Economic Regulation Authority

Material constrained portfolio determination

Quarter 3 - 2024

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Executive summary

This is the ERA's determination of material constrained portfolios in the Wholesale Electricity Market (WEM), from constraint data over the 8:00am 1 July 2024 to 7:59am 1 October 2024 three-month rolling test window.[1] This set of material constrained portfolios replaces the ERA's previously published set of material constrained portfolios on 29 July 2024.[2] The ERA's determination was made following the WEM Procedure for portfolio determinations.[3]

This determination is part of the WEM Rules' market power mitigation framework which aims to focus regulatory monitoring and surveillance effort on those entities with the greatest potential to exercise market power. The ERA monitors market participants' price offers in the real-time market to ensure that they are compliant with the general trading obligations, with particular focus on those facilities assigned to a material constrained portfolio.[4]

Material constrained portfolios contain those facilities that have the potential to exert localised market power due to network constraints.[5] Market participants whose facilities received energy uplift payments in more than 10 per cent of relevant intervals over the associated three-month rolling test window are part of a material constrained portfolio.[6] All facilities identified in the material constrained portfolios must comply with the requirements under the WEM Rules which includes record keeping obligations on offer price construction.[7]

Importantly, market participants whose facilities that are not included in these material constrained portfolios are still monitored. The ERA monitors ***all*** market participant bidding in ***all*** intervals as required by the WEM Rules. The ERA expects all market participants to comply with the offer construction guidelines as required by the WEM Rules.[8]

1 The ERA must make its material constrained portfolios determination within 20 business days of the end of the rolling test window as required by the Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.2, (online).

2 Economic Regulation Authority, 29 July 2024, *Material constrained portfolio determination*, (online), and Wholesale Electricity Market Rules (WA), 27 July 2024, Rule 2.16C.2A, (online).

3 Economic Regulation Authority, 1 October 2023, *WEM Procedure: Portfolio Determination*, (online).

4 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.4(b), (online).

5 Energy Policy Western Australia, *Market Power Mitigation Strategy: Information Paper*, 10 November 2022, p. 21, (online).

6 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.2, (online). A 'relevant interval' is an interval in which a constraint equation bound, and the facility received an energy uplift payment.

7 Further information is available in Economic Regulation Authority, 2023, *Offer Construction Guideline*, Chapter 10, (online). The record keeping requirement is in Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.3, (online).

8 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16A.1 and Section 2.16D, (online).

1. Introduction

The market power mitigation framework requires the ERA to complete two processes to identify those facilities with the greatest potential to exercise market power in the real-time market. These processes are:

1. Identify portfolios of facilities and those which are material portfolios.[9] The ERA published its latest portfolio and material portfolio determination on 10 October 2024.[10]

2. Identify those portfolios of facilities with the potential to exercise localised market power, due to network constraints that bound which affected dispatch in the real-time market. These portfolios are called material constrained portfolios.[11]

This determination uses the portfolios published on 10 October 2024 as an input into the assessment of which network constraints bound and which facilities received uplift payments related to those binding network constraints. Those facilities that received constrained uplift payments in 10 per cent or more of relevant intervals over the three-month rolling test window (from 8:00am 1 July 2024 to 7:59am 1 October 2024) are considered material constrained portfolios.[12] All market participants with facilities that are determined to be in a material constrained portfolio must keep adequate records as per the WEM Rules to substantiate and justify their offers into the WEM.[13]

1.1 ERA's determination process

To make this determination, the ERA:

1. Identified the constrained portfolios of facilities on 15 October 2024.[14]

2. Identified each material constrained portfolio and published this determination and notified the affected market participants on 29 October 2024 of their registered facilities being classified under a material constrained portfolio.[15]

To identify the constrained portfolios, the ERA:

1. Identified each constraint equation that bound for at least one interval between 8:00am 1 July 2024 to 7:59am 1 October 2024 (the three-month rolling test window).

2. Identified each constrained portfolio of facilities for each identified constraint equation.

9 Wholesale Electricity Market Rules (WA), 7 October 2024, Rules 2.16B.1 and 2.16C.1, (online).

10 Economic Regulation Authority, 11 April 2024, *Portfolio identification and material portfolio – Determination*, (online).

11 Energy Policy Western Australia, *Market Power Mitigation Strategy: Information Paper*, 10 November 2022, p. 11, (online).

12 A 'relevant interval' is an interval in which a constraint equation bound, and the facility received an energy uplift payment.

13 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.3, (online).

14 Ibid, 2.16B.2, (online).

15 Ibid, 2.16C.2, (online).

To identify each material constrained portfolio, the ERA:

1. Calculated the constrained uplift payment ratio for each constrained portfolio, for both the three-month rolling test window and any relevant fixed assessment period.[16]

2. Classified those constrained portfolios with constrained uplift payments in more than 10 per cent of all relevant intervals for which the relevant network constraint bound within the three-month rolling test window as material constrained portfolios.

