



National Electricity Code Administrator

Report into power system incident on 14 March 2005 in South Australia

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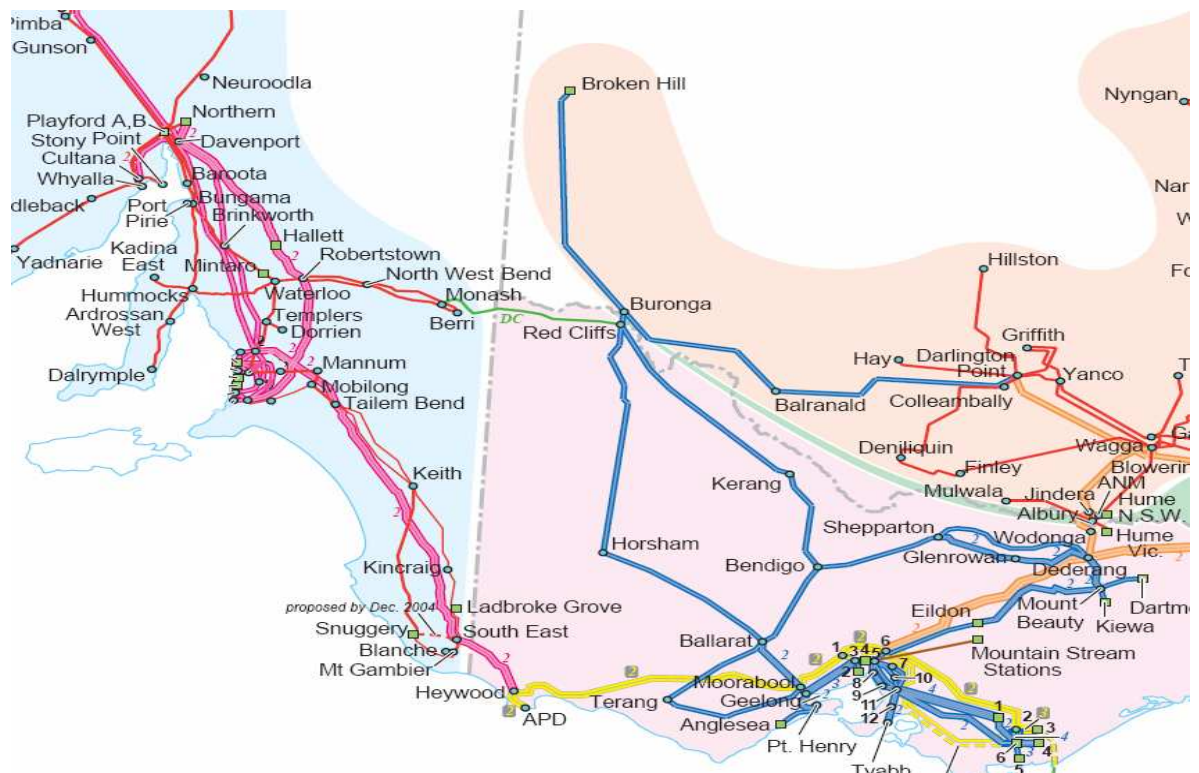
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Incident on 14 March 2005 in South Australia

Faults on Davenport line

- 1 During the morning of Monday 14 March 2005 there were three separate single-phase to ground faults on the same phase of the Davenport 275 kV line at Playford sub-station in South Australia. These faults occurred at approximately 6:13am, 6:39am and 6:57am (market/Eastern Standard Time).
- 2 These faults are most likely to have resulted from flashovers across a dirty insulator¹ at Playford substation associated with the Playford – Davenport 275 kV line. In each of the three faults, the Playford to Davenport 275 kV line protection operated successfully to clear the fault, and automatically re-close the line. All three faults were cleared in approximately 60 to 100 milliseconds, which is within the expected fault clearance times.
- 3 NRG Flinders operates the Northern Power Station (**NPS**), which is located north of Adelaide and close to the Davenport and Playford substations. This is shown in Figure 1.
- 4 Figure 1 also shows the route of the Victoria - South Australia interconnector, which is made up of two 275kV circuits between Adelaide and Heywood (in the South West of Victoria) and then two 500kV circuits between Heywood and Melbourne.

