INTERVENTION PRICING METHODOLOGY

PREPARED BY:	AEMO Markets – Electricity Market Monitoring
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VERSION RELEASE HISTORY

Version	Effective Date	Summary of Changes
1.0	Market start	First Issue
2.0	6 December 2007	Final Determination on NEMMCO review into Intervention Pricing to: • Incorporate an additional NEMDE run during Interventions, when Basslink is able to transfer market ancillary services (when frequency controller 'ON').
3.0	23 October 2014	Minor/administrative changes: • Amended 'NEMMCO' to 'AEMO'. • Updated the Rule references based on changes to 3.9.3
4.0	[TBA]	Improvements to the methodology to reduce the risk of anomalies in intervention pricing runs by better recognising the impact of: • feedback constraints; • tripped generating units trapping of generating units in their FCAS trapeziums

CONTENTS

1. INTRODUCTION

1.1. Purpose and scope

This document (the **Intervention Pricing Methodology** or **Methodology**) is made under clause 3.9.3(e) of the National Electricity Rules (**NER**). It sets out the methodology AEMO will use, and the assumptions it will make, to determine *dispatch prices* and *ancillary service prices* for *intervention price dispatch intervals* as required by clause 3.9.3(b) of the NER.

This Methodology has effect only for the purposes set out in the NER. The NER and the National Electricity Law prevail over this Methodology to the extent of any inconsistency.

1.2. Definitions and interpretation

1.2.1. Glossary

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Terms defined in the NER have the same meanings in this Methodology unless otherwise specified in this clause.

Terms defined in the NER are intended to be identified in these Procedures by italicising them, but failure to italicise a defined term does not affect its meaning.

[***Note: definitions table will be completed at the draft report stage****]*

Term	Definition

1.2.2. Interpretation

These Procedures are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.

[***Note: The remainder of this draft will be updated and revised at the draft report stage to be consistent with AEMO's current conventions for NER procedures. Changes marked from this point are intended to illustrate the solutions proposed in the Issues Paper, but drafting is subject to review***]

2. NATIONAL ELECTRICITY RULES REQUIREMENTS FOR INTERVENTION PRICING

The requirements for intervention pricing in the National Electricity Market (NEM) are outlined in Clause 3.9.3 of the Rules, and are interpreted as follows:

2.1. Intervention Pricing Calculation

The Intervention Prices shall be, under Clause 3.9.3(b)…

> "…at the value which *AEMO*, in its reasonable opinion, considers would have applied as the *dispatch price* and *ancillary services price* for that *dispatch interval* in the relevant *region* had the *AEMO intervention event* not occurred."

The Intervention Prices preserve the market signals that would have existed had the intervention action described above not been taken, and it is used as the dispatch price and market ancillary services prices for the purposes of spot price determination and settlements.

The scenario that generates the Intervention Prices is the so-called "What-if" scenario. The Intervention Prices are also called the "What-If" dispatch prices and market ancillary services prices.

2.2. Intervention Pricing Consistent With Price Determination Principles

In accordance with Clauses 3.9.1, 3.9.2 and 3.9.2A of the Rules, the intervention pricing calculation shall apply the same principles relating to unit, network and power system security constraints as used in determining the dispatch price and market ancillary services prices under normal market operating conditions.

2.3. Intervention Pricing Calculated and Published Every 5 Minutes

The Intervention Price is only required to be calculated by the on-line Dispatch process and published every 5-minutes.

While there is no explicit Rules requirement to calculate and publish Intervention Prices for the Pre-Dispatch process, changes were implemented in the November 2003 MMS release to introduce Intervention Pricing to Pre-dispatch.

Note that implementation of the intervention pricing calculation other than on-line (for example, as an off-line manually-initiated batch process for a series of intervention price dispatch intervals) would not be compliant with Clauses in the Rules dealing with intervention pricing (Clause 3.9.3) and with Market Information reporting (Clause 3.13.4). Furthermore the intervention-based dispatch price and market ancillary services prices (and therefore the spot prices) for settlements would not be available until the off-line batch process had completed, which may be some time after the end of each trading interval.

