attard- Metropolitan Fire Brigade (MFB) In attendance: Teresa Signorello — Course development Susan Fechner — Course development Libby Leetch — PMO Manager, Future Energy Skills These courses: • do not duplicate, by title or coverage, the outcomes of an endorsed training package qualification or skill set • are not a subset of a single training package qualification that could be recognised through one or more statements of attainment or a skill set • do not include units of competency additional to those in a training package qualification that could be recognised through statements of attainment in addition to the qualification • do not comprise units that duplicate units of competency of a training package qualification.
3.2 Review for re-accreditation	Standards 5.1, 5.2, 5.3 and 5.4 AQTF 2021 Standards for Accredited Courses Not applicable. New course accreditation.
4 Course outcomes	

4.1 Qualification level	Standard 5.5 AQTF 2021 Standards for Accredited Courses The Course in Design Stand-alone Power Systems meets industry needs, but does not have the breadth, depth or volume of learning of a qualification. The Course in Install Stand-alone Power Systems meets industry needs, but does not have the breadth, depth or volume of learning of a qualification.
4.2 Foundation skills	Standard 5.6 AQTF 2021 Standards for Accredited Courses The Course in Design Stand-alone Power Systems: Foundation skills applicable to the outcomes of this course are identified in the units of competency. The Course in Install Stand-alone Power Systems: Foundation skills applicable to the outcomes of this course are identified in the units of competency.
4.3 Recognition given to the course **(if applicable)**	Standard 5.7 AQTF 2021 Standards for Accredited Courses Successful attainment of 22601VIC Course in Design Stand-alone Power Systems will enable graduates to apply for CEC Stand-alone Power System (SPS) Design Accreditation. Successful attainment of both 22601VIC Course in Design Stand-alone Power Systems and VU23207 Install a stand-alone power system will enable graduates to apply for CEC Stand-alone Power System Design and Install Accreditation. Note: The Clean Energy Council does not accredit individuals for any extra-low voltage work. All low voltage work (>120V d.c but not exceeding 1500 V d.c or >50V a.c but not exceeding 1000V a.c) must be completed by an appropriately licensed electrical worker in accordance with the relevant Australian Standards and legislation. Note: a period of workplace application may form part of the CEC Accreditations. Further information on CEC accreditations may be found *here.*
4.4 Licensing/regulatory requirements **(if applicable)**	Standard 5.7 AQTF 2021 Standards for Accredited Courses To undertake the VU23207 Install a stand-alone power system unit, you are required to: • hold an Electrician's Licence (A) registered with Energy Safe Victoria, **or**

	• be licensed as per local statutory requirements where the installation is occurring. A licensed electrician must install any electrical equipment that normally operates at a voltage greater than extra low voltage (ELV). This is legislated and governed by the Electricity Safety Act 1998 (The Act).

5 Course rules

Standards 5.8 and 5.9 AQTF 2021 Standards for Accredited courses

5.1 Course structure

To achieve the award of 22601VIC Course in Design Stand-alone Power Systems the learner must successfully complete one unit listed below:

Unit of competency code	Field of Education code (six-digit)	Unit of competency title	Pre-requisite	Nominal hours
Core unit				
VU23206	031399	Design a stand-alone power system	Nil	80
			Total nominal hours	**80**

To achieve the award of 22600VIC Course in Install Stand-alone Power Systems the learner must successfully complete one unit listed below:

Unit of competency code	Field of Education code (six-digit)	Unit of competency title	Pre-requisite	Nominal hours
Core unit				
VU23207	031399	Install a stand-alone power system	VU23206	60
			Total nominal hours	**60**

5.2 Entry requirements	Standard 5.11 AQTF 2021 Standards for Accredited Courses To enter the 22601VIC Course in Design Stand-alone Power Systems, applicants are required to have successfully completed 22453VIC Course in New