Figure 1



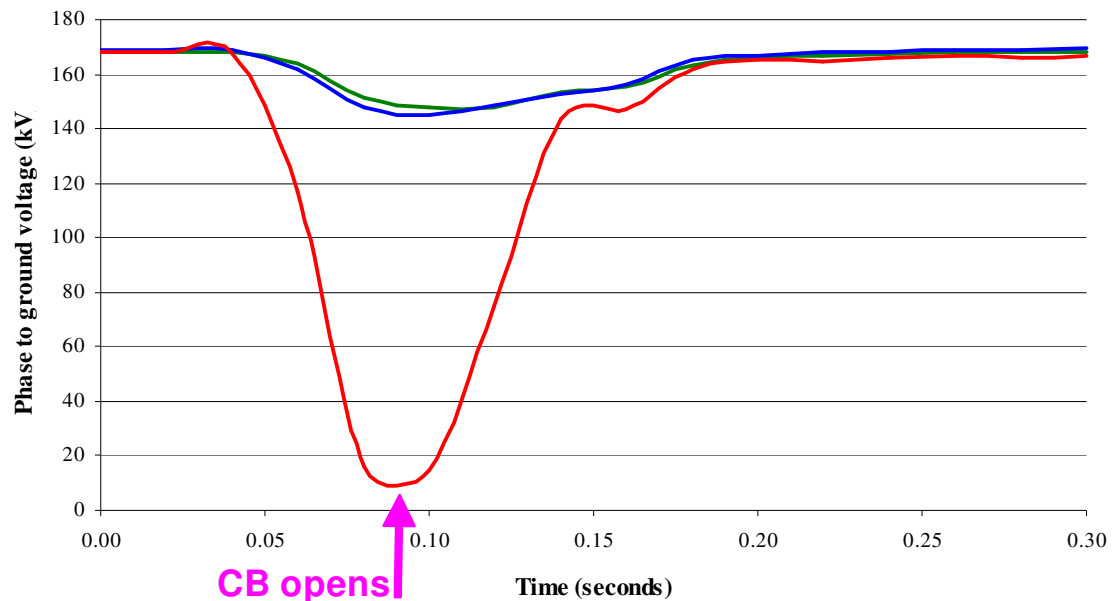
¹ The insulators were contaminated with a mix of salt spray and dust, which when combined with the moisture associated with an early morning dew caused a breakdown of insulation and the high voltage electricity tracked to earth.

5 The response to each of these three faults is set out below.

The 6:13am event

6 The fault on the Davenport line at approximately 6:13am caused a brief voltage depression which was recorded at Davenport substation as shown in Figure 2.

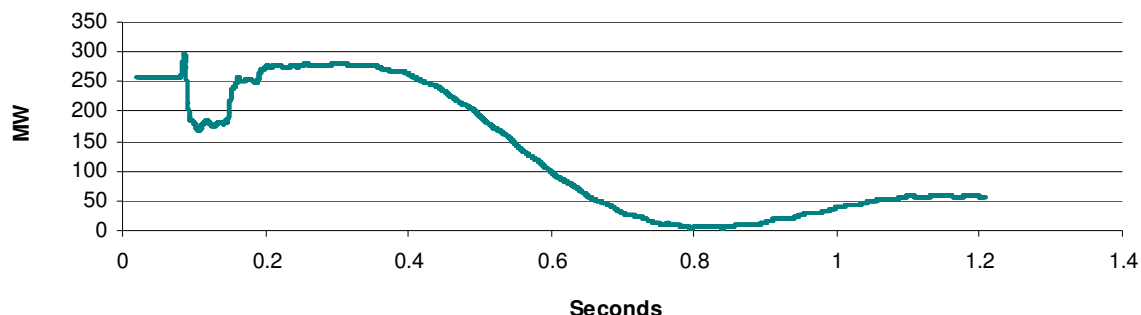
Figure 2: Voltage disturbance during the 6:13am fault



