

OVER-CONSTRAINED DISPATCH RERUN PROCESS DOCUMENT

PREPARED BY: Electricity Market Performance

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Version Release History

Version	Date	By	Changes
1.2	16/06/2011	Maianh Diesendorf	Rebranded as a process document
1.1	14/03/2011	Vonny Wijaya	Amended 'full FCAS violation' to 'FCAS violation' in OCD and Intervention section Clarified violated constraint as one of the condition for OCD in OCD Rerun Principles section
1.0	20/01/2011	Vonny Wijaya	Initial Creation

Contents

1	Reference.....	5
1.1	Abbreviations	5
1.2	References.....	5
2	Introduction	6
3	OCD Rerun Process	6
3.1	Original NEMDE Run	7
3.2	Inline OCD Rerun.....	7
3.2.1	OCD Rerun Principles	8
3.2.2	Constraint RHS Relaxation Logic.....	8
3.2.3	OCD and Price Revision	9
3.2.4	OCD and Intervention.....	9
3.3	Market Notice	9
3.4	Offline and Manual OCD Rerun.....	10
3.5	Price and Constraint Relaxation Information	11
3.5.1	MMS Data Model.....	11
3.5.2	NEMDE and Price Setting Files	11
3.5.3	Market Suspension Pricing Report.....	11

1 Reference

1.1 Abbreviations

ABBREVIATION	ABBREVIATION EXPLANATION
DI	Dispatch Interval
FCAS	Frequency Control Ancillary Service
MFP	Market Floor Price
MPC	Market Price Cap (formerly VoLL – Value of Lost Load)
MPDI	Manual Price Dispatch Interval
NEMDE	NEM Dispatch Engine or central dispatch algorithm
NEMMCO	National Electricity Market Management Company (now AEMO)
NER	National Electricity Rules; also often just called the Rules
OCD	Over-Constrained Dispatch
ROP	Regional Original Price
RRP	Regional Reference Price
Rules	National Electricity Rules (NER)

1.2 References

1998, 2004 and 2005 OCD Rerun Process Rule Consultations

2 Introduction

The National Electricity Market (NEM) dispatch process is based on the linear programming optimisation performed by the NEM Dispatch Engine (NEMDE), where a set of principles is given in the National Electricity Rules (NER) for the objective function and relevant constraint sets are subsequently applied. In some instances, a feasible solution for a dispatch run cannot be found due to conflicting constraints in the NEMDE solve. AEMO assigns different Constraint Violation Penalty (CVP) to allow such conflicting constraints to be violated in a pre-determined priority order based on their relative CVP prices.

An over-constrained dispatch (OCD) run occurs when the marginal price of one or more regions is over the market price cap (MPC) or below the market floor price¹ (MFP) due to the added cost of violated constraints. The added costs that are reflected on the price means that the regional energy demand and/or frequency control ancillary services (FCAS) requirement can only be met by the short-term violation of network and/or FCAS requirement constraints above their secure limits.

In accordance with clause 3.8.1(c) of the NER, AEMO is required to establish procedures to allow relaxation of power system constraints in order to resolve the infeasible dispatch solutions subject to the following principles:

1. the procedures are developed in consultation with Registered Participants to achieve a reasonable dispatch outcome while maintaining consistency with AEMO's obligations to maintain power system security and the pricing principles listed in clause 3.9.1; and
2. AEMO must report to Registered Participants any events requiring the relaxation of these constraints.

