Guideline: Maximum Temperature for Transmission Connected Generating Systems

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Version	Effective Date	Summary of Changes
1.0	18 January 2023	First version developed in accordance with clause 3A.1.5 of the WEM Rules

Contents

1. Introduction

1.1. Purpose and scope

1.1.1. This document is made in accordance with AEMO's functions under clause 3A.1.5 of the Wholesale Electricity Market Rules (WEM Rules).

1.1.2. The *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules prevail over this document to the extent of any inconsistency.

1.1.3. The purpose of this document is to describe how AEMO determines the Maximum Temperature (as defined in Appendix 12 of the WEM Rules) for the purpose of assessing Generator Performance Standards for a Transmission Connected Generating System.

1.2. Definitions

1.2.1. Terms defined in the Electricity Industry Act 2004, the WEM Regulations and the WEM Rules (including terms defined in Appendix 12 of the WEM Rules where applicable) have the same meanings in this document unless the context requires otherwise.

1.3. Interpretation

1.3.1. The following principles of interpretation apply in this document unless the context requires otherwise.

(a) Clauses 1.3 to 1.5 of the WEM Rules apply in this document.

(b) References to time are references to Australian Western Standard Time.

(c) Terms that are capitalised, but not defined in this document, have the meaning given in the WEM Rules.

(d) A reference to the WEM Rules or WEM Procedures includes any associated forms required or contemplated by the WEM Rules or WEM Procedures.

(e) Words expressed in the singular include the plural and vice versa.

(f) A reference to a paragraph refers to a paragraph of this document.

(g) A reference to a clause refers to a clause or section of the WEM Rules.

(h) References to WEM Rules in this document in bold and square brackets **[Clause XXX]** are included for convenience only, and do not form part of this document.

(i) The body of this document prevails to the extent of any inconsistency with the figures, diagrams, appendices, schedules, annexures or attachments contained within this document.

1.4. Contact details

1.4.1. All enquiries relating to this document, including requests for calculation of the Maximum Temperature for specific locations should be submitted to AEMO by email to: WEM.GPS@aemo.com.au

2. Background

2.1.1. In accordance with Appendix 12 of the WEM Rules, a Transmission Connected Generating System must be capable of meeting Technical Requirements[1] up to a Maximum Temperature specified by AEMO.

2.1.2. Clause 3A.1.5 requires AEMO, in consultation with the Network Operator, to prepare and publish guidelines on how AEMO determines the Maximum Temperature as defined in Appendix 12 of the WEM Rules.

2.2. Principles for Assessment

2.2.1. A Transmission Connected Generating System must be able to operate reliably at the location of its nominated Connection Point. For various reasons, including the fact that Western Australian weather conditions vary significantly, depending on the geographical location of the Connection Point, it is important that a location-specific methodology is used to determine the Maximum Temperature. A location-specific methodology enables a Generating System connecting to the Network to be assessed appropriately to determine whether it complies with the applicable Registered Generator Performance Standards under local operating conditions.

2.2.2. The methodology for calculating Maximum Temperature described in paragraph 3 is based on the following principles:

(a) consistent with other relevant processes under the WEM Rules (where practicable);

(b) consistent with the methodology for determining 'maximum ambient temperatures' previously published in the temperature heat map in Chapter 3.3 of the Technical Rules (2016) (where practicable);

(c) applies consistently to all Generating System types;

(d) can be replicated by AEMO, the Network Operator and Market Participants using data that is accessible to all parties; and

(e) accounts for relevant changes in local conditions such as an increase in maximum temperature.

2.2.3. A Maximum Temperature for a Transmission Connected Generating System recorded on the Generator Register as part of a Registered Generator Performance Standard continues to apply unless the Network Operator declares a Potential Relevant Generator Modification to be a Relevant Generator Modification **[clause 3A.13]**.

[1] A Market Participant must also provide Temperature Dependency Data for a Transmission Connected Generating System at temperatures above the Maximum Temperatture **[clause A12.2.3.2 of Appendix 12]**.

3. Methodology for Calculating Maximum Temperature

3.1. Geographic Location and Weather Data

3.1.1. AEMO will determine the nearest valid Bureau of Meteorology (BOM) weather station to a Facility using the geographical location of a Facility obtained from the Network Operator.