1.2 Record keeping obligations for facilities that are part of a material constrained portfolio

All market participants with facilities that are part of a material constrained portfolio must ensure that adequate records are kept that can be independently verified to support a market participant's price offers for those facilities made in the real-time market, within three months of receiving the notice from the ERA.

An example of the types of records that are required include:

1. Internal governance arrangements.

2. Methods, assumptions, and cost inputs.

This includes those documents that market participants use to develop their prices, quantities, and ramp rates for each identified facility.

[16] This includes any Fixed Assessment Periods during the rolling test window which is a period of at least seven consecutive trading days in which a relevant constraint equation has bound continuously within a rolling test window. This is defined in Wholesale Electricity Market Rules (WA), 7 October 2024, Chapter 11, (online).

2. Assessment of constrained portfolios

The ERA has completed its assessment of constrained portfolios and identified each constraint equation for network constraints that bound within the rolling test window of 8:00am 1 July 2024 to 7:59am 1 October 2024. Constraint equations are a mathematical representation of a constraint or limitation on how electricity can be transferred over parts of the network.[17] A constraint equation is considered binding when AEMO applies a constraint to limit the risk to power system security or reliability. When a constraint equation is applied, those registered facilities that are located behind that constraint are assigned to a constrained portfolio. The constrained portfolio includes all registered facilities behind the constraint equation that are in the same portfolio.

The ERA identified 71 unique binding network constraint equations in the 8:00am 1 July 2024 to 7:59am 1 October 2024 rolling test window. This resulted in identification of 161 unique constrained portfolios. A full list of constraint equations and constrained portfolios is included in Appendix 4.

The ERA used the portfolios identified in October 2024 for this constrained portfolio identification process.[18]

2.1 Constraint equation identification

The ERA identified 71 unique binding network constraint equations over the 8:00am 1 July 2024 to 7:59am 1 October 2024 rolling test window. The ERA used AEMO's constraint equation data to identify all network constraints that bound during the rolling test window. The data was filtered to include data for binding network constraints only from within the rolling test window. AEMO publishes this data on its public data site, which is embedded in the dispatch solution files.[19]

2.2 Constrained portfolio identification

The ERA identified 161 unique constrained portfolios over this rolling test window. The constrained portfolios consist of those registered facilities identified in the ERA's portfolio determination and where the facility is located behind a binding network constraint.[20] Registered facilities can be assigned to multiple constrained portfolios.[21]

The ERA uses a combination of data provided by AEMO and information available in AEMO's public constraints library to identify the constrained portfolios.[22]

17 Wholesale Electricity Market Rules (WA) 7 October 2024, Chapter 11, (online).

18 Economic Regulation Authority, 10 October 2024, *Portfolio Identification and Material Portfolio Determination*, p. 3, (online).

19 Australian Energy Market Operator, Market Data Western Australia, (online).

20 Economic Regulation Authority, 10 October 2024, *Portfolio Identification and Material Portfolio Determination*, p. 3, (online).

21 Wholesale Electricity Market Rules (WA) 7 October 2024, Rule 2.16B.3, (online).

22 Australian Energy Market Operator, 'Operational Constraints Library', (online).

3. Material constrained portfolio determination

After identifying the constrained portfolios over a rolling test window, the ERA must determine the material constrained portfolios by calculating and applying the materiality threshold specified in the WEM Rules to the constrained uplift payment ratio (see section 3.1). The ratio is a percentage of the number of dispatch intervals where a network constraint bound and any registered facilities within the relevant constrained portfolio that received energy uplift payments.

A material constrained portfolio is a constrained portfolio that meets or exceeds the 10 per cent threshold in its constrained uplift payment ratio. The ERA has notified market participants that have registered facilities allocated to a material constrained portfolio. The ERA monitors any prices offered by the market participant in the real time market in line with the market power test.[23,24]

Market participants have three months from the date of receipt of a material constrained portfolio determination notice to maintain additional records to support their compliance with the general trading obligations under the WEM Rules.[25] Additional guidance regarding the record keeping obligations is available in the WEM procedure detailing portfolio determination and in the offer construction guideline.[26,27]

3.1 Constrained uplift payment ratio

The ERA identifies those constrained portfolios that have received energy uplift payments in 10 per cent or more relevant dispatch intervals within the rolling test window.[28] Where this occurs, the constrained portfolio is deemed to be a material constrained portfolio and the facilities within each material constrained portfolio are considered to have the potential to exercise market power when located behind a network constraint.

