



WEM Procedure: Determination of Market Schedules

Prepared by: AEMO

Document ref:

Version: 0.1

Effective date:

Status: DRAFT

Approved for distribution and use by:

Approved by: Draft – not approved for distribution or use

Title:

Date:

aemo.com.au

New South Wales | Queensland | South Australia | Victoria | Australian Capital Territory | Tasmania | Western Australia

Australian Energy Market Operator Ltd ABN 94 072 010 327

Version Release History

Version	Effective Date	Summary of Changes
0.1		Draft for consultation. First version developed in accordance with clause 7.8.9 of the WEM Rules

IMPORTANT NOTICE – EXPLANATORY NOTES

Disclaimer

Explanatory notes included in this document as shaded in-line text are provided for explanatory purposes only to assist comprehension and readability. The information contained in these explanatory notes does not constitute legal or business advice and should not be relied on as a substitute for obtaining detailed advice about the *Electricity Industry Act 2004 (WA)*, WEM Rules, or any other applicable laws, procedures or policies. AEMO has made reasonable efforts to ensure the quality of the information, but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the explanatory information in this document; and
- are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

Contents

1. Introduction	4
1.1. Purpose and scope	4
1.2. Definitions	4
1.3. Interpretation	5
1.4. Related documents	5
2. Scenario determination and general provisions for Dispatch Algorithm inputs	7
3. Input Data for Market Schedules	8
3.1. Forecast Unscheduled Operational Demand and variations	8
3.2. Essential System Service requirements	8
3.3. SCADA data and other network data	8
3.4. ESS Trapezia values and Ramp Rates	9
3.5. Unconstrained Injection Forecasts and Unconstrained Withdrawal Forecasts	9
3.6. Other data provided via Real-Time Market Submissions	10
3.7. Registration data	10
3.8. Constraint Sets and Constraint Equations	10
3.9. Dynamic Frequency Control Model and Facility Performance Factors	10
3.10. Loss Factors	11
3.11. Constraint Violation Penalties	11
3.12. ESS Maximum Provision Percentages	12
3.13. Market Service Price Ceilings and Floors	12
4. Application of Storage Constraints in Market Schedules and Scenarios	13
Appendix A. Relevant clauses of the WEM Rules	14

Tables

Table 1	Definitions	4
Table 2	Related documents	6
Table 3	Relevant clauses of the WEM Rules	14

1. Introduction

1.1. Purpose and scope

- 1.1.1. This WEM Procedure: Market Schedules and Scenarios (Procedure) is made in accordance with AEMO's functions under clause 2.1A.2(h) 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 Procedure to the extent of any inconsistency.
- 1.1.3. In this Procedure, where obligations are conferred on a Rule Participant, that Rule Participant must comply with the relevant obligations in accordance with clause 2.9.7A, 2.9.7D or 2.9.8 of the WEM Rules, as applicable.
- 1.1.4. The purpose of this Procedure is to document the processes for determining Market Schedules, including:
- (a) The number and types of Scenarios **[clause 7.8.9(a)]**;
 - (b) The principles, methodologies and calculations used to determine:
 - (i) input data for each Market Schedule **[clause 7.8.9(b)(i)]**; and
 - (ii) input data for each Scenario **[clause 7.8.9(b)(ii)]**; and
 - (c) How AEMO will apply clause 7.5.9 to each Market Schedule, including:
 - (i) For each type of Market Schedule **[clause 7.8.9(c)(i)]**; and
 - (ii) Dispatch Intervals or Pre-Dispatch Intervals within each Market Schedule **[clause 7.8.9(c)(ii)]**.
- 1.1.5. Appendix A of this Procedure outlines the head of power clauses that this Procedure is made under, as well as other obligations in the WEM Rules covered by this Procedure.

1.2. Definitions

- 1.2.1. Terms defined in the *Electricity Industry Act 2004*, the WEM Regulations and the WEM Rules have the same meanings in this Procedure unless the context requires otherwise.
- 1.2.2. The following definitions apply in this Procedure unless the context requires otherwise.