	Energy Technology Systems or equivalent competencies. To enter the 22600VIC Course in Install Stand-alone Power Systems, applicants are required to: 1. have successfully completed 22601VIC Course in Design Stand-alone Power Systems 2. hold a current A Grade electrical licence. Note: Any person who is required to install equipment that is fixed-wired into an electrical installation must be licensed to practice in accordance with the requirements of the Victorian Electricity Safety Act 1998 Learners are best equipped to achieve both course outcomes if they have minimum language, literacy and numeracy skills that are equivalent to Level 3 of the ACSF. The ACSF can be accessed from the education department's website available here. *https://www.dese.gov.au/skills-information-training-providers/australian-core-skills-framework* Learners with language, literacy and numeracy skills at a lower level than suggested may require additional support to successfully undertake the course.
6 Assessment	
6.1 Assessment strategy	Standard 5.12 AQTF 2021 Standards for Accredited Courses All assessment, including Recognition of Prior Learning (RPL), must be compliant with the requirements of: • Standard 1 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 4.1 and 4.2 of the VRQA Guidelines for VET Providers, or • the Standards for Registered Training Organisations 2015 (SRTOs), or • the relevant standards and Guidelines for RTOs at the time of assessment. These standards ensure that the assessment strategies meet the requirement of the course. The nature of work undertaken is hands on and practical and therefore the assessment strategies should reflect this. Assessment may be undertaken holistically to integrate a number of units involving practical tasks or projects. Assessment strategies should reflect a range of

	variables, the underpinning skills and knowledge and the assessment requirements specified in each unit. The assessment conditions for the units of competency specifies the conditions under which evidence for assessment must be gathered.
6.2 Assessor competencies	Standard 5.14 AQTF 2021 Standards for Accredited Courses The Course in Design Stand-alone Power Systems and the Course in Install Stand-alone Power Systems both require assessment to be undertaken by a person or persons in accordance with: • Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and Guidelines 3 of the VRQA Guidelines for VET Providers, or • the Standards for Registered Training Organisations 2015 (SRTOs), or • the relevant standards and Guidelines for RTOs at the time of assessment. The Course in Install Stand-alone Power Systems has an additional requirement; assessors must be a holder of an electrical licence (A grade).
7 Delivery	
7.1 Delivery modes	Standard 11 AQTF 2021 Standards for Accredited Courses The courses are 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 may be 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 courses aim to develop competence within the stand-alone 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 analysis

	• practical exercises • projects. Program delivery should allow for self-directed learning and development together with independent judgement and accountability for outputs.
7.2 Resources	Standard 5.14 AQTF 2021 Standards for Accredited Courses Facilities, equipment and other resources required to deliver the Course in Design Stand-alone Power Systems and Course in Install Stand-alone Power Systems include access to: • Stand-alone power system training facilities and equipment, including; o drawing facilities o plant / equipment and components comprising two (2) solar PV stand-alone power system (SPS) o a person representing a 'client' • 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 relevant to solar PV SPS installation tasks • access to plans, drawings and instructions • manufacturer specifications/manuals • workplace environment or simulated workplace environment appropriate to the assessment tasks. Specific resources are identified within each unit of competency comprising each course. The Course in Design Stand-alone Power Systems and the Course in Install Stand-alone Power Systems both require training be undertaken by a person or persons in accordance with: • Standard 1.4 of the AQTF: Essential Conditions and Standards for Initial/Continuing Registration and

	Guideline 3 of the VRQA Guidelines for VET Providers, or • the Standards for Registered Training Organisations 2015 (SRTOs), or • the relevant standards and Guidelines for RTOs at the time of assessment. The Course in Install Stand-alone Power Systems requires trainers to be a holder of an electrical licence (A grade).
8 Pathways and articulation	
	Standard 5.10 AQTF 2021 Standards for Accredited Courses Completion of the 22601VIC Course in Design Stand-alone Power Systems provides a recognised pathway into the 22600VIC Course in Install Stand-alone Power Systems.
9 Ongoing monitoring and evaluation	
	Standard 5.15 AQTF 2021 Standards for Accredited Courses The Curriculum Maintenance Manager for Engineering, is responsible for the ongoing monitoring and evaluation of the 22601VIC Course in Design Stand-alone Power Systems and 22600VIC Course in Install Stand -alone Power Systems. Formal course evaluations will be undertaken halfway through the accreditation period and will be based on student and teacher evaluation surveys and industry stakeholder surveys/consultations. The Victorian Registration and Qualifications Authority (VRQA) will be notified of any significant changes to the course/s resulting from course monitoring and evaluation processes.