The calculation of the constrained uplift payment ratio is:[29]

$$Constrained\ Uplift\ Payment\ Ratio = \frac{CP\_UP}{NC} \times 100$$

where:

CP_UP is the number of dispatch intervals in the rolling test window or fixed assessment period (as applicable) in which:

1. the constraint equation relevant to the identification of the constrained portfolio identified under clause 2.16B.2(a) bound; and

23 Wholesale Electricity Market Rules (WA) 7 October 2024, Rule 2.16C.2(d), (online).

24 Ibid, Rule 2.16C.4, (online).

25 Ibid, Section 2.16A, (online).

26 Economic Regulation Authority, 1 October 2023, *WEM Procedure: Portfolio Determination*, p. 10, (online).

27 Economic Regulation Authority, 5 September 2024, *Offer Construction Guideline*, p. 52, (online).

28 This includes any Fixed Assessment Periods during the rolling test window which is a period of at least seven consecutive trading days in which a relevant constraint equation has bound continuously within a rolling test window. This is defined in Wholesale Electricity Market Rules (WA), 7 October 2024, Chapter 11, (online).

29 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.2(a), (online).

2. a registered facility in the constrained portfolio received an energy uplift Payment; and

NC is the total number of dispatch intervals in the rolling test window or fixed assessment period (as applicable) in which the constraint equation relevant to the identification of the constrained portfolio bound.

3.2 Constrained uplift payment ratio calculation results

The constrained uplift payment ratio calculation is applied to the rolling test window and in any relevant fixed assessment periods.[30] The calculation returned 64 of 161 identified constrained portfolios with a non-zero result.

Full results of the calculation are provided in Appendix 4.

3.3 Material constrained portfolios

The constrained uplift payment ratio calculation resulted in 55 material constrained portfolios, capturing a total of 5 different facilities belonging to 5 different market participants.

Table 1 lists all material constrained portfolios. These are identified as all constrained portfolios that met or exceeded the 10 per cent threshold of the constrained uplift payment ratio calculation. In this rolling test window, one relevant fixed assessment period was identified however, no facilities classified within the fixed assessment period received uplift payments which meant that the fixed assessment period did not contain a material constrained portfolio.[31] This list of material constrained portfolios replaces the previously published list of material constrained portfolios.[32]

Differences between this material constrained portfolio determination and the previous determination are detailed in Section 3.5.

Table 1: List of material constrained portfolios

Constrained portfolio	Constraint equation	Registered facility	Constrained uplift payment ratio (%)[33]
11	#E 1*MERSOLAR_PV1 >= 15 id-778	MERSOLAR_PV1	100
12	#E 1*MERSOLAR_PV1 >= 25 id-735	MERSOLAR_PV1	100
13	#E 1*NAMKKN_MERR_SG1 = 10 id-714	NAMKKN_MERR_SG1	100
14	#E 1*NAMKKN_MERR_SG1 = 10 id-719	NAMKKN_MERR_SG1	100

30 Economic Regulation Authority, *WEM Procedure: Portfolio Determination*, 1 October 2023, 4.2.1, (online).

31 Fixed Assessment Period is a period of at least seven consecutive Trading Days in which the Constraint Equation relevant to the identification of a Constrained Portfolio has continuously bound within a Rolling Test Window. This is defined in Wholesale Electricity Market Rules (WA), 7 October 2024, Chapter 11, (online).

32 Wholesale Electricity Market Rules (WA), 7 October 2024, Rule 2.16C.2A, (online).

33 Value rounded to the nearest percentage point.

Constrained portfolio	Constraint equation	Registered facility	Constrained uplift payment ratio (%)[33]
15	#E 1*NAMKKN_MERR_SG1 = 7 id-720	NAMKKN_MERR_SG1	100
16	#E 1*NAMKKN_MERR_SG1 >= 10 id-742	NAMKKN_MERR_SG1	97
17	#E 1*NAMKKN_MERR_SG1 >= 6 id-708	NAMKKN_MERR_SG1	79
19	#E 1*NAMKKN_MERR_SG1 >= 6 id-711	NAMKKN_MERR_SG1	79
20	#E 1*NAMKKN_MERR_SG1 >= 6 id-713	NAMKKN_MERR_SG1	50
21	#E 1*NAMKKN_MERR_SG1 >= 6 id-716	NAMKKN_MERR_SG1	81
22	#E 1*NAMKKN_MERR_SG1 >= 6 id-721	NAMKKN_MERR_SG1	89
23	#E 1*NAMKKN_MERR_SG1 >= 6 id-723	NAMKKN_MERR_SG1	92
24	#E 1*NAMKKN_MERR_SG1 >= 6 id-724	NAMKKN_MERR_SG1	93
27	#E 1*NAMKKN_MERR_SG1 >= 6 id-736	NAMKKN_MERR_SG1	75
28	#E 1*NAMKKN_MERR_SG1 >= 6 id-740	NAMKKN_MERR_SG1	100
29	#E 1*NAMKKN_MERR_SG1 >= 6 id-744	NAMKKN_MERR_SG1	100
30	#E 1*NAMKKN_MERR_SG1 >= 6 id-748	NAMKKN_MERR_SG1	100
31	#E 1*NAMKKN_MERR_SG1 >= 6 id-749	NAMKKN_MERR_SG1	100
32	#E 1*NAMKKN_MERR_SG1 >= 6 id-750	NAMKKN_MERR_SG1	100
33	#E 1*NAMKKN_MERR_SG1 >= 6 id-751	NAMKKN_MERR_SG1	100
34	#E 1*NAMKKN_MERR_SG1 >= 6 id-758	NAMKKN_MERR_SG1	100
35	#E 1*NAMKKN_MERR_SG1 >= 6 id-770	NAMKKN_MERR_SG1	73
36	#E 1*NAMKKN_MERR_SG1 >= 6 id-786	NAMKKN_MERR_SG1	92
37	#E 1*NAMKKN_MERR_SG1 >= 6 id-794	NAMKKN_MERR_SG1	67
39	#E 1*PRK_AG >= 1 id-737	PRK_AG	94
40	#E 1*PRK_AG >= 1 id-743	PRK_AG	45
41	#E 1*PRK_AG >= 1 id-745	PRK_AG	88
42	#E 1*PRK_AG >= 1 id-771	PRK_AG	86
54	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	INVESTEC_COLLGAR_WF1	45