3. INTERVENTION PRICING PROCESS

3.1. Initiation

Every run of both the on-line Dispatch process and the Pre-dispatch process checks for the presence of any AEMO-invoked intervention-type generic constraints applying for any interval over the relevant scheduling period.

If any invoked intervention-type generic constraints are detected an additional intervention pricing run of the NEMDE Dispatch algorithm is automatically performed in parallel with the base case target run, in order to calculate Intervention Prices.

3.2. Calculation

On initiation of the intervention pricing run, all invoked generic constraints with an "Intervention" status are automatically ignored in the intervention pricing run calculations.

The same inputs that are used in the base case target run are loaded into the intervention pricing calculation with the exceptions listed below (and outlined in Sections 3.2.3, 3.2.4 and 3.2.5):

- The initial loading for each unit is set equal to the “What-if” value of that unit’s dispatch target calculated in the intervention pricing run of the previous dispatch or trading interval (if one was performed) rather than using the metered SCADA value.
- The initial operating mode for each fast start unit is set equal to the “What-if” value of that unit’s fast start mode calculated in the intervention pricing run of the previous dispatch or trading interval (if one was performed).

The initial loading for each *interconnector* is set equal to the “What-if” value of that *interconnector*’s flow target calculated in the intervention pricing run of the previous dispatch or trading interval (if one was performed) rather than using the metered SCADA value.

For the very first intervention pricing run only the metered SCADA values are available and are therefore used.

The NEMDE Solver algorithm is then run and all the "What-if" dispatch price and *ancillary services prices*, unit and *interconnector* “What-if" dispatch targets are written back to the MMS database for reporting to the market.

Arrangements for the Basslink *interconnector* which has *market ancillary service* transfer capability:

The "What-if" run may be performed twice if the Basslink *interconnector* is capable of transferring market ancillary services: One run is performed with the Frequency Controller "on" and the other with it assumed to be "off". The *dispatch prices* and *ancillary service prices* for the intervention price dispatch interval are published from the "What-if" run with the lower objective function value.

3.2.1. RHS Computation of feedback constraints in Intervention Pricing runs

The Right Hand Side (RHS) of feedback constraint equations in the Intervention Pricing runs are computed the same as the base case target run. I.e. Generator and Interconnector terms on the RHS of feedback constraint equations in the Pricing run use metered SCADA values rather than What-If dispatch target or What-If flow targets calculated in the previous DI of the Pricing run.

The technical envelope for all network elements between the base case target run and Intervention Pricing run are the same, and hence the RHS of the constraint equations reflecting the network limits are computed the same.

Table 1 below summarizes the inputs for feedback constraint equations in the Intervention Pricing runs.

Table 1 Inputs for feedback constraint equations in Intervention Pricing runs

Generic Constraint RHS term	Input for Outturn run	Input for Pricing Run
Rating	Defined Value	Defined Value
Scheduled gens/loads	Measured value	Measured value
Semi-scheduled gens	Measured value	Measured value
Interconnector flows	Measured value	Measured value
Intra-regional flows	Measured value	Measured value

3.2.2. RHS Computation of non-feedback constraints in Intervention Pricing runs

Other generic constraints which are market-related (e.g. Negative residue management, Non-physical losses, Non-conformance, MNSP ROC constraints) or FCAS constraints will continue to be determined dynamically, i.e. the RHS for these constraint equations would be determined based on the What-If dispatch target or What-If flow targets calculated in the previous DI of the Pricing run. This is because these constraint equations are not reflective of a network limit but are used to manage market outcomes or FCAS requirements both of which are dependent on generator and interconnector operating points in the Pricing run. Table 2 below outlines the approach for each generic constraint type in the Pricing run.

