

Market Operator

Generating Unit Tie Break Procedure

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1. Purpose

This procedure specifies the principles in applying a *tie-break* to competing *generating units* when operating in the *I-NTEM* to ensure an orderly merit order dispatch process by the *Power System Controller*.

2. Scope

- 2.1 The procedure only applies to the *I-NTEM*.
- 2.2 The procedure is prepared under the authority of Section 4.4B(e) of the System Control Technical Code.
- 2.3 The procedure covers those parts of the commitment and dispatch process¹ that involve:
 - 2.3.1 The priority of the off-load order when comparing *generating units* (whose offer price is zero) from more than one *Generator*; and
 - 2.3.2 The dispatch of *generating units* from two or more *Generators* when the offer prices are equal and greater than zero at the *Pool Price Point*.
- 2.4 The procedure does not cover other parts of the commitment and dispatch process.

¹ The commitment and dispatch process is referred to in Section 4.4B(c) of the System Control Technical Code.

3. Roles and Responsibilities

Role / Title	Responsibility
General Manager System Control	<ul style="list-style-type: none"> • Ensure that the requirements of Section 4(e) have been correctly actioned. • Ensure that this procedure is fit for purpose. • Approve the procedure. • Ensure compliance with this procedure.
Operational Systems Manager	<ul style="list-style-type: none"> • Process Offers in accordance with this procedure. • Advise <i>Generator</i> representatives of any instance that an Offer is not consistent with this procedure. • Escalate (after discussion with the <i>Generator</i> representative) a situation to the General Manager System Control where a <i>tie-break</i> event occurs but the application of this procedure would cause an unintended consequence on system security if the <i>generating units</i> were dispatched in accordance with this procedure. • Review and revise the procedure form time to time, and no later than the review date to maintain its relevance.
<i>Generator</i> representative	<ul style="list-style-type: none"> • Abide by the instructions from the <i>Power System Controller</i> arising from the application of this procedure.

4. Definitions

The definitions of words recorded in the Glossary of the System Control Technical Code apply to this document, in addition to the words recorded in the table below, as shown in italics throughout the document.

Definitions		
No.	Term	Meaning
1	<i>Off-load order</i>	The term specified in the relevant column of the commitment and dispatch template shown in Attachment 4 of the System Control Technical Code, as superseded by the Generator Offer procedure.
2	<i>Pool Price Point (PPP)</i>	Pool Price Point. The reference supply point for all <i>generating units</i> in respect to power system losses
3	<i>Random day</i>	The trading day assigned to a specific <i>Generator</i> for assigning a marginal price priority order, as nominated in the <i>random day selection process</i> (refer to Attachment B).
4	<i>Random period</i>	The period allocated to a specific <i>Generator</i> for assigning the off-load priority order, as nominated in the <i>random period selection process</i> (refer to Attachment A). The duration of the period is specified in Attachment A.
5	<i>Random day selection process</i>	The process where each <i>Generator</i> is assigned a series of trading days in a period and on any one of those trading days, that <i>Generator's generating units</i> whose offer price is greater than zero and marginal will be dispatched by the <i>Power System Controller</i> before any other <i>Generator's generating unit</i> with an equal marginal price is dispatched.

		Examples are provided in Appendix C.
6	<i>Random period selection process</i>	The process where each <i>Generator</i> is assigned a period (consisting of multiple consecutive trading days) where the <i>Generator's generating units</i> with an <i>off-load order</i> may be instructed to be taken off-line by the <i>Power System Controller</i> before any other <i>Generator's generating unit</i> with an identical <i>off-load order</i> is instructed to be taken off line (refer to Attachment B). Examples are provided in Appendix C.
7	<i>Generating Unit tie break</i>	In the NT, generating unit tie break is the term given to the methodologies used to resolve following two conditions: (a) The condition where <i>generating units</i> from more than one <i>Generator</i> have similar <i>off-load order</i> sequences. For example: (i) <i>generating units (Generator1) off-load order</i> sequence = 1, 2, 3, 4; and (ii) <i>generating units (Generator2) off-load order</i> sequence= 1, 2, 3. Note: the number of characters in the sequences can be different. (b) The condition where equal price offers (greater than zero) for which the prices submitted in <i>Generator Offers</i> for a particular <i>trading interval</i> result in identical prices at their <i>Pool Price Point</i> , then the MW quantities specified in the relevant <i>price bands</i> of those <i>dispatch bids</i> or <i>dispatch offers</i> must be <i>dispatched</i> using the <i>random day selection process</i> , where this can be achieved without violating other constraints.