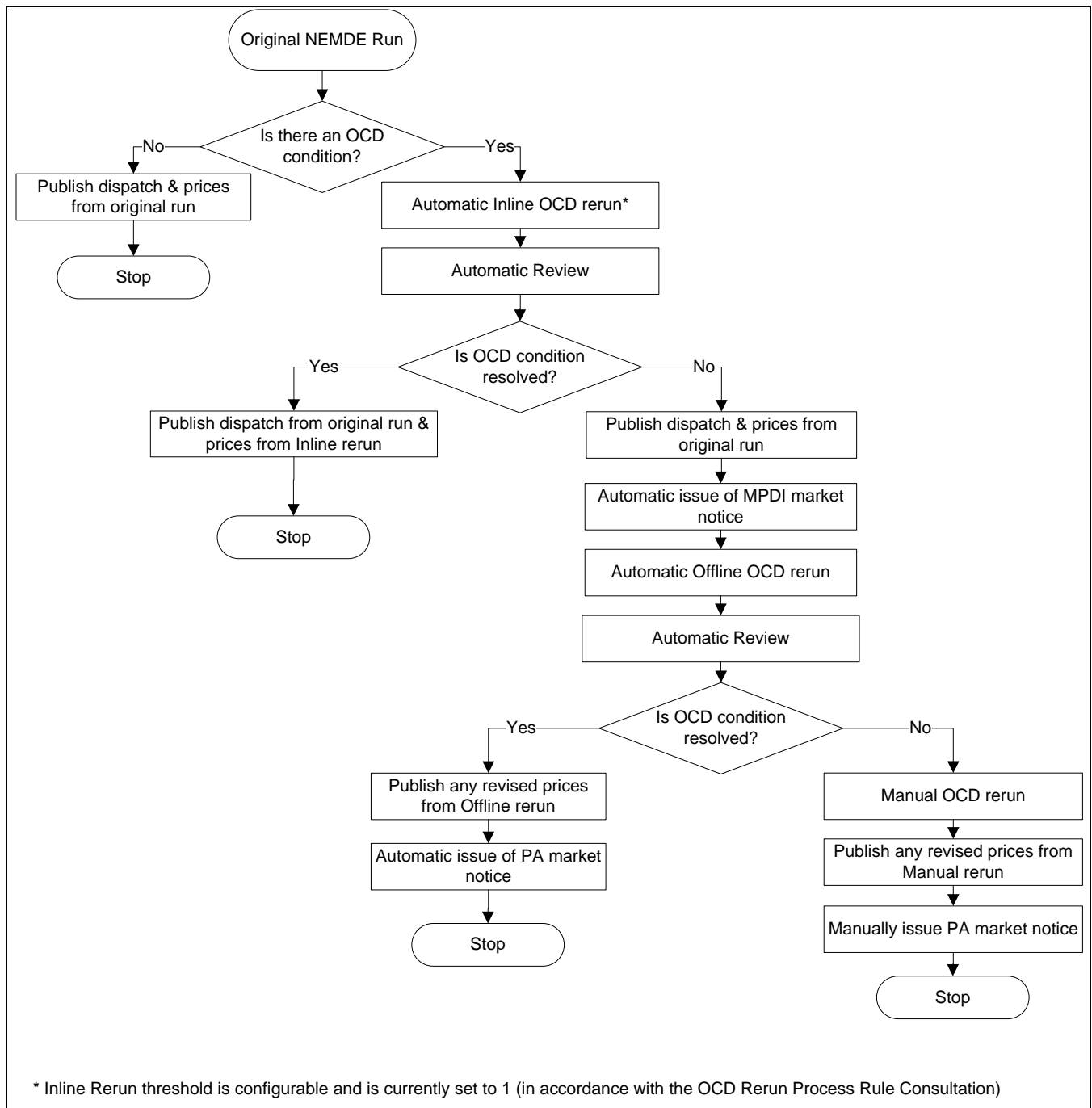
In 1998, AEMO (formerly NEMMCO) conducted the OCD Rerun Process rule consultation to develop the procedure as set out in above NER clause. Following the rule consultation, the OCD rerun process was implemented and has been in operation since then. A comprehensive review was also carried out in 2004 and 2005 to address issues with the fast start unit commitment process and the treatment of FCAS prices in the OCD process. The purpose of this document is to explain and capture the OCD rerun process and procedure as set out in the Rule Consultation.

3 OCD Rerun Process

The OCD rerun process fundamentally aims to remove the violation cost components from energy/FCAS prices by sufficiently relaxing violated constraints so that only scheduled units are setting the prices. The following diagram depicts the overall process flow and subsequent sections give further details on each of the process.

¹ MFP is only applied to energy price since frequency control ancillary services (FCAS) price cannot be below zero

Diagram 1: OCD Rerun Process Flow



3.1 Original NEMDE Run

It is the first NEMDE run for the dispatch interval. The physical target solution comes from this original NEMDE run.

3.2 Inline OCD Rerun

The inline OCD re-run is automatically triggered immediately after the original NEMDE run if the OCD condition exists in the original run. This process involves modifying the original NEMDE input file wherein the RHS of violated constraint identified in the original solution is relaxed and one NEMDE rerun is performed with the relaxed constraints. If OCD condition still persists in the inline

OCD rerun solution, it would automatically trigger MPDI market notice issuance and offline rerun (followed by manual OCD review rerun, if OCD condition is not resolved during offline rerun).

The process to detect an OCD condition and resolve through the inline OCD rerun is provided below. This process is described in sections 3.2.1 to 3.2.4 and is also applied during Offline/Manual OCD rerun process.

3.2.1 OCD Rerun Principles

The principles of the OCD rerun process are outlined below.

