



Australian Government

UEERE0028 Design hybrid renewable power systems

Release: 1

UEERE0028 Design hybrid renewable power systems

Modification History

Release 1. This is the first release of this unit of competency in the UEE Electrotechnology Training Package.

Application

This unit involves the skills and knowledge required to design a hybrid renewable power system and its installation.

It includes determining and developing hybrid power systems design, following design briefs, documenting design calculations and criteria, and obtaining approval for hybrid renewable power system design.

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

Pre-requisite Unit

UEERE0046 Solve problems in stand-alone renewable energy systems

Competency Field

Renewable Energy

Unit Sector

Electrotechnology

Elements and Performance Criteria

ELEMENTS

Elements describe the essential outcomes.

1 Prepare to design hybrid renewable power system

PERFORMANCE CRITERIA

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

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|------------|---|
| 1.1 | Work health and safety (WHS)/occupational health and safety (OHS) processes and workplace procedures for a given work area are identified, obtained and applied |
| 1.2 | Scope of the system is determined from design brief |

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|----------|---|---|
| | 1.3 | Safety and other regulatory requirements to which the renewable power system installation must comply are identified and applied |
| | 1.4 | Design development work is planned to meet scheduled timelines in consultation with relevant person/s involved in the hybrid power system installation or associated work |
| 2 | Develop hybrid renewable power system design | |
| | 2.1 | Hybrid renewable power system performance standards and compliance methods are applied to the design |
| | 2.2 | Alternative hybrid renewable power system designs are considered in accordance with the design brief |
| | 2.3 | Safety, functionality and budgetary considerations are incorporated in the hybrid renewable power system design |
| | 2.4 | Hybrid renewable power system design is drafted and checked for compliance with the design brief and regulatory requirements |
| | 2.5 | Hybrid renewable power system design is documented for submission to relevant person/s for acceptance and approval |
| | 2.6 | Unplanned situations are dealt with safely and effectively in accordance with workplace procedures |
| 3 | Obtain design approval for hybrid renewable power system | |
| | 3.1 | Hybrid renewable power system design is presented for approval and any issues clarified with client representative and/or relevant person/s |
| | 3.2 | Requests for alterations to the design are negotiated with relevant person/s within the constraints of workplace policies |
| | 3.3 | Final design is documented and approval obtained from relevant person/s |
| | 3.4 | Quality of work is monitored in accordance with relevant performance agreement and/or workplace procedures or industry standards |

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 may be found in the UEE Electrotechnology Training Package Companion Volume Implementation Guide.

Designing hybrid renewable power systems must include at least the following:

- two different hybrid renewable power system designs using different technologies

Unit Mapping Information

This unit replaces and is equivalent to UEENEEK133A Design hybrid renewable power systems.

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 UEERE0028 Design hybrid renewable power systems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy all of the requirements of the elements, performance criteria and range of conditions on at least one occasion and include:

- developing outlines of alternative designs
- developing the design within the safety and functional requirements and budget limitations
- documenting and presenting design effectively
- successfully negotiating design alteration requests
- obtaining approval for final design
- dealing with unplanned events
- applying relevant work health and safety (WHS)/occupational health and safety (OHS) requirements, including:
 - implementing workplace procedures and practices
 - using risk control measures
- applying sustainable energy principles and practices when designing hybrid renewable power system
- designing hybrid renewable power system
- preparing to design hybrid power system in accordance with design brief.

Knowledge Evidence

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

- hybrid energy systems, including:
 - energy demand encompassing:
 - end-use services and energy demand for each service
 - most appropriate energy sources for each energy service for a given application and location, taking into consideration economic, environmental and client requirements
 - greenhouse gas savings from a hybrid energy system compared to an existing non-hybrid system, resulting from energy source switching and reduction in fuel usage
 - daily load profiles illustrating average demand and maximum demand, based on time

- of use data for all electrical loads
- daily load profiles based on given load data, with consideration of likely variations in usage patterns
- load management strategies and or energy source switching options to reduce the maximum and surge demand, based on load profile analysis
- load profile using alternating current (a.c.) power logging equipment
- daily load profiles illustrating average demand and maximum demand, based on time of use data for all electrical loads
- hybrid energy system operation encompassing:
 - definition of the terms complementarily (in relation to renewable energy (RE) resources)
 - availability
 - advantages and disadvantages of hybrid energy systems
 - major features of typical system configurations, including pure renewables, renewables and genset, series, switched and parallel (including those with nominal daily genset running)
 - operation of a hybrid system over the short term (e.g. daily) and long term (e.g. seasonal and annual)
 - response of a genset to a step change in load, and to an overload condition
 - calculations relating to real and apparent power, power factor, mechanical power, voltage regulation and speed droop for single and three phase gensets
 - calculation of the average efficiency of a genset supplying a given daily load profile, given genset efficiency vs. load data
- system design encompassing:
 - system design criteria in consultation with a client
 - RE resources available at a site through the use of on-site measurements and pre-existing weather data as appropriate
 - selection of a suitable hybrid power system configuration
 - selection and sizing of suitable RE generators for a hybrid energy system taking into consideration available RE resources and daily and seasonal load profiles consistent with AS/NZS 4509.2 Stand-alone power systems – System design
 - analysis of load data to determine preferred time of day for genset running, and required energy storage in a parallel hybrid system
 - selection and sizing of a suitable genset for any system configuration, including a parallel system, according to AS/NZS 4509.2 Stand-alone power systems – System design
 - selection and sizing of suitable balance-of-system components for a hybrid energy system, including energy storage, controls and inverters consistent with AS/NZS 4509.2 Stand-alone power systems – System design
 - selection and sizing of a battery bank to meet both energy and maximum power demands in a parallel hybrid system, using an appropriate battery discharge rate and considering load data and genset running times
 - selection of an inverter for a parallel hybrid system, considering load data, genset