Table 2 Generic constraints RHS computation approach in Pricing runs

Constraint Type	Constraint Description	Proposed Approach
FCAS	FCAS Requirement Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
Ramping	Network ramping Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
NC	Non-conformance Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
NRM	Negative Residue Management Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
NSA	Network Support Agreement Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)

Fixed Loading	Unit fixed loading Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
ROC	Rate of Change (ROC) Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
System Normal	**Feedback Constraints**	**Static (RHS calculated same as Outturn run)**
	Non-feedback Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)
Network Outage	**Feedback Constraints**	**Static (RHS calculated same as Outturn run)**
	Non-feedback Constraints	Dynamic (RHS calculated as per outcomes in Pricing run)

3.2.3. Identifying tripped generators in Intervention Pricing runs

Generators that trip in the base case target run are also treated similarly in the pricing runs. A generator trip may involve a partial trip (actual output reduces well below bid availability but above 0 MW) or a full trip (actual output reduces to 0 MW). A generator with bid availability **and** Initial MW (actual output in base case target run) less than What-If Initial MW (What-If dispatch target calculated in previous DI of pricing run) by an amount exceeding twice the rate of change down (ROC Down) rate is treated as a tripped generator i.e. the unit's What-If Initial MW will be set equal to Initial MW in the Pricing run.

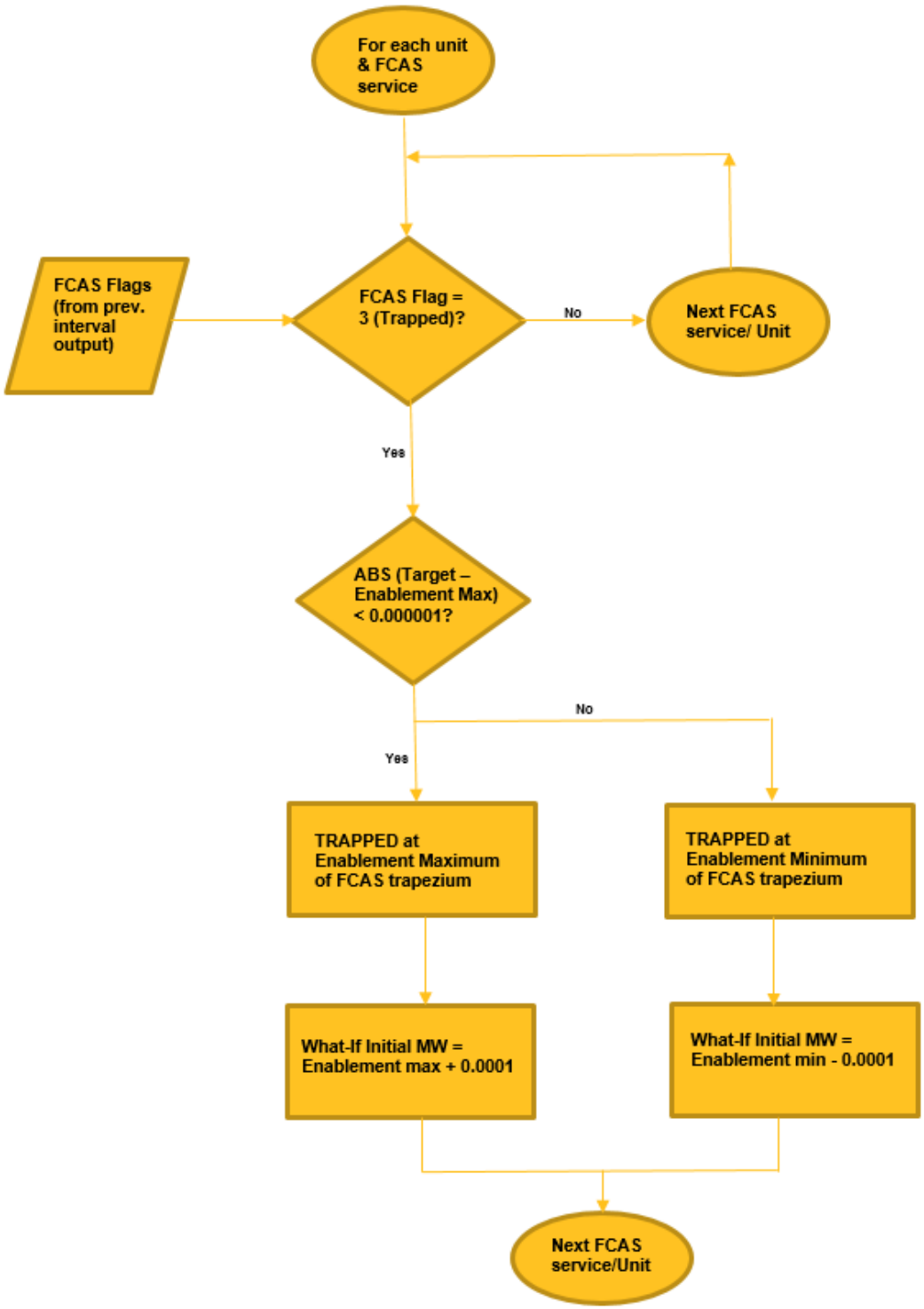
The following check in the NEMDE Caseloader identifies tripped generators in the Pricing runs:

> ***For all generators in each DI:***
>
> ***IF*** *[Bid Availability < (What-If Initial MW - 2 x ROC down/DI)* ***AND***
> *InitialMW < (What-If Initial MW - 2 x ROC down/DI)]*
>
> ***THEN*** *What-If Initial MW = Initial MW.*
> ***ELSE*** *What-If Initial MW = What-If Initial MW (no change).*

3.2.4. FCAS Un-trapping logic in Intervention Pricing runs

To avoid generators being trapped in their FCAS trapeziums for extended periods in the Pricing runs, an FCAS un-trapping logic has been implemented in the NEMDE Caseloader. The logic involves checking whether a unit is trapped at the Enablement maximum or Enablement minimum of each FCAS service trapezium and if so, amending the What-If Initial MW (unit output in pricing run) by a very small amount (0.0001 MW) to move the unit's What-If output outside the trapezium (thus un-trapping the unit). Figure 1 below shows the proposed un-trapping logic to be applied in Pricing runs.

Figure 1 FCAS trapezium Untrapping logic



3.2.5. Generators with zero MW/min ramp rates

A few Generators have historically submitted ramp up/down rates of 0 MW/min by default in dispatch, under legacy arrangements.

For generating units with default 0 MW/min ramp rates on an ongoing basis, the What-If Initial MW is set equal to their Initial MW for all intervals in the Pricing run. This is to ensure the dispatch of these generating units are consistent between the Outturn and Pricing runs.

3.3. Reporting

After completing the intervention pricing run, both the original base case target run and the intervention pricing run solutions are fully reported to the market.

The base case target run solution is flagged as “Intervention=1” and the intervention pricing run solution is flagged as “Intervention=0”.

For on-line Dispatch the dispatch prices from the intervention pricing run are used in the dispatch price averaging calculation of spot price for the relevant trading interval, which is subsequently published and used in settlements.

4. “WHAT-IF” INPUTS TO THE INTERVENTION PRICING CALCULATION

Apart from the “What-if” inputs, the remaining market-based inputs that are passed to both the target and intervention pricing runs of on-line Dispatch algorithm (i.e. bids, offers, network constraints, demand) are identical.

As discussed previously the “What-if” inputs are determined as a function of the “What-if” results of the previous dispatch interval’s intervention pricing run rather than from the results of the previous dispatch interval’s base case target run.

Note that as an intervention progresses over time, the values of the “What-if” inputs derived in the intervention pricing run may differ significantly from the values of the corresponding inputs used in the base case target run, with this difference potentially increasing the longer the intervention continues.