3.1.2. A Market Participant may provide AEMO with latitude-longitude coordinates of their Facility to assist with determining the nearest valid BOM weather station.

3.1.3. Where a Facility contains geographically diverse Generating Units (e.g. a windfarm), a Market Participant may provide a list of latitude-longitude coordinates for the relevant generating units and AEMO will determine the most representative valid BOM weather station where multiple exist.

3.1.4. If a Market Participant nominates a BOM weather station under WEM Rules clause 4.10.1(e)(iv), then the same weather station will be used for the purpose of determining Maximum Temperature as described in this document.

3.1.5. For a weather station to be considered valid, a weather station must:

(a) contain at least 10 years of weather station data; and

(b) contain daily maximum temperature data that has been determined using data intervals of 30 minutes or less.

3.1.6. AEMO may, where the nearest weather station data has less than 10 years of valid daily maximum temperature data or where AEMO reasonably considers the nearest weather station data to be inaccurate use:

(a) data for the same location at a historical weather station; or

(b) data from the next nearest weather station to the Facility (or group of generating units comprising the Facility) being considered.

3.2. Determining Maximum Temperature

3.2.1. AEMO will determine Maximum Temperature values each time a Market Participant applies to connect a new Transmission Connected Generating System or applies to make a Relevant Generator Modification to an existing Transmission Connected Generating System to reflect any increase or change in Maximum Temperature trends.

3.2.2. In determining the Maximum Temperature, AEMO will use weather station data that meets the requirements outlined under paragraph 3.1, as publicly available from the BOM Weather Station Directory at http://www.bom.gov.au/climate/data/stations/.

3.2.3. AEMO when determining the Maximum Temperature, will use the maximum temperature data from the nominated weather station using:

(a) all available data for a minimum period of 10 years and up to a maximum of the most recent 30 years; and

(b) the 99th percentile of data captured during the Hot Season[2]. Data outside of the Hot Season should be excluded from calculations.

3.2.4. AEMO will round up the recommended Maximum Temperature for a Facility to the nearest integer (whole number), e.g., 35.9°C is rounded to 36°C, 47.3°C is rounded to 48°C.

3.2.5. A Maximum Temperature determined during a Market Participant's application to the Network Operator to connect a new Transmission Connected Generating System to the Network will typically not be re-determined during the completion of the application process unless it is determined by AEMO or the Network Operator that a previously determined Maximum Temperature is no longer suitable for use. Reasons for a Maximum Temperature re-determination may include but are not limited to:

(a) a change in the location of a proposed Facility; and

(b) a period greater than 24 months elapsing from calculation where a Facility has not yet Registered Generator Performance Standards for that Transmission Connected Generating System.

3.3. Maximum Temperature Calculations

3.3.1. A Market Participant may submit a request for Maximum Temperature calculations to AEMO via email in accordance with contact details described in paragraph 1.4.1.

Note: Sample Maximum Temperature calculations for selected BOM weather stations are provided in Appendix A.

[2] For the purposes of determining Maximum Temperature the Hot Season (as defined in the WEM Rules) is used to align with the period where peak electricity demand will typically occur.

Appendix A. Sample Maximum Temperature Calculations

The sample Maximum Temperature provided in Table 1 calculations are provided for information only; Market Participants should engage AEMO prior to the use of these values for Registering Generator Performance Standards to ensure that current Maximum Temperature values are used.

Table 1: Sample Maximum Temperature Calculations (effective December 2022)

Weather Station	Minimum last 10 years, up to 30 years. (Where available, Dec 1991 to March 2022)		Maximum temperature (°C)
	Absolute Max (°C)	99th percentile (°C)	
Geraldton Airport (8315)	47.3	44.1	**45**
Merredin Research Station (10092)	46.0	43.2	**44**
Kalgoorlie Boulder Airport (12038)	46.1	43.6	**44**
Perth Metro (9225)	44.5	41.6	**42**
Collie East (9994)	41.3	39.6	**40**
Bunbury (9965)	40.8	38.4	**39**
Albany (9500)	42.2	32.2	**33**