- 1) A 5-minute dispatch run solution is declared as Over-Constrained Dispatch if:
 - (a) Any network or regional FCAS requirement constraint is violated
AND
 - (b) Any regional Energy and/or FCAS price is either:
 1. greater than or equal to MPC or;
 2. less than or equal to the MFP (for Energy only)
- 2) If the above condition exists then all violated network and regional FCAS requirement constraints are relaxed before the 5-minute dispatch algorithm is rerun - this rerun is called an OCD rerun. Violated constraints are relaxed by adjusting their constraint RHS by an amount just exceeding the violation degree reported for that constraint in the original dispatch run. Refer to 3.2.2 for constraint relaxation logic.
- 3) Revised prices for all regions are determined from the solution of the final OCD rerun that eliminates the OCD condition. These revised energy prices are published to the market.
- 4) Fast Start unit commitment remains unaltered, being determined on the basis of the (unpublished) Fast Start unit commitment solve undertaken prior to the original Dispatch run.
- 5) If the automated OCD rerun process fails to remove all eligible constraint violations then AEMO will issue a market notice declaring a manual price dispatch interval (MPDI) & advising that prices for that dispatch interval will be reviewed. Before the end of the next business day, an offline/manual OCD rerun will be undertaken. The results of this offline/manual OCD rerun will be advised through a second market notice.

The OCD rerun trigger condition is to be determined from the Intervention=0 solution, which is the sole solution during normal market operation and the intervention pricing solution during intervention pricing dispatch intervals.

The physical target solution continues to be published from the original dispatch run only (rather than from any OCD rerun), given that scheduled units have already been automatically dispatched on the basis of that original over-constrained dispatch solution.

3.2.2 Constraint RHS Relaxation Logic

For all relaxable constraints (as described in 3.2.1):

IF Deficit < 0 (Constraint Inequality Operator is '≥' or "=")

THEN

Adjusted RHS = Original RHS plus Deficit minus Relaxation Offset

ELSE IF Deficit > 0 (Constraint Inequality Operator is '≤' or "=")

THEN

Adjusted RHS = Original RHS plus Deficit plus Relaxation Offset

Where:

Constraint Inequality Operator	As identified in NEMDE Input file 'GenericConstraint' record for relevant Constraint: Type = '0' refers to '=' Type = '1' refers to '≤' Type = '2' refers to '≥'
Deficit	Violation amount, reported as 'Deficit' in the constraint's ConstraintSolution record of the NEMDE Output file. Deficit = Dispatched LHS amount minus Original RHS.
Relaxation Offset	Constraint Over-relaxation constant, currently = +0.01 MW

3.2.3 OCD and Price Revision

A dispatch interval could be subject to price revision if the difference in price and interconnector flow (compare to the previous dispatch interval) reaches certain thresholds. During the price revision process, the Control Room might reject the prices in the dispatch interval (due to manifestly incorrect input) and the prices from previous good dispatch interval would be used instead.

If an OCD interval is subject to price revision and the prices are rejected during this event, the offline/manual OCD rerun and review are not required on this dispatch interval. However, if a non-OCD interval is subject to price revision and its prices are rejected, and the previous good dispatch interval is flagged as OCD, any adjusted energy/FCAS price arising from the offline/manual OCD rerun and review process on the previous interval needs to be brought forward to the non-OCD interval.

3.2.4 OCD and Intervention

When OCD and intervention occur at the same time, only constraint violation in the intervention pricing run is taken into consideration when determining the cause of OCD. Although constraint relaxation is applied to both intervention target and intervention pricing runs during the OCD rerun, only the OCD rerun intervention pricing solution is used to determine the pricing outcomes while the physical MW target solution comes from the intervention target run of the original NEMDE run.

When OCD and intervention occur at the same time for more than 30 minutes and network constraint has continually been violated within that time, the network constraint must no longer be violated in the subsequent intervention pricing interval (nor be relaxed). Instead, the network constraint CVP would be set to above the default load shedding CVP to show MPC energy prices in downstream regions and thus reflecting the need for load shedding. Note that when this happens, the pricesetting information would show violation component of the energy balance constraint.

Similarly for FCAS constraints, if FCAS constraint violation has been detected in successive OCD and intervention pricing intervals for more than 30 minutes then the violated FCAS constraint would not be relaxed in the subsequent intervention pricing runs.

3.3 Market Notice

There are two market notices related to an OCD event:

- MPDI

Indicates a manual price dispatch interval, this market notice is sent out when inline OCD rerun triggers and unable to resolve the OCD condition.

Figure 1: Example of MPDI Notice

External Reference: MANUAL PRICE DISPATCH INTERVAL (OCD) - Monday 19 January 2009 01:55 ⁺
Reason:

AEMO ELECTRICITY MARKET NOTICE

MANUAL PRICE DISPATCH INTERVAL

The following dispatch interval price will be reviewed in accordance with the Over-Constrained Dispatch process published on the AEMO website.