Table 1 Definitions

Term	Definition
Constraint Violation Penalty	As defined in WEM Procedure: Dispatch Algorithm Formulation
Dynamic Frequency Control Model	A computer simulation of the SWIS power system frequency that uses an ESS System Configuration as an input and, for a given quantity of RoCoF Control Service, calculates the quantity of Contingency Reserve Raise in response to the Largest Credible Supply Contingency; or Contingency Reserve Lower in response to the Largest Credible Load Contingency, required to maintain the frequency of the SWIS within the Credible Contingency Event Frequency Band.
Energy Management System	The systems used by AEMO to manage the SWIS in real-time.
ESS Maximum Provision Percentage	As defined in WEM Procedure: Essential System Service Quantities
Historian	A system that archives real-time readings from SCADA.

Term	Definition
Initial MW	For a Registered Facility, the level of Inject or Withdrawal in MW at the start of a Dispatch Interval or Pre-Dispatch Interval, as used for the purpose of the Dispatch Algorithm.
Inter Control Center Protocol	A standard used for control centre communication in the power sector, also known as "IEC 60870/TASE.2".
Primary Dispatch Interval	The first Dispatch Interval in a Dispatch Schedule, from which operative Dispatch Instructions and Market Clearing Prices are determined.
Pure Storage Constraint	As defined in the WEM Procedure: Dispatch Algorithm Formulation.
SCADA	Supervisory Control and Data Acquisition (SCADA) is a system that is used to monitor and control field device(s) at remote locations.
State Estimator	A system that uses a network model to produce estimates of SCADA readings based on other readings in the Network.

1.3. Interpretation

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

- (a) Clauses 1.3 to 1.5 of the WEM Rules apply in this Procedure.
- (b) References to time are references to Australian Western Standard Time.
- (c) Terms that are capitalised, but not defined in this Procedure, 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 Procedure.
- (g) A reference to an appendix refers to an appendix of this Procedure.
- (h) A reference to a clause refers to a clause or section of the WEM Rules.
- (i) References to WEM Rules in this Procedure in bold and square brackets **[Clause XXX]** are included for convenience only, and do not form part of this Procedure.
- (j) Text located in boxes and headed as **E[X]** in this Procedure is included by way of explanation only and does not form part of this Procedure. The Procedure prevails to the extent of any inconsistency with the explanatory notes contained within it.
- (k) The body of this Procedure prevails to the extent of any inconsistency with the figures, diagrams, appendices, schedules, annexures or attachments contained within this document.

1.4. Related documents

1.4.1. The documents in Table 2 are associated with this Procedure.

Table 2 Related documents

Reference	Title	Location
WEM Procedure	WEM Procedure: Dispatch Algorithm Formulation	AEMO website
WEM Procedure	WEM Procedure: Forecast Unscheduled Operational Demand	AEMO website
WEM Procedure	WEM Procedure: Adjustment of Real Time Inputs	AEMO website
WEM Procedure	WEM Procedure: Essential System Service Quantities	AEMO website
WEM Procedure	WEM Procedure: Facility Dispatch Process	AEMO website

1.5. Communications and provision of information

- 1.5.1. All communication and provision of information by a Market Participant to AEMO under this Procedure must be undertaken via email, unless otherwise specified in this Procedure.
- 1.5.2. All communication and provision of information by AEMO to a Market Participant under this Procedure will be undertaken via email, unless otherwise specified in this Procedure.

2. Market Schedule and scenario determination

2.1.1. AEMO will only produce Scenarios that are required to be produced under clause 7.8.6.

E[A] Note on projected energy schedules

Paragraphs 2.1.2 and 2.1.3 assume that all Registered Facilities follow their Dispatch Instructions for the purpose of calculating forecast Dispatch Intervals and Pre-Dispatch Intervals.

- 2.1.2. For all Scenarios, for a Dispatch Interval in a Dispatch Schedule except the Primary Dispatch Interval, AEMO will use the cleared energy quantity from the solution to the Dispatch Algorithm in the prior Dispatch Interval as the Initial MW value for that Dispatch Interval.
- 2.1.3. For all Scenarios, for a Pre-Dispatch Interval in a Pre-Dispatch Schedule or Week-Ahead Schedule, except the first Pre-Dispatch Interval in the Pre-Dispatch Schedule or Week-Ahead Schedule, AEMO will use the cleared energy quantity from the prior Pre-Dispatch Interval as the Initial MW value for that Pre-Dispatch Interval.
- 2.1.4. AEMO's process for determining all Market Schedules and Scenarios will be as per the timeframes and provisions in clause 7 and the WEM Procedure: Dispatch Algorithm Formulation.