Constrained portfolio	Constraint equation	Registered facility	Constrained uplift payment ratio (%)[33]
58	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	40
59	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	48
63	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	24
64	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	68
69	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	INVESTEC_COLLGAR_WF1	72
73	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	38
74	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	48
78	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	23
79	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	73
83	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	81
88	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	40
93	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	100
98	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	100
103	MSR-KMK 81 * {NIL} [Manual(TIWEST_COG1)]	TIWEST_COG1	24
104	MSR-KMK 81 * {NIL} [RegLower(TIWEST_COG1)]	TIWEST_COG1	24
105	MSR-KMK 81 * {NIL} [RegRaise(TIWEST_COG1)]	TIWEST_COG1	24
106	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	14

Constrained portfolio	Constraint equation	Registered facility	Constrained uplift payment ratio (%)[33]
107	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	36
108	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	INVESTEC_COLLGAR_WF1	10
112	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	43
113	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	23
122	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	17
123	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	43
124	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	INVESTEC_COLLGAR_WF1	13
128	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	MERSOLAR_PV1	43
129	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	NAMKKN_MERR_SG1	23

Source: ERA analysis of WEM data.

3.4 Market participants and facilities in a material constrained portfolio

Table 2 is a list of market participants with facilities that are part of a material constrained portfolio.

Table 2: Market participants and those facilities that are part of a material constrained portfolio

Market participant	Facility
Collgar Wind Farm	INVESTEC_COLLGAR_WF1
Goldfields Power Pty Ltd	PRK_AG
Merredin Energy	NAMKKN_MERR_SG1
Merredin Solar Farm Nominee Pty Ltd	MERSOLAR_PV1
Tronox	TIWEST_COG1

Source: ERA assessment of WEM data.

3.5 Comparison to previous determination

The differences between the most recent and previous rolling test windows are detailed below:

Table 3 is the number of constraint equations identified to have bound.

Table 4 is the number of unique constrained portfolios identified.

Table 5 is the number of unique facilities that were part of a material constrained portfolio.

Table 6 is the number of unique market participants that have facilities that are part of a material constrained portfolio.

Table 3: Number of constraint equations identified

Rolling test window	Number of constraint equations identified
Q3 2024	71
Q2 2024	86

Source: ERA analysis of WEM data.

Table 4: Number of unique constrained portfolios identified

Rolling test window	Number of unique constrained portfolios
Q3 2024	161
Q2 2024	346

Source: ERA analysis of WEM data.

Table 5: Number of unique facilities within a material constrained portfolio

Rolling test window	Number of unique constrained portfolios
Q3 2024	5
Q2 2024	30

Source: ERA analysis of WEM data.

Table 6: Number of unique market participants that have facilities in a material constrained portfolio

Rolling test window	Number of unique constrained portfolios
Q3 2024	5
Q2 2024	8

Source: ERA analysis of WEM data.