Dispatch interval:
18/01/2009⁺⁺ DI 263

The outcome of the review will be advised in a Price Adjustment Market Notice.

Auto-generated on behalf of PSO Manager

+ settlement/calendar date & time, ++ trading date

- Price Adjustment

In response to MPDI notice, price adjustment notice is issued after the offline/manual OCD review process to notify of any changes to the published price as the result of the review. This market notice is issued by the end of the next business day following an unresolved inline OCD rerun.

Figure 2: Example of Price Adjustment Notice

External Reference:
PRICE ADJUSTMENTS - OCD - Monday 19 January 2009 01:55⁺

Reason:
AEMO ELECTRICITY MARKET NOTICE

PRICE ADJUSTMENTS- MANUALLY PRICED DISPATCH INTERVALS (OVER-CONSTRAINED DISPATCH)

In accordance with the AEMO determination on OCD (published on AEMO website), the published price in the following dispatch interval (identified in Market Notice ID 24367[^]) has been reviewed by AEMO.

Trading Day	DI	Region	Type	Original Price(\$/MWh)	Adjusted Price(\$/MWh)
20090118 ⁺⁺	263	SA1	Energy	\$12,500.00000	\$ 9,000.00000
20090118	263	NSW1	Energy	-\$ 1,000.00000	-\$ 999.00000

Adjusted Prices are published on AEMO website and Server \\nempart2\Intrface under participant directory in \IMPORT\REPORTS\CSVReports\
Auto-generated on behalf of EMP

+ settlement/calendar date & time, ^ associated MPDI notice ID, ++ trading date

3.4 Offline and Manual OCD Rerun

If inline OCD rerun fails to resolve the OCD condition, AEMO would review the original run and inline rerun outcome to determine the cause of OCD and take necessary actions until OCD condition is resolved. These actions would be done by means of additional OCD reruns, and occasionally in combination with constraint CVP modifications.

Following the automatic inline rerun, the offline OCD rerun process would be triggered and automatically perform additional reruns. This offline process is identical to the inline rerun process (apart from the number of rerun iterations) and was introduced in November 2010 to improve the manual OCD rerun process. If the OCD condition is resolved during the automatic offline rerun process, revised prices and price adjustment notice may be sent out before the end of the dispatch interval that the OCD condition was detected in. If OCD condition still persists after the offline rerun process, AEMO staff would intervene and resolve the OCD condition manually.

3.5 Price and Constraint Relaxation Information

If inline OCD rerun fails to resolve OCD condition, the prices from original run would be initially published to the market. However, subsequent to offline/manual OCD rerun process these prices may be revised.

In addition to the Price Adjustment Market Notice, the following information would also be made available. Note: Price Adjustment Market Notice would indicate the original RRP as “Original Price” and manual OCD RRP as “Adjusted Price”.

3.5.1 MMS Data Model

The following tables in the MMS Data Model provide details of OCD reruns and are updated in real time with price and constraint information from inline OCD rerun and/or offline/manual OCD rerun solution:

DISPATCHPRICE	Contains the energy and FCAS RRP values. If prices were changed during offline/manual OCD rerun, the existing prices would be overwritten with prices from offline/manual OCD solution.
CONSTRAINTRELAXATION_OCD	Indicates the constraints that were relaxed during a successful OCD rerun.
DISPATCH_CONSTRAINT_FCAS_OCD	Lists all FCAS constraints' RHS, marginal value, and violation amount for the dispatch interval
DISPATCHCASE_OCD	Indicates the OCD interval

All Constraint solutions written into the DISPATCHCONSTRAINT table of the NEM Database (including all FCAS requirement constraint solutions) come from the original NEMDE run, as these constraint solutions are considered a fundamental part of the physical target solution. The publication of the original constraint solutions includes any violated constraints & their original amount of violation.

Note that the FCAS requirement marginal prices (aka Constraint Marginal Values or Constraint MV) used in the FCAS Settlements Cost Recovery calculation are based on the constraint solutions from the OCD rerun that removes the OCD condition. This maintains consistency with use of FCAS prices from that same OCD rerun solution, given that the FCAS prices are based on the sum of FCAS requirement constraint marginal values.

3.5.2 NEMDE and Price Setting Files

The Price Setting information and NEMDE files from successful inline OCD rerun or offline/manual OCD are published to the market on the next trading day.

3.5.3 Market Suspension Pricing Report

Any price adjustment arising from offline/manual OCD rerun process would trigger the re-issuing of Market Suspension Pricing Report.