3. Input Data for Market Schedules

3.1. Forecast Unscheduled Operational Demand and variations

- 3.1.1. For all Market Schedules for the Reference Scenario, AEMO will use the latest Forecast Unscheduled Operational Demand, as determined under the WEM Procedure: Forecast Unscheduled Operational Demand, to determine an input to the Dispatch Algorithm for the relevant Dispatch Interval or Pre-Dispatch Interval.
- 3.1.2. For all Market Schedules, for the purpose of the Scenario under clause 7.8.6(b), AEMO will use the methodology for determining a higher load forecast under the WEM Procedure: Forecast Unscheduled Operational Demand to determine an input to the Dispatch Algorithm.
- 3.1.3. For all Market Schedules, for the purpose of the Scenario under clause 7.8.6(c), AEMO will use the methodology for determining a lower load forecast under the WEM Procedure: Forecast Unscheduled Operational Demand to determine an input to the Dispatch Algorithm.
- 3.1.4. For all Market Schedules and Scenarios, AEMO may use data that forecasts future system conditions, including regional load forecasts, in the Dispatch Algorithm in place of Network data determined under paragraph 3.3, for the purposes of determining forecast right hand side values for inputs to Constraint Equations.
- 3.1.5. Where AEMO uses forecast data under paragraph 3.1.4, it must make this data available to Market Participants under the same conditions that data produced under paragraph 3.2 are made available.

3.2. Essential System Service requirements

- 3.2.1. For all Market Schedules and Scenarios, AEMO will use the requirement for each Essential System Service as determined under the WEM Procedure: Essential System Service Quantities as inputs to the Dispatch Algorithm.

3.3. SCADA data and other network data

- 3.3.1. For the Primary Dispatch Interval or the first Pre-Dispatch Interval of a Pre-Dispatch Schedule or Week-Ahead Schedule, AEMO will use the following, for all Scenarios, as sources of real-time data from the SWIS and inputs to the Dispatch Algorithm where they are available, in descending order of preference:
 - (a) SCADA data from AEMO's Energy Management System or from Western Power's SCADA system via Inter Control Center Protocol;
 - (b) State Estimator data, where AEMO reasonably considers that this data is accurately modelled;
 - (c) data from AEMO's Historian, where AEMO reasonably considers that this data is no more than five minutes old;
 - (d) projected data based on outcomes, from the most recent Primary Dispatch Interval, of running the Dispatch Algorithm; or

- (e) a default value that is expected to maintain Power System Security in typical operating conditions.
- 3.3.2. Where AEMO reasonably believes that data from a source listed in paragraph 3.3.1 is erroneous, AEMO may replace this data using another source listed in paragraph 3.3.1.
- 3.3.3. For any data source used under paragraph 3.3.1, AEMO will use the most recently available valid reading from the Dispatch Algorithm, at the time the Dispatch Algorithm solve is commenced for the relevant Primary Dispatch Interval.

3.4. ESS Trapezia values and Ramp Rates

- 3.4.1. For Market Schedules and Scenarios, AEMO will use Enablement Minimum, Low Breakpoint, High Breakpoint, Enablement Maximum, Maximum Upwards Ramp Rate, and Maximum Downwards Ramp Rate values for Registered Facilities, in accordance with the WEM Procedure: Adjustment of Real-Time Inputs, in the Dispatch Algorithm.

3.5. Unconstrained Injection Forecasts and Unconstrained Withdrawal Forecasts

- 3.5.1. AEMO must keep a record of which method under this paragraph 3.5 that it uses to determine Unconstrained Injection Forecasts (UIF) and Unconstrained Withdrawal Forecasts (UWF) for Semi-Scheduled Facilities and Non-Scheduled Facilities in each Market Schedule and Scenario.
- 3.5.2. For all Market Schedules and Scenarios where AEMO has determined that it will use persistence as the method to determine UIF and UWF in Dispatch Intervals and Pre-Dispatch Intervals for Semi-Scheduled Facilities and Non-Scheduled Facilities, AEMO will use the current Injection or Withdrawal of Registered Facilities as the forecasts of UIF and UWF as inputs to the Dispatch Algorithm.
- 3.5.3. For all Market Schedules and Scenarios where AEMO has determined that it will use Real-Time Market Submissions as the method to determine UIF and UWF in Dispatch Intervals and Pre-Dispatch Intervals for Semi-Scheduled Facilities and Non-Scheduled Facilities, AEMO will use the UIF and UWF values submitted in the effective Real-Time Market Submission for the Registered Facility as inputs to the Dispatch Algorithm.
- 3.5.4. For all Market Schedules and Scenarios where AEMO has determined that it will use a blend of persistence and Real-Time Market Submissions as the method to determine UIF and UWF in Dispatch Intervals and Pre-Dispatch Intervals for Semi-Scheduled Facilities and Non-Scheduled Facilities, AEMO will use an equation that, for a Registered Facility, interpolates the current Injection or Withdrawal, and the submitted UIF and UWF values over a period into the future, to determine the UIF and UWF values to be used as inputs to the the Dispatch Algorithm.
- 3.5.5. AEMO may determine that one equation applies to all Registered Facilities for the purpose of paragraph 3.5.4.
- 3.5.6. AEMO may publish any equations determined under paragraphs 3.5.4 and 3.5.5 on the WEM Website within seven Business Days of them being used within a Market Schedule.