Section C—Units of competency

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UNIT CODE		VU23206	
UNIT TITLE		Design a stand-alone power system	
APPLICATION		This unit of competency describes the performance outcomes, skills and knowledge required to design a stand-alone Photo Voltaic (PV) energy system with battery storage (Stand-alone Power System-SPS). It requires the ability to determine client energy requirements, undertake a site analysis, evaluate and select appropriate systems to meet requirements, document and present final system design to client. The work context relates to metropolitan, regional and remote residential applications predominantly, however commercial and industrial environments are equally applicable. It applies to those seeking accreditation as a designer of stand-alone solar PV energy systems with battery storage. Note, communication and agreement from the site owner for the design process to begin precedes this unit outcome. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.	
ELEMENTS		**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. Assessment of performance is to be consistent with the evidence guide.	
1	Determine client's energy requirements	1.1	Clarify designer and client responsibilities with regard to established energy system proposal
		1.2	Explain the advantages and drawbacks of a stand-alone energy system with battery storage to the client
		1.3	Confirm scope, lifecycle, system maintenance and cost of the existing energy system
		1.4	Clarify the client's energy needs, expectations and budget

		1.5	Collect and assess the client's current or proposed energy usage data
		1.6	Calculate full load profile considering maximum demand, surge capacity, power factor, simultaneous loads and days of autonomy
		1.7	Identify and discuss relevant system compliance issues with client
2	Carry out site analysis	2.1	Inspect and assess the proposed system installation site, including PV and battery storage location, and access to internet for system setup and monitoring
		2.2	Identify, record and convey to the client any actual or potential hazards and/or restrictions that may affect the proposed system installation site
		2.3	Ensure that any existing renewable energy system components and related electrical infrastructure are examined by a licensed electrician to determine their condition and compliance to relevant standards and wiring rules for potential use or reuse
3	Select system components to meet output requirements	3.1	Determine and document suitable type and quantity of solar photovoltaic (PV) panels to meet client output requirements, budget and available ground or roof space
		3.2	Research and select suitable type and capacity of charge controller and power conversion equipment (PCE) to manage the anticipated electrical flow rate
		3.3	Determine and specify the appropriate battery type, capacity and quantity for energy storage requirements according to client budget constraints
		3.4	Select energy generation systems where required and determine a suitable location
		3.5	Determine the location, dimensions and specifications of the battery enclosure, including associated signage, to meet relevant Australian Standards, national, state and local regulatory requirements
		3.6	Select system cabling, protection devices, metering and instrumentation requirements to comply with the

			relevant Australian Standards, and the design parameters, and identify their respective locations on site
		3.7	Select stand-alone system power conversion equipment (PCE) to comply with relevant Australian Standard and determine a suitable mounting location
		3.8	Select suitable internet connection and hardware to meet the customer's needs and site conditions for the purpose of remote access for monitoring and software updates.
4	Document system design and present to client	4.1	Prepare layout of the proposed system and provide recommendation of component specifications and related infrastructure
		4.2	Calculate and record cost estimate of the proposed stand-alone system and any alternative component options
		4.3	Document installation considerations, including options for the address any existing and/or potential hazards
		4.4	Present and explain final energy system design to client, including load analysis, components, system size, energy storage capacity, estimated generator runtime, maintenance and layout options
		4.5	Gain approval from the client on energy system design
		4.6	Confirm with the client the requirement for using a licensed electrician to carry out the installation.