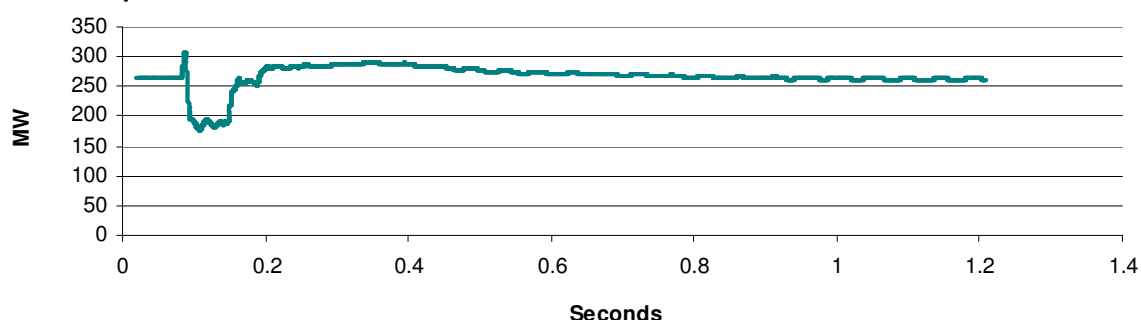
- 7 The response of the units at Northern Power Station to this brief voltage depression is shown in Figure 3. Initially, power output from NPS units 1 and 2 reduced slightly before returning to normal levels. However, about half a second later, NPS unit 1 reduced power output to almost zero MW.
- 8 NECA was informed by NRG Flinders that this occurred because of the operation of the NPS unit 1 Over-speed Protection Controller (**OPC**) system (a control scheme which is designed to protect the generator from exceeding its maximum rotational speed).

Figure 3: NPS response to the 6:13am fault

Unit 1 response

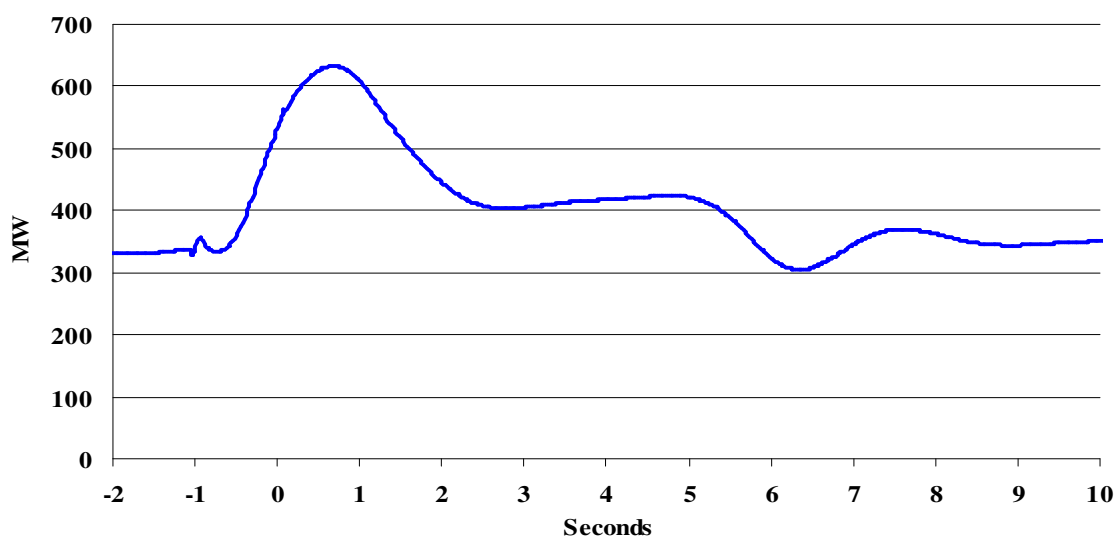


Unit 2 response



- 9 The response of the Victoria - South Australia interconnector to the reduction in output at NPS unit 1 is shown in Figure 4. The increased power flow across the interconnector roughly approximates the reduced power output of NPS unit 1. This increase was within the interconnector's normal operating capability².