3.6. Other data provided via Real-Time Market Submissions

- 3.6.1. For all Market Schedules and Scenarios, AEMO will use data from a Registered Facility's effective Real-Time Market Submission as inputs to the Dispatch Algorithm, as applicable to the relevant Dispatch Interval or Pre-Dispatch Interval, where this is available to AEMO, unless otherwise specified in this Procedure.

3.7. Registration data

- 3.7.1. For all Market Schedules and Scenarios, AEMO will use effective Facility Standing Data and other registration data associated with a Registered Facility as inputs to the Dispatch Algorithm.

3.8. Constraint Sets and Constraint Equations

- 3.8.1. For all Market Schedules and Scenarios, AEMO will use Constraint Equations in accordance with the WEM Procedure: Dispatch Algorithm Formulation.
- 3.8.2. For all Market Schedules and Scenarios, AEMO will only use invoked Constraint Sets for a Network and their associated Network Constraints in the Dispatch Algorithm, as per the logic for invoking and revoking Constraint Sets and Constraint Equations in the WEM Procedure: Facility Dispatch Process.
- 3.8.3. For the Primary Dispatch Interval, for all Scenarios, AEMO will use the dispatch form of a Network Constraint for the Primary Dispatch Interval.
- 3.8.4. For all Scenarios, AEMO will use the pre-dispatch form of a Network Constraint for:
- (a) all Dispatch Intervals in the Dispatch Schedule, except the Primary Dispatch Interval; and
 - (b) all Pre-Dispatch Intervals in the Pre-Dispatch Schedule.
- 3.8.5. For all Scenarios, AEMO will use the Short Term PASA form of a Network Constraint for the Week-Ahead Schedule.

3.9. Dynamic Frequency Control Model and Facility Performance Factors

- 3.9.1. For all Market Schedules and Scenarios, AEMO will use the effective Dynamic Frequency Control Model (DFCM) as determined in the WEM Procedure: Essential System Service Quantities.
- 3.9.2. For the Primary Dispatch Interval, AEMO will use network data sourced under paragraph 3.2 to determine the Operational Demand value that is used as part of the determination of the subset of the DFCM that will apply to the Dispatch Interval in question.

- 3.9.3. For all Market Schedules in relation to the Reference Scenario, AEMO will use the Forecast Unscheduled Operational Demand for the applicable Dispatch Interval or Pre-Dispatch Interval as part of the determination of the subset of the DFCM that will apply to:
- (a) all Dispatch Intervals in the Dispatch Schedule, except the Primary Dispatch Interval; and
 - (b) all Pre-Dispatch Intervals in the Pre-Dispatch Schedule and Week-Ahead Schedules.
- 3.9.4. For all Market Schedules, for the Scenario produced under clause 7.8.6(b), AEMO will use the load forecast determined under paragraph 3.1.2 for the applicable Dispatch Interval or Pre-Dispatch Interval as part of the determination of the subset of the DFCM that will apply to:
- (a) all Dispatch Intervals in the Dispatch Schedule, except the Primary Dispatch Interval; and
 - (b) all Pre-Dispatch Intervals in the Pre-Dispatch Schedule and Week-Ahead Schedules.
- 3.9.5. For all Market Schedules, for the Scenario produced under clause 7.8.6(c), AEMO will use the load forecast determined under paragraph 3.1.3 for the applicable Dispatch Interval or Pre-Dispatch Interval as part of the determination of the subset of the DFCM that will apply to:
- (a) all Dispatch Intervals in the Dispatch Schedule except the Primary Dispatch Interval; and
 - (b) all Pre-Dispatch Intervals in the Pre-Dispatch Schedule and Week-Ahead Schedules.
- 3.9.6. For all Market Schedules and Scenarios, AEMO will use its reasonable estimate of Inertia of the Load in the SWIS as an input to the Dispatch Algorithm for the Dispatch Interval or Pre-Dispatch Interval in question.
- 3.9.7. For all Market Schedules and Scenarios, AEMO will use the effective Facility Speed Factor for each Registered Facility, in conjunction with the effective DFCM, to determine Facility Performance Factors for Contingency Reserve Raise for Registered Facilities accredited to provide Contingency Reserve Raise.
- 3.9.8. For all Market Schedules and Scenarios, AEMO will use a Facility Performance Factor of 1.0 for Contingency Reserve Lower for all Registered Facilities accredited to provide Contingency Reserve Lower.