5. Principles

The following principles apply to the preparation and submission of *Generator Offers*.

The following principles are to be used to guide the application of the *generating unit tie break* methodologies:

Off-load order for price offers equal to zero:

- 5.1 A self-committed *generating unit* whose band 1 offer price is zero must have an *off-load order* nominated in the *Generator's Offers*.
 - 5.1.1 For the removal of doubt, this applies to a *generating unit* that is operating in either the open cycle mode or the closed cycle mode.
- 5.2 The treatment of different *generating unit* technology in regard to *off-load order* characters is explained in the *Generator Offers* procedure. To assist this document:
 - 5.2.1 open cycle gas turbine *generating units* are to be assigned off-load characters that are alphabetic.
 - 5.2.2 combined cycle gas turbine *generating units* are to be assigned off-load characters that are primarily numeric.
- 5.3 The *off-load order* of a *generating unit* operating in an open cycle gas turbine mode is to commence at alpha character A (first off) and increase sequentially by alphabetical characters until all open cycle *generating units* are assigned an off load number.
 - 5.3.1 The *generating units* that are assigned an alpha off-load order are to be taken off-line prior to the off-load of the combined cycle gas turbines, subject to System Control secure system guidelines.

- 5.4 The *off-load order* of a *generating unit* operating in a combined cycle gas turbine mode is to commence at number 1 (first off) and increase sequentially by integers until all *generating units* (other than a steam *generating unit* that operates in combined cycle mode) are assigned an off load number.
- 5.4.1 For the removal of doubt, the steam *generating unit* is to be assigned to a closed cycle *generating unit* using an alpha character, as explained in item 9.5 of the Table in Attachment A of the Generator Offers procedure.
- 5.5 During the pre-dispatch process or the real-time dispatch process (as the case may be), if the *power system* load falls to the level where a *generating unit* band 1 has to be taken off-line, the *Power System Controller* is to:
- 5.5.1 select the on-line *generating unit* that has the lowest *off-load order*; and
- 5.5.2 instruct that unit to be taken off-line.
- 5.6 If in paragraph 5.5 the *Power System Controller* identifies *generating units* from two or more Generator Offers who have the same *off-load order* number, the *Power System Controller* must instruct one of the *Generators* to take off-line their *generating unit* that has the lowest *off-load order* according to the methodology specified in paragraph 5.5.
- 5.6.1 For the removal of doubt, once the first *generating unit* has been taken off-line in accordance with the *random period selection process*, the next *generating unit* to be chosen will be from the remaining *Generator(s)* that have the lowest *off-load order*.
- 5.7 The *Generator* to be instructed in paragraph 5.5 must be chosen in accordance with the *random period selection process*.
- 5.7.1 The days in a year that are allocated to each *Generator* for the purpose of activating the *random period selection process* are to be those days specified in Attachment A.
- 5.7.2 Refer to Attachment C for an example of the *random day selection process* when applied to the *off-load order*.
- 5.8 Once the system load bottoms and starts increasing, the *Power System Controller* must request the *Generator(s)* who have been the subject of a *random period* instruction to either place their *generating unit(s)* on-line and to increase output in accordance with the pre-dispatch schedule before other *generating units* or bands are dispatched.
- 5.8.1 A *Generator* whose generating unit has been the subject of a *random period* instruction may, at that *Generator's* discretion, decide not to return the affected *generating unit* to service, in which case the *Generator* must advise the *Power System Controller* of this decision at the earliest possible time, and no later than in immediate response to the request to place the *generating unit* on-line.