Range of Conditions
N/A

FOUNDATION SKILLS

Foundation skills essential to performance in this unit, but not explicit in the performance criteria are listed here.

Skill	**Description**
Communication skills to:	• listen and communicate effectively with client
Reading skills to:	• interpret legislation, standards and codes • interpret manufacturer component information

Numeracy skills to:	• compare energy usage data to system capabilities
Problem-solving skills to:	• determine suitability of existing components to support sustainable reuse
Planning and organising skills to:	• complete work tasks in a logical and efficient sequence
Digital literacy skills to:	• use search engines to research energy system related information

UNIT MAPPING INFORMATION	New unit, no equivalent unit

Assessment Requirements Template

TITLE *Mandatory field*	Assessment Requirements for VU23206 Design a stand-alone power system
PERFORMANCE EVIDENCE *Mandatory field*	A person who demonstrates competency in this unit must be able to provide evidence of two solar PV SPS designs: 1. one(1)infrequently used building such as a small holiday cabin 2. one(1)continually used building such as a commercial premises or occupied family home. In so doing they must: • assess the site's suitability for the installation of a stand-alone solar PV energy system with battery storage • design and present a stand-alone solar PV energy system with battery storage which meets: – client's energy requirements, and budget – relevant Australian Standards – electrical regulations and codes of practice.
KNOWLEDGE EVIDENCE *Mandatory field*	The learner must be able to demonstrate essential knowledge required to effectively perform the task outlined in elements and performance criteria of this unit, manage the task and manage contingencies in the context of the work role. This includes knowledge of: • Australian Standards - AS/NZS 3000, AS 4509 series, AS/NZS 5033, AS/NZS 5139, AS/NSZ 3008, AS 3011 series, IEC 60038, AS 2676, AS/NZS 1170, AS/NZS 3010, AS/NZS 4777 series or updated equivalent standards • Electricity Safety Act 1998 • Renewable Energy Act 2001 • Occupational Health and Safety Regulations 2017 • Electricity Safety (General) Regulations 2019 • AS/NZS 4836 Safe working on or near low-voltage electrical installations and equipment. • Energy Safe Victoria (ESV) and Essential Services Commission (ESC) obligations • Clean Energy Council (CEC) and Energy Storage Council (ESC) guidelines • Types of energy generation systems: – photovoltaic (PV)

	– wind – micro hydro – backup generator • Advantages and drawbacks of a stand-alone energy system: – Advantages: o presents a viable option where mains electricity is not available o can be cheaper than connecting to the grid in more remote locations o negates the need to purchase electricity (and pay connection fees) from a retail supplier o off-grid solar systems can be designed to power single items only such as water pumps, large appliances and solar hot water systems – Drawbacks: o higher maintenance than grid-connected systems and relatively expensive to set up o more electrical components, so there's more potential for faults o requires specialist expert design and installation • Features of stand-alone system design and layout: – site assessment including: o roof space/profile/tilt o ground space/surface quality o access o existing and/or potential hazards o compatibility of any existing renewable energy components o safety hazards – system sizing calculations including: o load and generation estimates o tools for estimating renewable energy generation o days of autonomy o depth of battery discharge – system key equipment including: o types and performance of solar panels o types and features of charge controllers o types, capacity and features of PCE o back-up generator options

	– battery technology including: o types and classifications o life cycle o hazards and safety issues o accommodation/enclosure and labelling requirements o building code requirements o charge control mechanism and PCE o electrical infrastructure, cabling and metering o system installation requirements • system components and installation costs • general range of energy systems in use and trending into the future • site features conducive to compliant energy system and battery storage positioning • hazards and risks associated with site selection options, including: – site access – available space for solar array – roof mounted PV array: o roofing material / condition o roof orientation o roof angle o roof obstructions / shading – ground mounted PV array: o amount of level surface o surface quality o surface drainage o surface obstruction / shading – cable sizing and distances for connection to equipment including data access – available space for: o batteries and enclosure location o back-up generator – overhead, underground services or nearby obstructions – awareness of asbestos containing material (ACM), reporting and management processes – arc flash considerations • communications requirements for system setup and monitoring in remote locations:

	– internet OR – radio OR – satellite for upgrades of software/firmware, remote access for installer/manufacturer and customer access for performance monitoring • designer and client relationship building including: – principles of effective communication – client's expectation of a design service – system designer's responsibilities • costing of a design service • sustainability principles to support reuse practices • mathematical formulas to facilitate load calculations and data comparisons • energy system compliance requirements and common issues • sources of product information • relevant electrical principles • signage requirements of energy systems and battery storage enclosures • electrical drawings and diagrams requirements for licensed and accredited personnel for energy system installation • completion of risk assessment (requirement in AS/NZS 5139 Section3) • information provision to support compliant system documentation as per Australian standards and industry guidelines
ASSESSMENT CONDITIONS *Mandatory field*	Skills in this unit must be demonstrated in a workplace or simulated environment where the conditions replicate the design of stand-alone power systems. Simulated assessment environments must model the real-life working environment where these skills and knowledge would be performed, with all the relevant equipment and resources of that working environment. Students must have access to suitable facilities, resources and equipment including: • Australian Standards, electrical regulations, codes, renewable energy guidelines • drawing facilities • relevant renewable energy equipment manuals / specifications • electrical appliance energy usage information

	• a person representing a 'client'. Assessors of this unit must satisfy the requirements for assessors in applicable vocational education and training legislation, frameworks and/or standards. No other specialist vocational competency requirements for assessors apply to this unit.

UNIT CODE		VU23207	
UNIT TITLE		Install a stand-alone power system	
APPLICATION		This unit of competency describes the performance outcomes, skills and knowledge required to install a stand-alone Photo Voltaic (PV) energy system with battery storage (Stand-alone Power System-SPS) according to client approved design. It requires the ability to determine job requirements, prepare and install energy systems and battery storage and finalise work processes. The work context relates to metropolitan, regional and remote residential applications predominantly, however commercial and industrial environments are equally applicable. It applies to those seeking accreditation as an installer of stand-alone PV (solar) energy systems with battery storage, commonly referred to as 'off-grid systems'. Licensing, legislative, regulatory or certification requirements may apply to this unit. Refer to relevant State / Territory regulator for guidance.	
PREREQUISITE UNIT(S)		VU23206 Design a stand-alone power system	
ELEMENTS		**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. Assessment of performance is to be consistent with the evidence guide.	
1	Determine job requirements	1.1	Confirm energy system design requirements with client /site owner
		1.2	Review site and compare for appropriateness with system design layout requirements
		1.3	Access additional data or information required for the design brief, including the risks of potential product damage through transportation within the site
		1.4	Confirm proposed installation location and configuration are compliant to all relevant Australian Standards, Regulations, Clean Energy Council Guidelines and manufacturer's installation requirements

		1.5	Notify client and designer of any anomalies identified between planned installation location and product type, to actual installation location and customer requirements
		1.6	Clarify and confirm final energy system installation location and product details with client to ensure compliance with approved energy system design and job specification
		1.7	Discuss and prepare the final design brief with client to confirm system requirement meets client energy needs
		1.8	Determine applicable occupational health and safety (OHS) / work health and safety (WHS) requirements, in accordance with safe work method statement (SWMS) and relevant workplace policies
2	Prepare to undertake installation	2.1	Select and dress in appropriate personal protective equipment (PPE) ensuring all items are secure and intact, as per workplace safety regulations
		2.2	Determine need for roof access to erect a safety system according to roof type / material or safety requirements for ground mount systems and regulatory and manufacturers specifications, where required
		2.3	Identify the existence of any asbestos materials and manage in accordance with organisational, OHS / WHS and regulatory requirements
		2.4	Analyse and mitigate risk of potential product damage through the use of appropriate transportation methods
		2.5	Select materials, tools and equipment for energy system installation task, according to job specification
		2.6	Review sequence of energy system installation task and assemble materials, tools, equipment and energy system and battery storage product elements for efficient access and use
3	Install energy system and battery storage	3.1	Measure and mark location and positioning of energy system components to meet standards and client needs