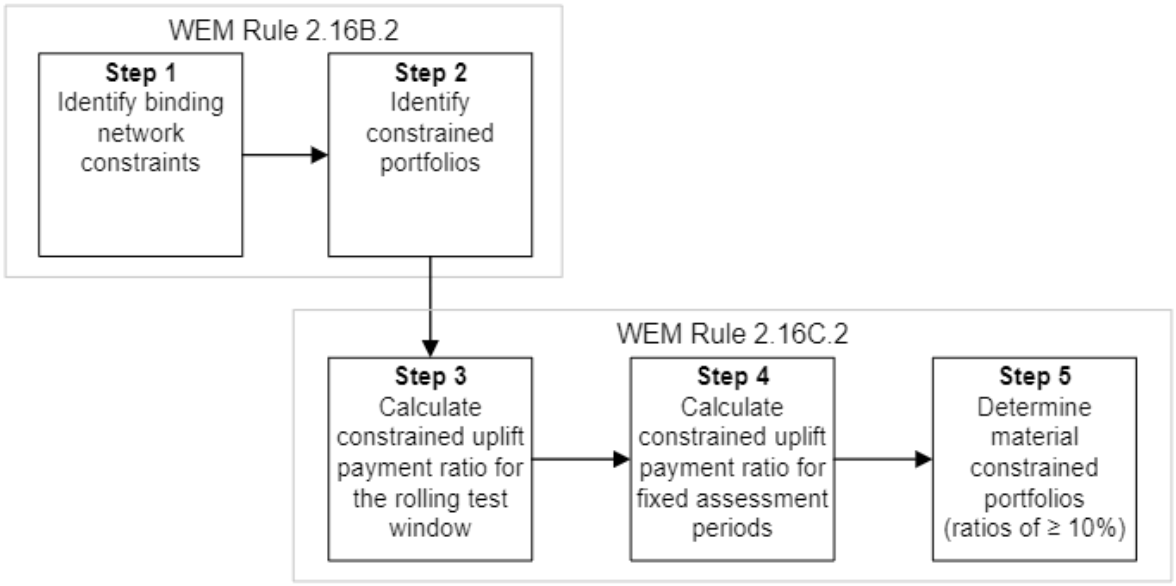
Appendix 1 List of Tables

Appendix 2 List of Figures

Appendix 3 Constrained portfolio method

The ERA developed and applied the process and method, outlined in this appendix, to identify constrained portfolios and calculate the constrained uplift payment ratio for determining material constrained portfolios. The method is outlined in **Figure 1**, with additional detail provided in the following sections.

Figure 1: High level steps in the constrained portfolio method



The assignment of constrained portfolios and the calculation of the constrained uplift payment ratio is completed using R within RStudio.[34]

Data sets

The following data sets were used as inputs to this process:

1. WEMDE dispatch solution constraints.[35]
2. 'Left Hand Side' terms of network constraints, which lists all facilities located behind each network constraint.
3. Energy uplift payment data.
4. Portfolios identified under WEM Rule 2.16B.1.[36]

Data set 1 is available publicly via AEMO's public data site.[37] Data set 2 is partially available publicly via the Operational Constraints Library, however discretionary constraints are not included.[38] Data set 3 is not publicly available. Data set 4 is published by the ERA.[39]

34 Libraries used were "tidyverse", "readxl" and "here".

35 WEMDE stands for the Wholesale Electricity Market Dispatch Engine.

36 Wholesale Electricity Market Rules (WA) 7 October 2024, Rule 2.16B.1, (online).

37 Australian Energy Market Operator, Market Data Wester Australia: Dispatch Solution Files, (online).

38 Australian Energy Market Operator, Operational Constraints Library, (online).

39 Economic Regulation Authority, 1 October 2023, WEM Procedure: Portfolio Determination, (online).

Data cleansing

All data underwent cleansing processes. This included filtering the data to include only dispatch intervals falling within the rolling test window, ensuring consistent variable naming and formatting across data frames, and extracting facility names from string variable values.

Step 1 - Binding network constraint identification

The first step in the process of identifying constrained portfolios is to identify all binding network constraints within a rolling test window is. [40]

A network constraint is a limitation or requirement in a part of a network that may impact one or more registered facilities in the central dispatch process, such that it would be unacceptable to transfer electricity across that part of the network at a level or in a manner outside the limit or requirement.[41]

This step in the process requires the list of WEMDE dispatch solution constraints. This data was checked against the publicly available data. The three filters applied are date range, constraintType = “Network” and isBindingConstraint = “TRUE”.

The list of unique constraint IDs are the network constraints that bound within the rolling test window.

Step 2 - Constrained portfolio identification

Following identification of all network constraints that bound during the rolling test window, the ERA then identified all constrained portfolios for each constraint equation.[42] A constrained portfolio is, for each constraint equation, a set comprising all the registered facilities within a single portfolio that are located behind the relevant network constraint.[43]

This step requires three data sets:

5. The list of unique binding network constraint resulting from part A of this process.

6. ‘Left Hand Side’ terms of those network constraints, which lists all the facilities located behind each network constraint.

7. Portfolios identified under WEM Rule 2.16B.1.[44]

Some network constraints have versions which applied through the rolling test window. Whilst most version changes only affect facility coefficients in the constraint equation, if a facility is commissioned or decommissioned, the terms of the equation would change. A strict interpretation of the WEM Rules definition of constrained portfolio is used, and the set comprising all the registered facilities that are located behind any version of the network constraint are considered.

40 Wholesale Electricity Market Rules (WA) 7 October 2024, Rule 2.16B.2(a), (online).

41 Ibid, Chapter 11, p. 742, (online).

42 Ibid, Rule 2.16B.2(b), (online).

43 Ibid, Chapter 11, p. 715, (online).

44 Economic Regulation Authority, 1 October 2023, WEM Procedure: Portfolio Determination, (online).

The three data sets are merged, the first two by network constraint ID and the last two by facility. Only those facilities which sit behind a network constraint that bound during the period are included in this process.