Equal price offers that are greater than zero:

- 5.9 If in performing the pre-dispatch process the *Power System Controller* finds that two or more *generating units* have the same offer prices (that are greater than zero) at the *Pool Price Point*, the *Power System Controller* must apply that *random day selection process* to each of the *generating units* when allocating quantities to the price stack, as follows:
- 5.9.1 The *Generator* who has been allocated the *random day* will have its *generating unit* assigned to the price stack in preference to a *generating unit* from another *Generator*.
- 5.9.2 Once the first *Generator's* *generating unit* has been assigned to the price stack, the other *Generator's* *generating unit* will be assigned to the price stack before moving up the price stack to identify the next lowest priced *generating unit*.
- 5.9.3 If any one *Generator* provides equal offer prices for two or more *generating units*, the Generator Offer is to be rejected by the *Power System Controller*. Under this situation, the *Generator* may submit a revised Generator Offer, or a Revised Offer (according to the timing of the event).

5.9.4 Refer to Attachment C for an example of the *random day selection process* when applied to the equal offer price condition where the prices are greater than zero.

6. References

#	Document	Date	Location
1	System Control Technical Code	23/05/2015	D2015/414673
2	Tie Break Concept Paper	Feb 2016	Department of Treasury and Finance (Oakley Greenwood)
3	Tie Break Concept Paper (v2)	March 2016	Department of Treasury and Finance (Oakley Greenwood)
4	Generator Offers procedure (draft version 03) ¹	28/02/2016	D2016/93562

Note: 1: in draft – consultation in progress from 08/03/16 to 24/03/16.

7. Attachments

- 7.1 Attachment A: Random period selection process
- 7.2 Attachment B: Random day selection process.
- 7.3 Attachment C: Examples.

8. Records

This Guideline is to be stored in Power and Water’s Records Management System (TRIM) in accordance with the Document and Record Control Procedure.

9. Review

This document is to be reviewed in accordance with changes to the System Control Technical Code.

10. Document History

Date of Issue	Version	Prepared By	Description of Changes
11/03/2016	V01	Andrew Roberts	Initial version for consultation
02/06/2016	V1.0	Andrew Roberts	Approved after consultation

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This version 1.0 will take effect on 01 July 2016. Note that further time may be required for the Power System Controller to implement changes to relevant systems.

Attachment A: Random Period Selection Process

The *random period selection process* has the following attributes:

- A.1 The *random period* is four calendar weeks commencing on a Monday and finishing on a Sunday in the cycle.
- A.2 The *Power System Controller* assigns days in a period to *Generators* in accordance with their registration sequence with the *Market Operator*.
- A.3 Based on this principle, TGen is assigned every trading day in the four week period until a second *Generator* has been registered with the *Market Operator*.
 - a. The period commenced on 27 May 2015 and will end on the trading day prior to the commencement of the second *Generator* in the *I-NTEM*.
- A.4 When the second *Generator* registers with the *Market Operator*, that *Generator* will be assigned a four week period commencing on the first Monday after its commencement date (or if the commencement day is a Monday, that day).
- A.5 When the third *Generator* registers with the *Market Operator*:
 - a. that *Generator* will be assigned a four week period commencing on the first Monday after its commencement date (or if the commencement day is a Monday, that day); and
 - b. TGen is to be assigned the four week period commencing on the trading day after the third *Generator* completes its *random period*; and
 - c. the second *Generator* is to be assigned the four week period commencing on the trading day after TGen completes its *random period*.
 - d. the choice between the *generating units* of the remaining *Generators* during any one *random period* is to be based solely on the first/second/third market registration sequence. That is:
 - if the *random period* applies to the first *Generator*, the choice between the second and third *Generators* will be: second *Generator* followed by the third *Generator*.
 - if the *random period* applies to the second *Generator*, the choice between the remaining two *Generators* will be: third *Generator* followed by the first *Generator*.
 - if the *random period* applies to the third *Generator*, the choice between the remaining two *Generators* will be: first *Generator* followed by the second *Generator*.
- A.6 The re-assignment of the *random period* is to be replicated for four and subsequent *Generators* registering in the *I-NTEM*.