		3.2	Safely install components in sequence according to system design documentation, relevant Australian standards, Regulations, Clean Energy Council Guidelines and manufacturer's installation requirements
		3.3	Programme system charge controllers and inverters in accordance with system design documentation, relevant Australian standards, Regulations, Clean Energy Council Guidelines and manufacturer's installation requirements
		3.4	Test and commission system using checklist in accordance with relevant Australian standards, Regulations, Clean Energy Council Guidelines and manufacturer's installation requirements, including documenting and rectifying any faults
		3.5	Run system to confirm correct operation of all components including testing shutdown procedure
4	Complete work processes	4.1	Contain, label and store materials for reuse, or dispose of waste materials, in accordance with environmental requirements, legislation, such as regulations/codes of practice and workplace procedures
		4.2	Clean tools and equipment and check for serviceability in accordance with manufacturers' recommendations and standard workplace procedures
		4.3	Clean and tidy work area to ensure space is free of waste that may cause harm to self and others, in accordance with OHS /WHS regulations
		4.4	Dismantle safety system according to regulations and manufacturers specifications, where required
		4.5	Remove and/or dispose of PPE, according to OHS/WHS regulations
		4.6	Supply all required certification documentation according to local regulatory requirements
		4.7	Update client user and maintenance manuals to show as-installed information including component and software settings
		4.8	Supply client with the required operating and monitoring system software/hardware including

			shutdown procedures, maintenance manuals and emergency contact information
		4.9	Demonstrate correct system operation to client, such as actions to take under a fault and/or an emergency situation including use of supporting information
		4.10	Confirm client satisfaction with completed energy system installation according to final design brief and contract obligations

Range of Conditions
N/A

FOUNDATION SKILLS

Foundation skills essential to performance in this unit, but not explicit in the performance criteria are listed here.

Skill	**Description**
Reading skills to:	• interpret energy system design and job specification • interpret product information and material data sheet • interpret OHS / WHS, SWMS and other relevant workplace procedures
Technology skills to:	• use and maintain tools safely

UNIT MAPPING INFORMATION	New unit, no equivalent unit

Assessment Requirements Template

TITLE *Mandatory field*	Assessment Requirements for VU23207 Install a stand-alone power system
PERFORMANCE EVIDENCE *Mandatory field*	A person who demonstrates competency in this unit must be able to provide evidence of the ability to: • read, interpret and apply information for solar PV stand-alone power (SPS) installation operations • comply with appropriate workplace procedures, Australian standards and safety regulations related to solar PV SPS product installation • position and install, to workplace quality standards: – two (2) different solar PV SPS that must incorporate: o varying loads o simultaneous loads o alternate generation sources Each solar PV SPS must be applied to the following context: • one (1) infrequently used building such as a small holiday cabin • one (1) continually used building such as commercial premises or occupied family home.
KNOWLEDGE EVIDENCE *Mandatory field*	The learner must be able to demonstrate essential knowledge required to effectively perform the task outlined in elements and performance criteria of this unit, manage the task and manage contingencies in the context of the work role. This includes knowledge of: • terminology used for stand-alone battery energy storage system installation including nominal voltage, cell, primary and secondary cells, charge and discharge rate, bulk charge, absorption charge, float charge, equalisation charge, amp hour capacity, watt hour capacity, state of charge (SOC), depth of discharge (DOD). • basic work planning principles • workplace sustainability principles • communication principles • common mathematical formula /calculation • roof types and material including: – pitched – curved – flat – metal