Figure 4: Interconnector response to the 6:13am fault

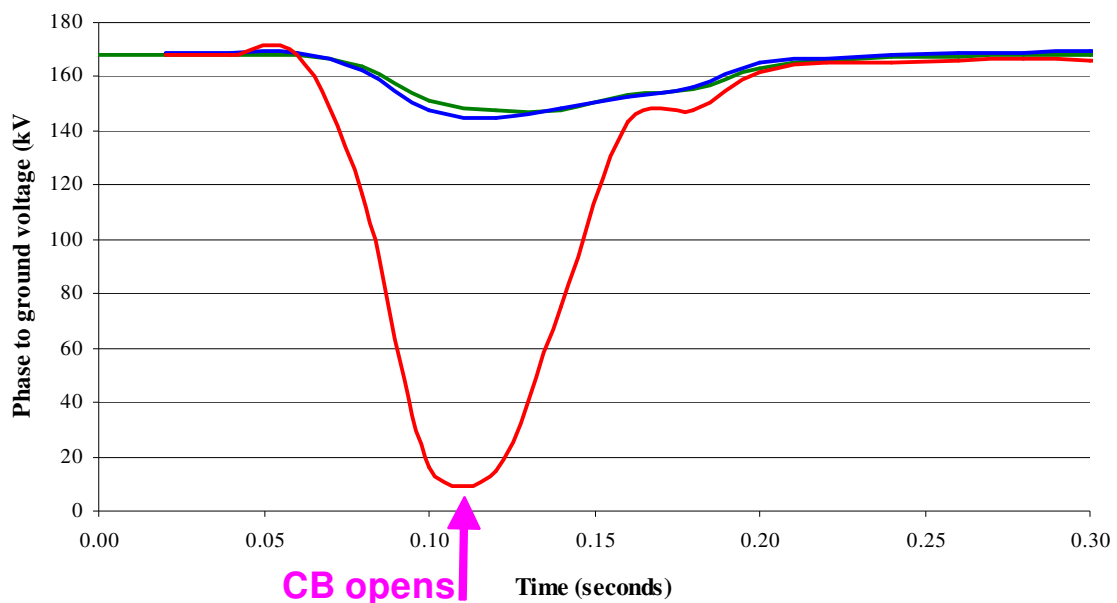


² NECA understands that NEMMCO was unaware of the rapid reduction in power output and subsequent recovery at NPS unit 1, and the consequent interconnector swings, until much later that day.

The 6:39am event

- 10 The fault on the Davenport line at approximately 6:39am caused a voltage depression which was recorded at Davenport substation as shown in Figure 5. This voltage depression is almost identical to the voltage depression caused by the fault at 6:13am.

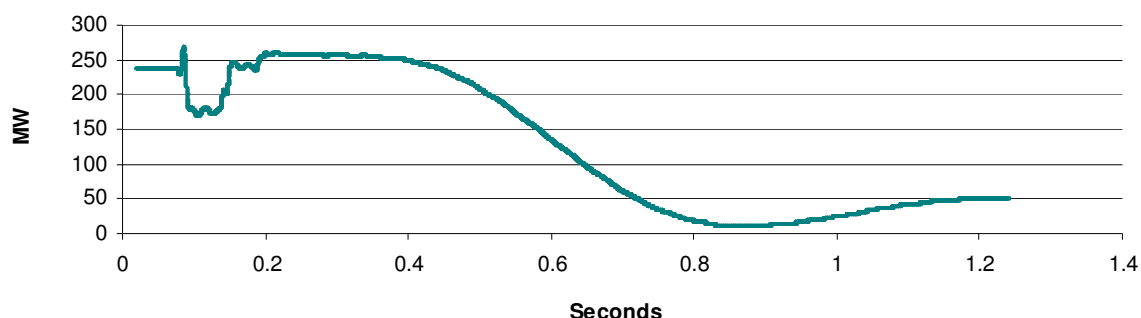
Figure 5: Voltage disturbance during the 6:39am fault