- A.7 On any nominated day, the *generating unit tie-break* principle for the *off-load order* will apply to the *Generator* who has been assigned the *random period*.
- A.8 The *random period selection process* will be terminated when superseded by a new *NTEM generating unit tie-break* principle.

Attachment B: Random Day Selection Process

The *random day selection process* has the following attributes:

- B.1 The *Power System Controller* assigns days in a period to *Generators* in accordance with their registration sequence with the *Market Operator*.
- B.2 Based on this principle, TGen is assigned every trading day in the period until a second *Generator* has been registered with the *Market Operator*.
 - a. The period commenced on 27 May 2015 and will end on the trading day prior to the commencement of the second *Generator* in the *I-NTEM*.
- B.3 When the second *Generator* registers with the *Market Operator*, TGen is to be assigned every second trading day in the subsequent period commencing with the trading day on which the second *Generator* commences trading in the *I-NTEM*, and the second *Generator* is assigned every second trading day commencing on the trading day after it commences trading in the *I-NTEM* (the second day of trading).
- B.4 When the third *Generator* registers with the *Market Operator*:
 - b. TGen is assigned every third trading day in the subsequent period commencing with the trading day on which the third *Generator* commences trading in the *I-NTEM*; and
 - c. the second *Generator* is assigned every third trading day commencing on the trading day after the third *Generator* commences trading in the *I-NTEM* (the second day of trading); and
 - d. the third *Generator* is assigned every third trading day commencing two trading days after it commences trading in the *I-NTEM* (the third day of trading).
 - e. the choice between the *generating units* of the second *Generator* and third *Generator* on any one *random day* is to be based solely on the first/second/third sequence. That is:
 - if the *random day* applies to the first *Generator*, the choice between the second and third *Generators* will be: second *Generator* followed by the third *Generator*.
 - if the *random day* applies to the second *Generator*, the choice between the second and third *Generators* will be: third *Generator* followed by the first *Generator*.
 - if the *random day* applies to the third *Generator*, the choice between the second and third *Generators* will be: first *Generator* followed by the second *Generator*.
- B.5 The re-assignment of the *random day* is to be replicated for four and subsequent *Generators* registering in the *I-NTEM*.
- B.6 On any nominated day, the *generating unit tie-break* principle will apply to the *Generator* who has been assigned the *random day*.

- B.7 The *random day selection process* will be terminated when superseded by a new *NTEM tie-break* principle.

Attachment C: Examples

The following examples are provided to clarify the application of the random selection process:

Example 1 – minimum system load condition (*random period selection process*):

An example of the *random period selection process* when two *Generators* are registered to operate in the *I-NTEM* under low system load is as follows:

Assumptions:

1. It is assumed that *Generator 2* commences trading in the *I-NTEM* on Friday 01 April 2016.

Random period allocation:

1. 2nd Gen *random period* >>Monday 4 April 16; Monday 30 May 16; etc
2. TGen *random period* >>Monday 2 May 16; Monday 27 June 16; etc
3. Note that the trading days will be *published* in a 12 month calendar format once the procedure is approved.

Application:

1. On trading day 05 Apr 2016, the system load has fallen to the point where the following units are on line at their minimum loads:
 - TGen U1, U2, U3 and U4 (where U1 and U2 are OCGT and U3 is a steam unit, and U4 is constrained on-line for frequency regulation and hence is constrained ON for system security purpose)
 - Gen#2 U1, U2, U3 (where U1 and U2 are OCGT and U3 is a steam unit).
2. On that trading day the load falls by another 10 MW. One of the on-line units has to be taken off-line.
3. TGen has nominated U1 as off-load order #1a, and U2 as off-load order #2. Gen#2 has nominated U1 as off-load order #1a, and U2 as off-load order #2.
4. In choosing between TGen U1 and Gen#2 U1 (both with off-load orders #1), the *Power System Controller* defers to the *random period* in which day 05 Apr 2016 falls. This is allocated to Gen#2. Consequently, the *Power System Controller* instructs Gen#2 to transfer U1 to OCGT mode (meaning it is decoupled from the steam unit) and the output of U1 is reduced to minimum open cycle load. A reduction of the output of the steam unit is also achieved at this time due to its operation on one gas turbine only. However, the total reduction is only 6 MW.
5. The *Power System Controller* is required to off-load a further 4 MWs, and consequently requests Gen#2 to take U1 off-line, provided system security guidelines permit.
6. The system load keeps falling and forty minutes later the *Power System Controller* requests TGen U1 to transfer U1 to OCGT mode (meaning it is decoupled from the steam unit) and the output of U1 is reduced to minimum open cycle load.
7. The next *off-load order* available to the *Power System Controller* is TGen U1 (the balance of off-load order #1a), provided system security guidelines permit. If this unit

can't be taken off-line, the *Power System Controller* would request the steam unit of Gen#2 to be taken off-line.

8. The system load reaches a minimum for the day before the *Power System Controller* is required to request TGen U1 to be taken off-line.
9. As the system load increases, the *Power System Controller* requests Gen#2 to place U1 on-line. Gen#2 has the choice as to when U1 is placed on-line, but must inform the *Power System Controller* if any delay is required in order for the *Power System Controller* to request another *generating unit* to be placed on-line.

Note 1: this example is intended to make it clear that the *random period* only influences the *Power System Controller* when two *generating units* from different *Generators* have the same *off-load order* number. Once the method for choosing the tied number has been exercised, the remaining identical off-load number is the next number in the off-load sequence to be chosen from all *Generators*.

Note 2: For the removal of doubt, the *random period* is not applied solely to all the *off-load orders* recorded in any one *Generator's* offer before the *off-load order* of another *Generator* becomes available for choice by the *Power System Controller*.

Example 2 – equal offer prices (*random day selection process*):

An example of the *random day selection process* when two *Generators* (who have registered to operate in the *I-NTEM*) present equal offer prices (that are greater than zero) is as follows:

Assumptions:

1. It is assumed that *Generator 2* commences trading in the *I-NTEM* on 01 April 2016.

Random day allocation:

2. TGen *random day* >> 01 Apr 16; 03 Apr 16; 05 Apr 16; 07 Apr 16; 09 Apr 16; 11 Apr 16; etc
3. 2nd Gen *random day* >> 02 Apr 16; 04 Apr 16; 06 Apr 16; 08 Apr 16; 10 Apr 16; 12 Apr 16; etc
4. Note that the trading days will be *published* in a 12 month calendar format once the procedure is approved.

Application:

5. At gate closure on 04 Apr 2016, the *Power System Controller* identifies the following equal price offers (for trading day 05 Apr 2016) from two *Generators*:
 - TGen U#12 offered as fast start with a band 1 price of \$80.00/MWh at the PPP and a band 1+2 capacity of 42 MW.
 - Gen#2 U4 offered as fast start with a band 1 price of \$80.00/MWh at the PPP and a band 1+2 capacity of 12 MW.
6. If the price of \$80.00/MWh is below the marginal *generating unit* for one or more trading intervals in the trading day, the *Power System Controller* must invoke the *random day selection process* for the selection of the capacity from the two *generating units*.
7. In preparing the pre-dispatch schedule, the *Power System Controller* identifies which *Generator* is assigned to the *random day* for 05 April 2016 in the *random day selection process*. The full capacity of that *Generator's* *generating unit* is chosen as the first capacity to be applied to the price stack.

- When more capacity is required, the second *Generator's generating unit* capacity is to be chosen and assigned to the price stack. Note that no change has been made to the offer prices, meaning that the identical marginal price is extended over two generating unit capacities.