The data frame is arranged alphabetically by constraint ID, then numerically by portfolio and then alphabetically by facility. An exception to this ordering is where a constraint ID uses a numerical suffix, in which case those constraints are arranged numerically by their suffix.

A constrained portfolio number is assigned to each facility, row by row, according to the constraint ID and portfolio number. If either the constraint ID or the portfolio changes, then a new constrained portfolio number is assigned, see **Table 7**.

Table 7: Example of constrained portfolio identification

Constraint ID	Facilities	Portfolio	Constrained portfolio number
Constraint-equation-1	Facility A	1	1
Constraint-equation-1	Facility B	1	1
Constraint-equation-1	Facility C	2	2
Constraint-equation-2	Facility A	1	3
Constraint-equation-3	Facility A	1	4

Source: ERA created example based on WEM data.

Step 3 - Constrained uplift payment ratio calculation (rolling test window)

Steps 1 and 2 of the process meet the WEM Rule 2.16B.2 requirements.[45] From this point on, the steps are designed to apply the calculation required under the market power test set in market rule 2.16C.2 to determine which of the constrained portfolios meet or exceed the materiality threshold in the WEM Rules.[46] This step calculates the constrained uplift payment ratio for each of the constrained portfolios within the rolling test window.

This calculation is applied to each constrained portfolio.

$$Constrained\ Uplift\ Payment\ Ratio = \frac{CP\_UP}{NC} \times 100$$

Where:

45 Wholesale Electricity Market Rules (WA) 7 October 2024, Rule 2.16B.2, (online).

46 Ibid, Rule 2.16C.2, (online).

CP_UP is the count of dispatch intervals within the rolling test window for a bound network constraint where uplift payments were made.

NC is the count of dispatch intervals within the rolling test window where a network constraint equation bound.

This process requires the following data sets:

1. WEMDE dispatch solution constraints.

2. 'Left Hand Side' (LHS) terms of those network constraints, which lists all the facilities located behind each network constraint.

3. Energy uplift payment data.

4. Constrained portfolios assigned in part B of this process.

The denominator (NC) is extracted for each constrained portfolio by filtering the WEMDE dispatch solution constraints by the network constraint for which the constrained portfolio was assigned. The row count is the number of dispatch intervals in the rolling test window for which the network constraint bound.

The numerator (CP_UP) is found by merging the solution constraints with the facilities from the LHS terms, and then with the facilities receiving energy uplift. The same filter for the relevant constraint is then applied as before. The data is then filtered to include intervals for which there is an energy uplift payment received by a facility within that constrained portfolio only. The number of unique dispatch intervals is counted, which forms the numerator.

For example, **Table 8** below shows a hypothetical example where all the dispatch intervals in which constraint equation 1 bound. This constraint equation resulted in identification of example constrained portfolios 1 and 2. Constrained portfolio 1 includes facilities A and B, while constrained portfolio 2 includes facility C. From this example, NC is determined to be 4 for both constrained portfolios, and CP_UP is the count of gold and blue shaded intervals for constrained portfolios 1 and 2 respectively.

Table 8: Example of determining constrained facilities that received energy uplift payments by dispatch interval

Dispatch interval	Constrained facilities	Energy uplift recipients
2023-10-01 11:00	A, B, C	A, B
2023-10-01 11:05	A, B, C	A
2023-10-02 17:30	A, B, C	-
2023-10-02 17:35	A, B, C	C

Source: ERA example based on WEM data.

These numbers are then input to a second table, in which the ratio is calculated according to the formula set out in the WEM Rules. **Table 9** below shows the calculation of constrained uplift payment ratios for example constrained portfolios 1 and 2.

Table 9: Example of how the constrained uplift payment ratio is calculated

Constrained portfolio	CP_UP	NC	Constrained uplift payment ratio (%)
1	2	4	50
2	1	4	25

Source: ERA example based on WEM data.

Step 4 - Constrained uplift payment ratio calculation (fixed assessment periods)

The process for calculating the fixed assessment period is the same used for the whole of the rolling test window period. However, instead of using the rolling test window, the calculation is applied where the constraint equation relevant to the constrained portfolio has continuously bound for a period of a least seven consecutive trading days within the rolling test window. A rolling test window may contain multiple fixed assessment periods.[47]

This process is the same as outlined in step 3 and uses the same data set, however the key difference is first filtering the network constraint data to consider only fixed assessment periods. This is done by creating a duration variable, by ordering the data by constraint ID, then by chronological order. Rows are then checked to see if they are five minutes apart, if they are then this is added to a cumulative duration, if they are not, a new count is started.

The duration variable is then filtered to only include those which exceed seven days. The numerator and denominator are then extracted as before, and the constrained uplift payment ratio is calculated. If there are multiple fixed assessment periods for the same network constraint, the highest constrained uplift payment ratio is provided.