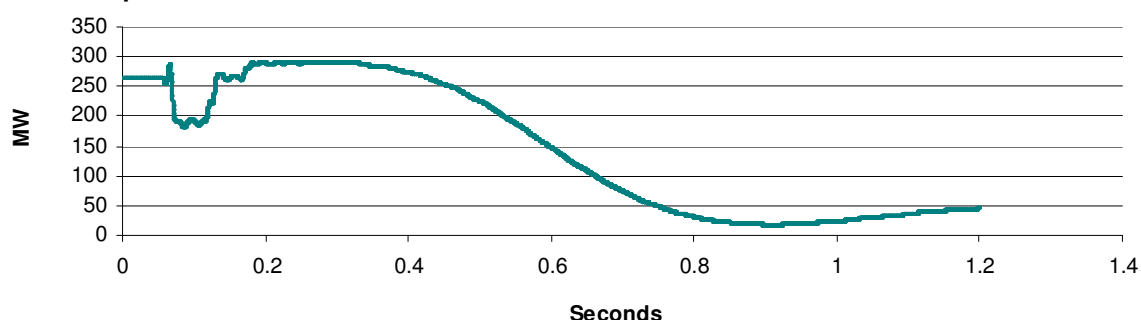
- 11 The response of the units at Northern Power Station to this brief voltage depression is shown in Figure 6. Initially, power output from NPS units 1 and 2 reduced slightly before returning to normal levels. However, about half a second later, both NPS unit 1 and NPS unit 2 reduced power output to almost zero MW.
- 12 NECA was informed by NRG Flinders that this occurred because of the operation of the OPC system on each unit.
- 13 Further, NECA was advised that the underlying cause of the loss of both units was the deterioration of the 14 volt DC power boards associated with the OPC systems on each of the NPS generating units.