E[B] Note Facility Performance Factors

Clause 2.34A.6(e) states that the Facility Performance Factor for Regulation or RoCoF Control Service is 1.0 in all circumstances. Therefore, these values are not set in this Procedure.

3.10. Loss Factors

- 3.10.1. For all Market Schedules and Scenarios, AEMO will use the effective Transmission Loss Factors and Distribution Loss Factors for a Registered Facility as inputs to the Dispatch Algorithm for the purpose of calculating Loss Factor Adjusted Prices.

3.11. Constraint Violation Penalties

- 3.11.1. For all Market Schedules and Scenarios, AEMO will use the effective Constraint Violation Penalties as inputs to the Dispatch Algorithm.

3.11.2. AEMO may determine and use a different Constraint Violation Penalty, that is, not the the default value specified in the WEM Procedure: Dispatch Algorithm Formulation, to apply to a Network Constraint, where it seeks to prioritise one Network Constraint relative to other Network Constraints, or to Constraints defined within the Dispatch Algorithm.

3.12. ESS Maximum Provision Percentages

3.12.1. For all Market Schedules and Scenarios, AEMO will use the effective ESS Maximum Provision Percentage for each of the Essential System Services, where this value can differ for each Essential System Service.

3.13. Market Service Price Ceilings and Floors

3.13.1. For all Market Schedules and Scenarios, AEMO will use the effective:

- (a) Energy Offer Price Ceiling;
- (b) Energy Offer Price Floor; and
- (c) FCESS Offer Price Ceilings.

4. Application of Energy Storage Constraints in Market Schedules and Scenarios

- 4.1.1. Where a Market Participant has notified AEMO under clause 7.5.10 and paragraph 4.1.4, AEMO will apply the Pure Storage Constraint to that Registered Facility from the time the Market Participant notifies AEMO that Energy Storage Constraints take effect for this Registered Facility.
- 4.1.2. Where a Market Participant has notified AEMO under clause 7.5.10A and paragraph 4.1.4, AEMO will cease to apply the Pure Storage Constraint to that Registered Facility from the time indicated by the Market Participant in their notification.
- 4.1.3. A notification under clause 7.5.10 or 7.5.10A can be made to AEMO via a registration data change request via the WEMS MPI portal.
- 4.1.4. For all Scenarios, where Energy Storage Constraints are applicable to a Registered Facility, AEMO will apply the Pure Storage Constraint to the Registered Facility for Primary Dispatch Intervals from the effective time of the notification given under paragraph 4.1.1.
- 4.1.5. For all Scenarios, AEMO will not apply the Pure Storage Constraint to:
- (a) all Dispatch Intervals in the Dispatch Schedule, except the Primary Dispatch Interval; and
 - (b) all Pre-Dispatch Intervals in the Pre-Dispatch Schedule and Week-Ahead Schedule.

Appendix A. Relevant clauses of the WEM Rules

Table 3 details:

- (a) the head of power clauses in the WEM Rules under which the Procedure has been developed; and
- (b) each clause in the WEM Rules requiring an obligation, process or requirement be documented in a WEM Procedure, where the obligation, process or requirement has been documented in this Procedure.

Table 3 Relevant clauses of the WEM Rules

Clause
7.8.9(a)
7.8.9(b)(i)
7.8.9(b)(ii)
7.8.9(c)(i)
7.8.9(c)(ii)

DRAFT