

INTERCONNECTOR LIMIT SETTER REPORTING CHANGES - BUSINESS SPECIFICATION

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Executive Summary

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Reference

1.1 Abbreviations

ABBREVIATION	ABBREVIATION EXPLANATION
5MPD	5-Minute Pre-dispatch process
FCAS	Frequency Control Ancillary Services
MMS	Market Management System; software, hardware, network and related processes to implement the National Electricity Market (NEM); a NEMMCO department responsible for maintaining the system
NER	National Electricity Rules; also often just called the Rules
RHS	Right-Hand-Side
Rules	National Electricity Rules (NER)

1.2 References

1. "Regional FCAS Recovery - Business Specification", NEMMCO website:
http://www.nemmco.com.au/dispatchandpricing/dispatch_pricing.htm
2. National Electricity Rules

2. Introduction

2.1 Overview

This Business Specification describes changes to the rules for determining what generic constraint equation is reported as setting an interconnector energy flow limit, where that flow limit could potentially be set by any one of a number of constraint equations.

These changes affect interconnector limit reporting for the Dispatch, 5MPD & Pre-dispatch processes.

The changes were implemented as part of the June 2004 MMS release.

2.2 Background to Changes

Interconnector export & import flow limits & the most restrictive constraint equation IDs that set each of these limits are determined after each Dispatch, Pre-dispatch & 5MPD run, as a part of the solution loading post-process. This information is reported to all market participants.

In most circumstances only one constraint equation would impose the most restrictive flow limit & therefore be identified as setting the interconnector limit.

However since implementation of FCAS requirements as generic constraints in Production systems on 3rd April 2003 market participants have raised issue with FCAS requirement constraints being reported as setting interconnector flow limits. This has occurred where an outage on a network element affects the security of the interconnection between regions & requires the management of the “at risk” interconnector flow through invocation of local islanding risk FCAS requirement constraints.

Islanding risk FCAS requirement constraints are designed to optimally trade-off the “at risk” interconnector flow into a region against the cost of locally supplying FCAS in that region, & do this by having both region contingency FCAS supply & interconnector flow terms on the constraint LHS. These islanding risk FCAS requirement constraints may bind when the interconnector flow associated with that constraint is setting the highest contingent risk for the local region, thus requiring more local FCAS than already dispatched to cover the global FCAS requirement.

In some of these cases the interconnector flow associated with the islanding risk FCAS requirement constraint is itself binding on another different interconnector-only flow constraint, with the latter constraint “driving” the islanding risk FCAS constraint to bind. At other times, a shortage of local contingency FCAS availability may result in the violation of the islanding risk FCAS requirement constraint, again “driven” by another (higher priority) binding interconnector-only flow constraint.

In all cases both the islanding risk FCAS requirement constraint & the single interconnector-only flow constraints are binding at effectively the same interconnector flow value, &

therefore both are theoretically eligible to be identified as the interconnector energy limit setter.

Prior to the changes in this Business Specification, the constraint equation ID that first appears alphabetically in the above list of eligible constraints is reported as the interconnector limit setter constraint. However this design was deemed unsatisfactory by market participants, as islanding risk FCAS requirement constraints are indirectly “driven” to become binding (or even violated) by other binding interconnector-only flow constraints, the latter of which have a higher priority (in terms of dispatch compliance) & should therefore be reported as the interconnector limit setter constraint.

To address this issue NEMMCO, in conjunction with its Dispatch & Pricing Reference Group, agreed to a set of rules governing how the interconnector limit setter constraint is reported where multiple constraints effectively have the same most restrictive interconnector flow RHS. In formulating these rules it was noted that binding FCAS requirement constraint information was already made available through other reporting measures, & it was deemed unnecessary to retain any preference to reporting FCAS requirement constraints as interconnector limit setters.

3. Status Prior to Change

Under the previous Interconnector Limit Setter constraint reporting design, if there were a number of constraint equation IDs all effectively presenting the same most restrictive interconnector flow limit (after substitution of solution targets into all non-subject interconnector LHS terms & shifting to RHS), then only the alphabetically-first constraint equation ID from that list of multiple constraints was reported.

Therefore if a region islanding risk FCAS requirement constraint was in this list (constraint IDs prefixed by ‘F’), then its constraint equation ID was likely to be always reported as setting the interconnector flow limit.

Interconnector Limit Setter constraint information forms part of the public interconnector solution reporting via NEM CSV report files & the Infoserver.