Step 5 – Material constrained portfolios

A filter is applied to the calculation tables generated in steps 3 and 4 to only include those portfolios with a constrained uplift payment ratio greater than 10 per cent from either of steps 3 or 4.

47 Wholesale Electricity Market Rules (WA) 7 October 2024, Chapter 11, (online).

Appendix 4 Constrained uplift payment ratio results

The ERA must publish the results of the calculations carried out for the WEM Rule clause 2.16C.2(a). This includes both the results of the constrained uplift payment ratio for all constrained portfolios for both the rolling test window and any fixed assessment periods.

Table 10: Complete results of the calculation carried out under WEM Rule clause 2.16C.2(a)

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
1	#E 1*BADGINGARRA_WF1 + 1*EDWFMAN_WF1 <= 185 id-766	0	NA
2	#E 1*BADGINGARRA_WF1 + 1*EDWFMAN_WF1 <= 185 id-766	0	NA
3	#E 1*BADGINGARRA_WF1 <= 110 id-741	0	NA
4	#E 1*BADGINGARRA_WF1 <= 120 id-764	0	NA
5	#E 1*COLLIE_G1 = 0 id-692	0	NA
6	#E 1*GREENOUGH_RIVER_PV1 = 0 id-756	0	NA
7	#E 1*GREENOUGH_RIVER_PV1 = 5 id-757	0	NA
8	#E 1*INVESTEC_COLLGAR_WF1 <= 0 id-773	0	NA
9	#E 1*KWINANA_ESR1 = 0 id-725	0	NA
10	#E 1*KWINANA_ESR1 = 0 id-726	0	NA
11	#E 1*MERSOLAR_PV1 >= 15 id-778	100	NA
12	#E 1*MERSOLAR_PV1 >= 25 id-735	100	NA
13	#E 1*NAMKKN_MERR_SG1 = 10 id-714	100	NA
14	#E 1*NAMKKN_MERR_SG1 = 10 id-719	100	NA
15	#E 1*NAMKKN_MERR_SG1 = 7 id-720	100	NA
16	#E 1*NAMKKN_MERR_SG1 >= 10 id-742	96.63	NA
17	#E 1*NAMKKN_MERR_SG1 >= 6 id-708	78.95	NA
18	#E 1*NAMKKN_MERR_SG1 >= 6 id-710	0	NA
19	#E 1*NAMKKN_MERR_SG1 >= 6 id-711	78.95	NA

[48] Values rounded to the nearest percentage point.