	– concrete with asbestos – tile – slate – shingles • battery energy storage system types, applications, maintenance and testing requirements • communications requirements for system setup and monitoring in remote locations: – internet OR – radio OR – satellite for upgrades of software/firmware, remote access for installer / manufacturer and customer access for performance monitoring • purpose, features and limitations of battery energy storage system components: – batteries – inverters – charge controllers – switching devices – programming software for inverters and charge controllers – interconnecting devices – protection and isolating devices – switchboards – cables and terminations – generators – signage • appropriateness of location and component positioning • functional block diagrams and plans for typical configurations • electrical principles concerning voltage, earthing, protection devices, AC loads, AC/DC current ratings, isolation, switching and metering • electrical drawings and circuit diagrams for typical stand-alone SPSs • charge controller output ratings • differences between multimode and grid connected inverters • multimode inverter output ratings, in relation to required maximum demand and capacity for battery storage

	• battery storage and safety • identification and protection of potential fault currents (PV and battery) • factors affecting battery life • suitable charging regimes for battery types • common causes of battery failure including sulphation and stratification in lead acid batteries • petrol / diesel generator types and interconnection • installation and testing tools and equipment: – types o measuring equipment o testing equipment o multimeter o insulation resistance and continuity tester o independent earth stake and lead o stud finder o insulated hand tools o insulated socket set o torque wrench o crimping tolls for connectors and lugs o tape o sealant o silicon gun o drill o grinder o internet connected device (e.g. lap top, iPAD,smart phone to programme equipment and download specifications, operating manuals, software) – usage methods and maintenance • SPS systems installations: – installing SPS systems in accordance with system design documentation, relevant industry standards, regulations, Clean Energy Council Guidelines and manufacturer requirements – installing inverters suitable for SPS systems in accordance with system design documentation, relevant industry standards, regulations, Clean Energy Council Guidelines and manufacturer requirements

	– installing charge controllers in accordance with system design documentation, relevant industry standards, regulations, Clean Energy Council Guidelines and manufacturer requirements – installing all balance of system equipment in accordance with system design documentation, relevant industry standards, regulations, Clean Energy Council Guidelines and manufacturer requirements • common faults associated with materials, tools and equipment • sources of data / information for system components • common types of product damage caused by transportation • efficient work processes, including product transportation methods • hazardous material types (including asbestos and asbestos containing material) • relevant OHS / WHS regulations, policies and codes of practice concerning manual handling, PPE, working at heights, fall protection and drop zone permits, electrical safety, enclosed spaces, hazardous substances (including asbestos), temporary structural supports, material storage methods, material disposal • types of PPE including: – fire rated protective clothing – safety glasses – gloves – ear muffs – dust mask – foot wear • types of safety systems including: – roof rails – scaffolding – edge protection – harness / work positioning systems • preparation requirements prior to installation • energy system installation methods • reporting processes (faults with materials, tools and equipment, processes and emergencies) • organisational safety policies and procedures • organisational insurance requirements • material safety management systems

	• workplace document location and types including: – design brief – job specification – technical site plan – testing and commissioning sheets – Material Data Sheets – Safe Work Method Statement – manufacturer installation manuals • relevant industry standards and guidelines • fault finding procedures for components and their interconnection • testing and commissioning procedures including: – safe testing of equipment – safe testing of system operation – commissioning of stand-alone system – stand-alone systems maintenance procedures
ASSESSMENT CONDITIONS *Mandatory field*	Skills in this unit must be demonstrated in a simulated environment where the conditions replicate the installation of stand-alone power systems. Simulated assessment environments must model the real-life working environment where these skills and knowledge would be performed, with all the relevant equipment and resources of that working environment. Students must have access to suitable facilities, resources and equipment including: • plant / equipment and components comprising two (2) solar PV stand-alone power system (SPS) • tools, materials and equipment relevant to solar PV SPS installation tasks • documentation including job plans and product specifications and manuals, job safety analysis (JSA), safe work method statement (SWMS), safety data sheets (SDS), technical data site plans, testing and commissioning sheets, and industry standards • a person representing a 'client'. Assessors of this unit must satisfy the requirements for assessors in applicable vocational education and training legislation, frameworks and/or standards. Assessors must be a holder of an electrician licence (A grade).