4. New Process Requirements

4.1 Scope

The changes in this Business Specification apply to Interconnector Export & Import Limit constraint setter reporting from the Dispatch, Pre-dispatch & 5MPD processes.

There are no changes to the existing calculation of Interconnector Energy & FCAS Export & Import Limits. These calculations are described in Appendix 1 of this document.

4.2 Process Requirements

4.2.1 Determination of Interconnector Limit Setter Constraint

For each interconnector ID (called subject interconnector) & interconnector flow upper & lower bound (called Export Limit & Import Limit respectively):

Create a master list of eligible constraint equation IDs with the same most restrictive interconnector flow limit value.

From this master list, determining the Interconnector Limit Setter constraint as follows:

IF

Priority #1

there are any constraint equations defined with only the Subject Interconnector as a LHS term

THEN

Report the alphabetically first Constraint ID from this list - ANSI sort order

ELSE IF

Priority #2

there are any constraint equations defined with either:

Subject Interconnector LHS terms + Other Interconnector LHS terms
(called Joint Interconnector constraints)

OR

Subject Interconnector LHS terms + Unit Energy LHS terms
(called “Option 4” constraints)

THEN

Report the alphabetically first Constraint ID from this list - ANSI sort order

ELSE IF

Priority #3

there are any constraint equations defined with either:

Subject Interconnector LHS terms + Region FCAS LHS terms
(called Islanding Risk FCAS requirement constraints)

OR

Subject Interconnector LHS terms + Unit FCAS LHS terms

THEN

Report the alphabetically first Constraint ID from this list - ANSI sort order

ENDIF

4.2.2 Rationale behind the Limit Setter Reporting Order

The rationale behind the preferential reporting rules is that:

- The “driving” constraint is ultimately responsible for setting the interconnector flow limit. The “driving” constraint is typically that with interconnector-only LHS terms, as the

penalty for violating an interconnector-only constraint is higher than that for FCAS requirement constraints, including islanding risk constraints.

- When islanding risk FCAS requirement constraints are active, there is already sufficient constraint information published elsewhere to determine the effect of these constraints upon the market outcome & it is therefore unnecessary to include FCAS constraint information in the reporting of interconnector limit constraint setter.

4.2.3 Limiter Setter Reporting during an Intervention Period

During an Intervention period there are two run solutions published from the Dispatch & Pre-dispatch processes – the Target run solution (tagged as Intervention=1) & the Pricing run solution (tagged as Intervention=0).

The Interconnector Limit & Limit Setter calculations are repeated independently for each of these run solutions, using as input to the calculations only the interconnector solution from the relevant run.

This remains unchanged from the design prior to the changes in this Business Specification.

5. Examples of Limit Setter Reporting Functionality

ID	SCENARIO DESCRIPTION	LIMIT SETTER CONSTRAINT REPORTING
1	Single constraint with the most restrictive interconnector flow limit value	Report Constraint ID of that constraint
2	Multiple constraints with the most restrictive interconnector flow limit value AND All constraints with Subject Interconnector LHS term only	Report alphabetically first Constraint ID from “Subject Interconnector LHS term only” list
3	Multiple constraints with the most restrictive interconnector flow limit value AND Some constraints with Subject Interconnector LHS term only AND Some constraints with Subject + Other Interconnector LHS terms	Report alphabetically first Constraint ID from “Subject Interconnector LHS term only” list
4	Multiple constraints with the most restrictive interconnector flow limit value AND Some constraints with Subject Interconnector LHS term only AND Some constraints with Subject Interconnector + Unit energy LHS terms	Report alphabetically first Constraint ID from “Subject Interconnector LHS term only” list
5	Multiple constraints with the most restrictive interconnector flow limit value AND Some constraints with Subject + Other Interconnector LHS terms AND Some constraints with Subject Interconnector + Unit energy LHS terms	Report alphabetically first Constraint ID from joint list of “Constraints with Subject + Other Interconnector LHS terms” & “Constraints with Subject Interconnector + Unit energy LHS terms”
6	Multiple constraints with the most restrictive interconnector flow limit value AND	Report alphabetically first Constraint ID from “Subject + Other Interconnector LHS terms” list

ID	SCENARIO DESCRIPTION	LIMIT SETTER CONSTRAINT REPORTING
	Some constraints with Subject + Other Interconnector LHS terms AND Some constraints with Subject Interconnector + Region/Unit FCAS LHS terms	
7	Multiple constraints with the most restrictive interconnector flow limit value AND Some constraints with Subject Interconnector + Unit energy LHS terms AND Some constraints with Subject Interconnector + Region/Unit FCAS LHS terms	Report alphabetically first Constraint ID from "Subject Interconnector + Unit energy LHS terms" list

Appendix 1: Interconnector Limit Calculations

Interconnector Energy Flow Export & Import Limit calculation

For each subject interconnector / ...

