Title	**Demonstrate knowledge of maintenance and reliability of wind turbines**		
Level	**4**	**Credits**	**10**

Purpose	People credited with this unit standard are able to demonstrate knowledge of: maintenance and reliability principles of wind turbines, equipment failure mechanisms, and activities involved in wind turbine maintenance and testing.

Classification	Electricity Supply > Electricity Supply - Power System Maintenance

Available grade	Achieved

Guidance Information

1 Evidence presented for assessment against this unit standard must be consistent with safe working practices and be in accordance with applicable legislative and industry requirements.

2 Legislation, regulations and/or industry standards relevant to this unit standard include but are not limited to the current version of the Health and Safety at Work Act 2015; Electricity Act 1992; Electricity (Safety) Regulations 2010; and any subsequent amendments and replacements; Electricity supply industry codes of practice and documented enterprise procedures, including *Safety Manual – Electricity Industry* (2015) available from www.eea.co.nz.

3 Definitions
Asset owner refers to a participant who owns or operates assets used for generating or conveying electricity.
FMECA – Failure Mode Effects and Criticality Analysis.
HAZOPS – Hazard and Operability Study. A structured and systematic examination of a process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment or prevent efficient operation.
Industry requirements include all asset owner requirements; manufacturers' specifications; and enterprise requirements which cover the documented workplace policies, procedures, specifications, business, and quality management requirements relevant to the workplace in which assessment is carried out.
Non-destructive testing – the examination of materials and components in a way that doesn't change or destroy their characteristics or usefulness.
RCFA – Root Cause Failure Analysis.
RCM – Reliability Centred Maintenance. A systematic and structured process to develop an efficient and effective maintenance plan for an asset. The process aims to minimize the probability of failures, ensure safety, and meet operational objectives.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of maintenance and reliability principles of wind turbines.

Performance criteria

1.1 The concepts of maintainability and reliability, and their significance to the successful operation of a wind farm, are explained.

1.2 The key steps in the RCM process are explained in accordance with a recognised methodology.

Range key steps – FMECA, structured decision making, maintenance task analysis.

1.3 The purpose and benefits of RCFA and HAZOPS are explained in the context of a continuous maintenance improvement programme.

1.4 Key performance indicators used to measure wind turbine reliability are identified and their use explained.

Range evidence of three performance indicators is required.

Outcome 2

Demonstrate knowledge of equipment failure mechanisms.

Performance criteria

2.1 Failure patterns are described with the aid of sketches of probability of failure versus time which are sketched by the candidate.

Range patterns – bathtub, age-related, random.

2.2 Wear processes are described with reference to the cause of wear and where it may typically occur.

Range wear processes include but are not limited to – adhesion, abrasion, fretting, erosion, corrosion, surface fatigue.

Outcome 3

Demonstrate knowledge of activities involved in wind turbine maintenance and testing.

Performance criteria

3.1 Typical maintenance planning, scheduling, and shutdown activities are identified and explained for a range of maintenance approaches.

Range approaches include – reactive, planned, preventative, predictive, proactive, statistical control based, condition monitored, on condition.

3.2 Implications of approaches to maintenance of wind turbines are explained, using examples of practical situations.

Range approaches include – reactive, planned, preventative, predictive, proactive, statistical control based, condition monitored, on condition.

3.3 Mechanical and hydraulic maintenance activities are explained, and approaches compared according to turbine type and downtime considerations.

Range activities include – cleaning, servicing, adjusting, monitoring.

3.4 Electrical maintenance activities are explained, and approaches compared according to turbine type and downtime considerations

Range activities – cleaning, servicing, adjusting, monitoring.

3.5 Condition monitoring techniques are described in terms of purpose, monitoring instrument principle, and application in a maintenance programme.

Range techniques include – visual inspection, vibration analysis, oil sampling, infrared thermal imaging.

3.6 Methods of non-destructive testing are described in terms of their capabilities and limitations.

Range methods include – visual inspection, liquid penetrant, acoustic emission, magnetic particle, eddy current, ultrasonic, radiographic (x-ray).

Planned review date	31 December 2026

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	29 April 2021	N/A

Consent and Moderation Requirements (CMR) reference	0101

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Comments on this unit standard

Please contact Connexis - Infrastructure Industry Training Organisation qualifications@connexis.org.nz if you wish to suggest changes to the content of this unit standard.