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
20	#E 1*NAMKKN_MERR_SG1 >= 6 id-713	50	NA
21	#E 1*NAMKKN_MERR_SG1 >= 6 id-716	81.25	NA
22	#E 1*NAMKKN_MERR_SG1 >= 6 id-721	89.19	NA
23	#E 1*NAMKKN_MERR_SG1 >= 6 id-723	92.31	NA
24	#E 1*NAMKKN_MERR_SG1 >= 6 id-724	92.5	NA
25	#E 1*NAMKKN_MERR_SG1 >= 6 id-733	0	NA
26	#E 1*NAMKKN_MERR_SG1 >= 6 id-734	0	NA
27	#E 1*NAMKKN_MERR_SG1 >= 6 id-736	75.36	NA
28	#E 1*NAMKKN_MERR_SG1 >= 6 id-740	100	NA
29	#E 1*NAMKKN_MERR_SG1 >= 6 id-744	100	NA
30	#E 1*NAMKKN_MERR_SG1 >= 6 id-748	100	NA
31	#E 1*NAMKKN_MERR_SG1 >= 6 id-749	100	NA
32	#E 1*NAMKKN_MERR_SG1 >= 6 id-750	100	NA
33	#E 1*NAMKKN_MERR_SG1 >= 6 id-751	100	NA
34	#E 1*NAMKKN_MERR_SG1 >= 6 id-758	100	NA
35	#E 1*NAMKKN_MERR_SG1 >= 6 id-770	72.73	NA
36	#E 1*NAMKKN_MERR_SG1 >= 6 id-786	92.11	NA
37	#E 1*NAMKKN_MERR_SG1 >= 6 id-794	66.67	NA
38	#E 1*NEWGEN_NEERABUP_GT1 = 171 id-801	0	NA
39	#E 1*PRK_AG >= 1 id-737	93.63	NA
40	#E 1*PRK_AG >= 1 id-743	45	NA
41	#E 1*PRK_AG >= 1 id-745	88.24	NA
42	#E 1*PRK_AG >= 1 id-771	86.05	NA
43	CPS-SHO 91 * {NIL} [Off(COLLIE_G1)]	0	NA
44	CTB-EMD-BGA 81 * {NIL} [EMD SUT1 (8-)]	0	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
45	CTB-EMD-BGA 81 > {ENB-TS 81} [CTB-ENB 81 (ENB~)]	0	NA
46	CTB-EMD-BGA 81 > {ENB-TS 81} [CTB-ENB 81 (ENB~)]	0	NA
47	Island(EGF) * {NIL} [Manual(PRK_AG)]	0	NA
48	MRT-NOR-CNS 81 > CVP0 {MDP-MRT 81} [MU-NGS X1 (MU~)]	0	NA
49	MRT-NOR-CNS 81 > CVP0 {MDP-MRT 81} [MU-NGS X1 (MU~)]	0	NA
50	MRT-NOR-CNS 81 > CVP0 {MDP-MRT 81} [MU-NGS X1 (MU~)]	0	NA
51	MRT-NOR-CNS 81 > CVP0 {MDP-MRT 81} [MU-NGS X1 (MU~)]	0	NA
52	MRT-NOR-CNS 81 > CVP0 {MDP-MRT 81} [MU-NGS X1 (MU~)]	0	NA
53	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	7.5	NA
54	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	45	NA
55	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	0	NA
56	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	0	NA
57	MRT-NOR-CNS 81 > CVP0 {MRS-MRT X1} [MU-NGS X1 (MU~)]	2.5	NA
58	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	40.32	NA
59	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	48.39	NA
60	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	3.23	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
61	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
62	MRT-NOR-CNS 81 > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
63	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	24.07	NA
64	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	67.59	NA
65	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
66	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
67	MRT-NOR-CNS 81 > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
68	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	0	NA
69	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	72	NA
70	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	0	NA
71	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	0	NA
72	MRT-NOR-CNS 81 > {MRS-MRT X1} [MU-NGS X1 (MU~)]	4	NA
73	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	38.4	NA
74	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	48	NA
75	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	3.2	NA
76	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	0	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
77	MRT-NOR-CNS 81 > {WMK G501} [MU-NGS X1 (MU~)]	0	NA
78	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	23	NA
79	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	73	NA
80	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
81	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
82	MRT-NOR-CNS 81 > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
83	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	81.25	NA
84	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
85	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
86	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
87	MRT81-MNC > CVP0 {WMK G501} [MU-NGS X1 (MU~)]	0	NA
88	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	40	NA
89	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
90	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
91	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA
92	MRT81-MNC > CVP0 {WMS G501} [MU-NGS X1 (MU~)]	0	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
93	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	100	NA
94	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	0	NA
95	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	0	NA
96	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	0	NA
97	MRT81-MNC > {WMK G501} [MU-NGS X1 (MU~)]	0	NA
98	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	100	NA
99	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
100	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
101	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
102	MRT81-MNC > {WMS G501} [MU-NGS X1 (MU~)]	0	NA
103	MSR-KMK 81 * {NIL} [Manual(TIWEST_COG1)]	24.41	NA
104	MSR-KMK 81 * {NIL} [RegLower(TIWEST_COG1)]	24.41	NA
105	MSR-KMK 81 * {NIL} [RegRaise(TIWEST_COG1)]	24.41	NA
106	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	14.03	NA
107	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	35.82	NA
108	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	10.45	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
109	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
110	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
111	NIL > CVP0 {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
112	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	42.58	NA
113	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	23.09	NA
114	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	2.37	NA
115	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0	NA
116	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0	NA
117	NIL > CVP0 {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0.62	NA
118	NIL > CVP0 {WMK G501} [CGT-YLN X1 (YLN-)]	0	NA
119	NIL > CVP0 {WMK G501} [CGT-YLN X1 (YLN-)]	0	NA
120	NIL > CVP0 {WMS G501} [CGT-YLN X1 (YLN-)]	0	NA
121	NIL > CVP0 {WMS G501} [CGT-YLN X1 (YLN-)]	0	NA
122	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	16.91	NA
123	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	43.17	NA
124	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	12.59	NA
125	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
126	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
127	NIL > {MRT-NOR 81} [MU-NGS X1 (MU~)]	0	NA
128	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	42.67	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
129	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	23.14	NA
130	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	2.38	NA
131	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0	NA
132	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0	NA
133	NIL > {MRT-NOR-CNS 81} [MU-NGS X1 (MU~)]	0.62	NA
134	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
135	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
136	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
137	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
138	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
139	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
140	NIL > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
141	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
142	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
143	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
144	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
145	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
146	NIL > {PJR-CTB 81} [PJR-RGN 81 (RGN~)]	0	NA
147	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
148	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA

Constrained portfolio	Constraint equation	Constrained uplift payment ratio[48]	
		Rolling test window	Fixed assessment period
149	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
150	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
151	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
152	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
153	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-MUL 81 (JDP~)]	0	NA
154	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
155	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
156	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
157	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
158	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
159	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
160	NT-PJR 81 > {NBT-NT 91, SPS_MARNET} [JDP-WNO 81 (WNO~)]	0	NA
161	YDW-YDT 91 * {NIL} [Off(YANDIN_WF1)]	0	NA