1. Initialise Export & Import Limits to their Interconnector's default values, defined by EXPORTLIMIT & IMPORTLIMIT in the public MMS INTERCONNECTORCONSTRAINT table, as follows:

$$\text{Export Limit}_i = \text{EXPORTLIMIT}_i$$

$$\text{Import Limit}_i = - \text{IMPORTLIMIT}_i$$

2. From the set of generic constraint equation IDs active for that interval, filter on that sub-set of constraint equations that contain the subject InterconnectorID as a constraint LHS flow term.
3. From that sub-set, for each constraint equation, collect:
 - i) RHS value (as written to the MMS database)
 - ii) ConstraintType (as defined in the public MMS GENCONDATA table)
 - iii) Factor
(as defined in the public MMS SPDINTERCONNECTORCONSTRAINT, SPDCONNECTIONPOINTCONSTRAINT & SPDREGIONCONSTRAINT tables)
4. Re-arrange each constraint equation so that subject interconnector is only term on constraint LHS, & calculate the effective bound for this subject interconnector:

(ICLimit_i)(Factor_i) ...ConstraintType ... RHS - OtherLHSTerms

Where:

ICLimit_i = Interconnector Limit (in MW)

Factor_i = Scaling Factor for the subject interconnector LHS term

ConstraintType = Logical operator (\leq , \geq , =)

RHS = Constraint equation limit (in MW)

OtherLHSTerms = All LHS terms other than the subject interconnector
(ID_x)(Factor_x) + (ID_{x+1}) (Factor_{x+1}) + etc

ID_x = Solution Target for LHS variables other than the subject interconnector.

For Unit term (ConnectionPointID), this is energy target or TotalCleared in MMS database

For Interconnector term, this is flow target or MWFlow in MMS database

For Region FCASxx term, this is region total FCASxx enabled, or <FCASxx>LocalDispatch in MMS database

$Factor_x$ = Scaling Factor associated with each of OtherLHSTerms

- For all constraint equations with ConstraintType of “≥”, convert to an “≤” inequality by multiplying both the LHS & RHS of equation in Step 4 by -1:

For example:

+1 (V-SA Limit) ≥ 500 MW

Becomes...

-1 (V-SA Limit) ≤ - 500 MW

No processing is required for constraint equations with ConstraintType of “≤” or “=”.

- For all constraint equations with a positive $Factor_i$ for the subject interconnector, the effective RHS bound value (which may be negative) represents an upper bound (that is, contributes to setting the Export Limit) on the directed flow over the subject interconnector.

For all constraint equations with a negative $Factor_i$ for the subject interconnector, the effective RHS bound value (which may be negative) represents a lower bound (that is, contributes to setting the Import Limit) on the directed flow over the subject interconnector.

- Reported Export Limit_i = minimum of (default Export Limit (Step 1), all Upper Bound values (Step 6))

Reported Import Limit_i = maximum of (default Import Limit (Step 1), all Lower Bound values (Step 6))

Interconnector FCAS Export & Import Limit Calculation

For each subject interconnector / ...

- Initialise Export & Import Limits to their Interconnector’s default values, defined by EXPORTLIMIT & IMPORTLIMIT in the public MMS

INTERCONNECTORCONSTRAINT table, as follows:

Export Limit_i = EXPORTLIMIT_i

Import Limit_i = - IMPORTLIMIT_i

2. IF

Interconnector cannot transfer FCAS

(as defined by FCASSUPPORTUNAVAILABLE=1 in the public MMS
INTERCONNECTORCONSTRAINT table)

THEN...

Reported FCAS Export Limit_i = Calculated Energy Flow Export Limit_i

Reported FCAS Import Limit_i = Calculated Energy Flow Import Limit_i

Where Calculated Energy Flow Export Limit_i, & Calculated Energy Flow Import Limit_i
are both determined in above Section "Interconnector Energy Flow Export & Import
Limit calculation".