



Australian Government

UEERE5001 Design battery storage systems for grid-connected photovoltaic systems

Release: 1

UEERE5001 Design battery storage systems for grid-connected photovoltaic systems

Modification History

Release 1. New unit of competency.

Application

This unit involves the skills and knowledge required to design battery storage systems for grid-connected photovoltaic (PV) systems.

This unit applies to a person with a sound knowledge of the components and different system configurations of battery storage systems for grid-connected PV systems and suitable energy management strategies that can be applied to the site where a system can be installed.

A person competent in this unit will be able to design a system, which includes calculating and selecting the correct sized equipment so the system output performance meets the client specific requirements within the guidelines of relevant industry standards, regulations and manufacturer requirements.

The unit involves designing a system taking into consideration all necessary work health and safety requirements relevant for the selected system and documenting the design including all calculations, equipment specifications and layouts.

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

Pre-requisite Unit

UEENEEK135A Design grid connected photovoltaic power supply systems

Competency Field

Renewable and Sustainable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

Elements describe the essential outcomes.

Performance criteria describe the performance needed to demonstrate achievement of the element.

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|---|-------------|--|
| 1 Plan the design of battery storage systems for grid-connected photovoltaic systems | 1.1 | Available components are identified and the different system configurations are applied to system design planning |
| | 1.2 | Hazards associated with battery storage systems for grid-connected PV systems are determined and appropriate risk control measures are developed |
| | 1.3 | Electrical load/s to be supplied from the battery storage system are identified |
| | 1.4 | Energy assessments are undertaken using appropriate tools including data logging tools and/or energy assessment forms |
| | 1.5 | Site is assessed to determine feasibility, equipment location and any required switchboard modification |
| | 1.6 | Energy management strategies are applied to produce an energy management plan |
| | 1.7 | Relevant industry standards, building codes, regulations and manufacturer requirements are applied to system design planning |
| | 1.8 | Relevant electricity tariffs are incorporated in the system design |
| | 1.9 | Solar resource data is applied in the system design |
| | 1.10 | Client situation, budget and desired outcomes are incorporated in the system design |
| 2 Design battery storage systems for grid-connected photovoltaic systems | 2.1 | Suitable system configurations are selected to meet client requirements |
| | 2.2 | System efficiencies are applied to system designs and overall system yield for different system configurations is determined |
| | 2.3 | Type and capacity of inverter/s to meet performance requirements are determined |
| | 2.4 | Type and capacity of battery storage to meet performance requirements are determined |
| | 2.5 | Type and capacity of charge controller/s to meet performance requirements are determined |

	2.6	Capacity of PV array to meet performance requirements is determined
	2.7	Merits of alternate configurations including maintenance requirements are analysed and the most appropriate system design is selected
	2.8	Location of each item of equipment is determined
	2.9	Size of cables and ratings of protection and isolations devices are determined
3 Document the design of battery storage systems for grid-connected photovoltaic systems	3.1	Identified hazards are listed and appropriate risk control methods are specified
	3.2	Required items of equipment and system components are identified and listed
	3.3	System operating parameters are specified
	3.4	Electrical systems schematic/s and equipment location plan/s, inclusive of signage, are produced
	3.5	System cost and performance are documented
	3.6	Maintenance, client and installer documentation are produced

Foundation Skills

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

Range is restricted to essential operating conditions and any other variables essential to the work environment.

Non-essential conditions can be found in the Companion Volume Implementation Guide.

Unit Mapping Information

This is a new unit – no equivalent unit.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b8a8f136-5421-4ce1-92e0-2b50341431b6>

Assessment Requirements for UEERE5001 Design battery storage systems for grid-connected photovoltaic systems

Modification History

Not applicable.

Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria on at least two separate occasions and include:

- applying work health and safety (WHS)/occupational health and safety (OHS) policy, work procedures and instructions
- ascertaining and documenting system requirements including:
 - 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
- designing the system including:
 - analysing, reviewing and selecting configuration to meet performance requirements
 - assessing the photovoltaic (PV) array capacity to meet performance requirements
 - determining location of equipment
 - determining sub-system efficiencies
 - determining suitable configuration/s
 - drawing the suitable configuration/s
 - selecting and sizing cables, protection and isolation devices
 - selecting type and capacity of inverter/s, including programming of 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 of parameters to meet performance requirements
- documenting the system design including:

- compiling client documentation
- compiling installer documentation
- preparing electrical system schematic and equipment location plan
- specifying equipment including signage
- specifying system budget and performance including battery storage capacity and PV yield
- specifying maintenance requirements.

Knowledge Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements and performance criteria and include knowledge of:

- batteries including:
 - meaning of the terms that define aspects of batteries including:
 - amp hour capacity
 - battery
 - cell
 - charge and discharge rate
 - depth of discharge (DOD)
 - nominal voltage
 - primary and secondary cells
 - state of charge (SOC)
 - watt hour capacity
 - major features of commercially available types of batteries suitable for battery storage systems for grid-connected PV 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 PV systems including:
 - applications for battery storage including:
 - electrical energy supply direct to loads during periods of high tariffs
 - electrical energy supply during grid outages
 - drivers of grid-connected battery storage
 - purpose of each component in a battery storage system for grid-connected PV system
 - functional block diagrams for typical configurations of battery storage systems for grid-connected PV systems including:
 - multimode inverter/s for connecting to renewable energy, grid, loads and battery storage; this inverter/s provide backup to dedicated loads on grid failure and may:
 - have a built in charge controller for direct connection of a PV array or
 - require a separate charge controller to direct current (DC) couple the PV array and battery
 - two types of inverters comprising, photovoltaic grid-connected inverters and multimode inverters where:
 - both inverter types are connected to the grid and loads via a switching device that provides backup to dedicated loads during grid failure
 - both inverter types are connected to the grid and only the multimode inverter/s provide backup to dedicated loads on grid failure
 - only the multimode inverter/s are connected to the grid; the grid-connected inverter/s are alternating current (AC) coupled to the multimode inverter/s and both types can provide backup to dedicated loads on grid failure
- charge controllers including:
 - types and applications of charge controllers within the various system configurations
 - specifications of a charge controller including:
 - DC current rating in and out
 - DC voltage operating window and/or rating
 - efficiency
 - output rating
- diagrams including:
 - electrical schematics of battery storage systems for grid-connected PV systems including modifications to switchboard to cater for specified loads
 - site diagrams to show the locations of equipment, fittings and cabling
- energy management strategies and/or energy source switching options to reduce the maximum and surge demand, based on load profile analysis
- inverters including:

- 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 including:
 - maintenance schedule for battery storage systems for grid-connected PV systems
 - specification of the installation and maintenance requirements for battery storage systems for grid-connected PV systems taking into consideration safety and relevant industry standards, regulations and manufacturer requirements
- system design including:
 - determining the system yield/performance, equipment costs, maintenance requirements, budget and overall life-cycle costs
 - relationship between the system components:
 - PV array, 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.

Assessment Conditions

As a minimum, assessors must satisfy applicable regulatory requirements, which include requirements in the Standards for Registered Training Organisations, current at the time of assessment.

As a minimum, assessment must satisfy applicable regulatory requirements, which include requirements in the Standards for Registered Training Organisations, current at the time of assessment.

Assessment must occur in workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated workplace operational situations that replicate workplace conditions.

Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

Resources for assessment must include access to:

- relevant industry standards
- relevant industry product standards
- AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- applicable documentation including:
 - energy assessment forms
 - examples of typical client requirements and site specific details
 - manufacturer technical information including:
 - data sheets, installation manuals and user guides
 - block of systems configurations and circuit diagrams
 - relevant industry standards and regulations
 - solar resource data and electricity tariffs.

Assessment must include the design of battery storage systems for grid-connected PV systems that meet the specific requirements of the client within the guidelines of relevant Australian Standards, including designs for new and retrofit installations.

Links

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