- running times and battery charging requirement
- selection and sizing of suitable internal combustion generators (genset) for a hybrid energy system taking into consideration genset characteristics and de-rating requirements
- performance of the system given load data, resource data, equipment specifications, configuration and control strategy
- calculation of the load fraction contributed from each renewable energy generator and from the genset
- calculation of the genset run time and fuel usage
- optimisation of the system design based on a mix of design criteria such as cost, availability and reliability, maintenance, environmental factors and convenience
- system manual according to AS/NZS 4509.3 Stand-alone power systems – Installation and maintenance and AS/NZS 4509.2 Stand-alone power systems – System design, given system components and design data
- life cycle costing encompassing:
 - present worth of a future payment
 - major costs in the life cycle of a hybrid energy system to be considered in life cycle costing
 - selection of an appropriate discount rate, inflation rates, and life cycle for a hybrid system life cycle cost analysis
 - life cycle cost analysis, including the cost of finance and tax savings for a hybrid system using computer software
 - most cost-effective of a number of hybrid energy system options on the basis of life cycle costing analysis according to AS/NZS 4536 Life cycle costing, AS 3595 or similar standards
 - comparison of the capital cost, simple payback time and life cycle cost of a hybrid energy system with another energy supply option, according to AS/NZS 4536 Life cycle costing, AS 3595 or similar standards
 - sensitivity analysis of life cycle costing to variations in discount rate or other major parameters
- installation, commissioning and maintenance encompassing:
 - specification of the installation and maintenance requirements for a complete hybrid energy system taking into consideration safety and relevant Australian Standards
 - installation requirements for fuel storage for a given genset in accordance with AS 1940 The storage and handling of flammable and combustible liquids, AS/NZS 4509 Stand-alone power systems, and local regulations
 - considerations involved in providing adequate genset vibration isolation
 - considerations involved in providing a genset exhaust system suitable for a given genset and installation site
 - major considerations and methods used in providing suitable noise attenuation for a genset installation
 - specification of the physical accommodation requirements for a given genset to provide adequate air flow and noise attenuation, with due regard for safety, maintenance access, and in accordance with AS/NZS 3010 Electrical installations and

AS/NZS 4509 Stand-alone power systems

- methods used to allow extended service intervals for gensets
- main features of engine protection systems commonly used on small gensets and the genset sizes to which these are applicable
- installation and commissioning work on a small genset and controller observing relevant WHS/OHS guidelines
- symptoms of common genset faults
- basic fault location and rectification on a genset with the aid of troubleshooting guides or flowcharts
- symptoms, causes and possible solutions for the phenomenon of hunting
- maintenance schedule for a hybrid power system
- data communications encompassing:
 - typical applications of data communications in RE systems
 - different types of cables and connectors used in data communications between electronic devices and computers
 - commonly used protocols used for serial data communications
 - different communications ports on palmtop, laptop or desktop computers
 - correction of an electronic device (e.g. inverter or charge controller) to a computer directly, and via modems and telephony network, using appropriate cabling, connectors and computer ports
 - dial-up connection from a computer to a remote electronic device, such as an interactive inverter
 - standard terminal program or proprietary communications software to send to and receive data from an electronic device
 - programming and retrieving data from an interactive inverter via a computer and data communications link
 - logged data downloaded from an interactive inverter
- data-logging encompassing:
 - general features and operation of on-site and remote data logging systems for monitoring and control of a hybrid energy system
 - logger programming, data downloading, display and interpretation of the results
- interactive inverters encompassing:
 - main features of different devices commonly used as controllers in hybrid energy systems
 - function and operation of an interactive inverter
 - system control philosophies used in different interactive inverters
 - program parameters for an interactive inverter, as required for the correct operation of a parallel hybrid system given system component details, load data and preferred genset running times
 - appropriate charging regime for the system battery, based on manufacturer's data and system operating conditions
 - programming an interactive inverter through its front panel interface

- function, operation and major features of a genset controller and how it interfaces with a system controller such as an interactive inverter
- relevant job safety assessments or risk mitigation processes
- relevant manufacturer specifications
- relevant WHS/OHS legislated requirements
- relevant workplace documentation
- relevant workplace policies and procedures.

Assessment Conditions

Assessors must hold credentials specified within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must satisfy the Principles of Assessment and Rules of Evidence and all regulatory requirements included within the Standards for Registered Training Organisations current at the time of assessment.

Assessment must occur in suitable workplace operational situations where it is appropriate to do so; where this is not appropriate, assessment must occur in simulated suitable 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:

- a range of relevant exercises, case studies and/or simulations
- relevant and appropriate materials, tools, facilities and equipment currently used in industry
- resources that reflect current industry practices in relation to designing hybrid renewable power systems
- applicable documentation, including workplace procedures, equipment specifications, regulations, codes of practice and operation manuals.

Links

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