Figure 6: NPS response to the 6:39am fault

Unit 1 response

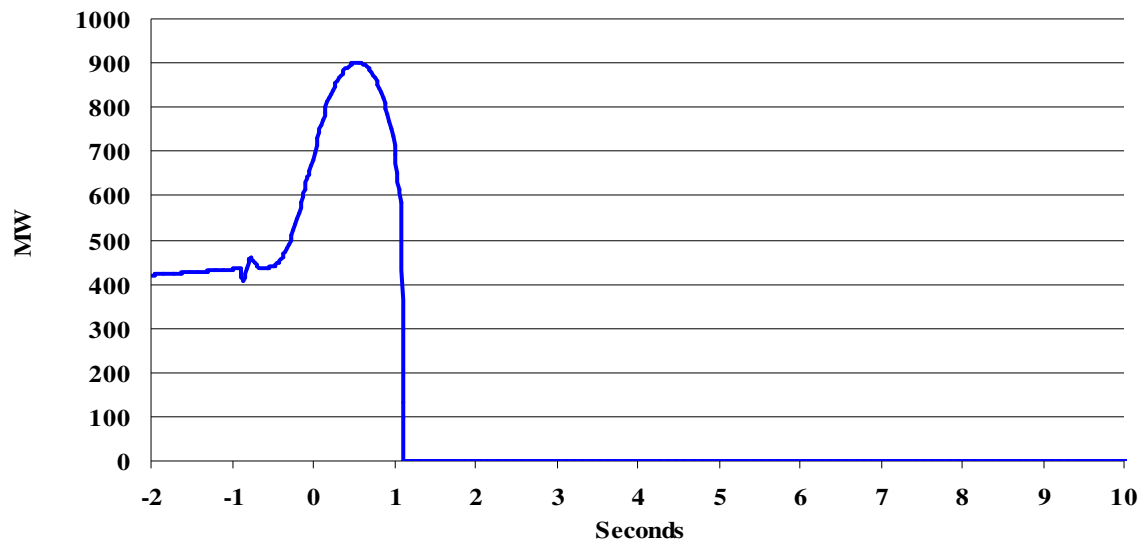


Unit 2 response



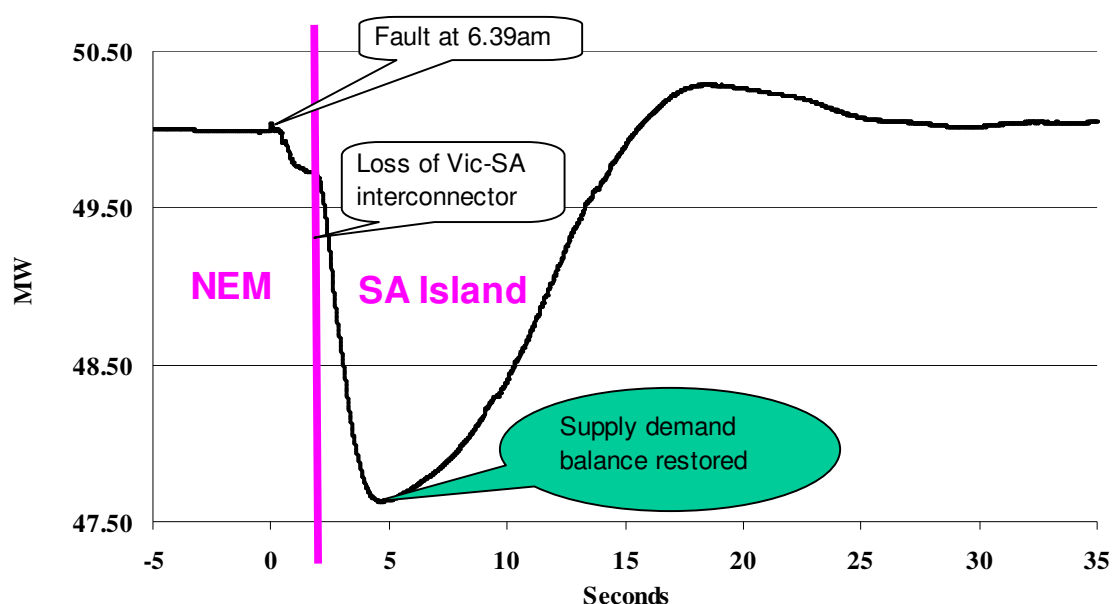
- 14 The response of the Victoria - South Australia interconnector to the reduction in output of both NPS units at 6:39am is shown in Figure 7. The power flows across the interconnector increased to meet the supply shortfall caused by the reduction in power output of both NPS units up to the point where the power flow across the interconnector was unsafe. At that point the loss of synchronism (**LOS**) emergency control scheme operated as designed to open the interconnector so as to cut power flows across the interconnector. Power flow was cut approximately 2 seconds after the initial fault. This led to the electrical separation of South Australia from the rest of the NEM.
- 15 The Victoria - South Australia interconnector was restored at approximately 7:01am, 22 minutes after separation.
- 16 As it is a DC link, Murraylink was not affected by the reduction in power output at NPS and remained in service with little power flowing from Victoria to South Australia.

Figure 7: Victoria to South Australia (Heywood) interconnector response to the 6:39 fault



- 17 Just prior to the incident at 6.39 South Australian demand was approximately 1,500MW. As NPS reduced output the combined National Electricity Market (**NEM**) frequency fell to around 49.75Hz as shown in Figure 8. The opening of the interconnector then caused South Australia to be islanded from the rest of the market.
- 18 This resulted in a supply demand imbalance in South Australia, which caused the remaining South Australian generators to slow down and the frequency to fall to 47.61 Hz. Without any further action the South Australian system would have collapsed.
- 19 In order to avoid such a catastrophic event, the automatic under-frequency load shedding system (**UFLS**) operated to interrupt customers (around 580 MW or over a third of South Australian demand) and restore the supply demand balance allowing the frequency to recover. The interrupted load on the power system in South Australia was progressively restored from 6:58am and all supply was restored by 8.25am.

Figure 8: SA frequency response following the 6:39 fault



The 6:57am event

- 20 The fault on the Davenport line at approximately 6:57am caused a voltage depression at Davenport substation similar to those observed at 6:13am and 6:39am. This fault occurred well after the load shedding described above had occurred.
- 21 The response of both NPS units to this voltage depression was a slight reduction in power output for a brief period of time. However, on this occasion, the OPC system did not operate on either NPS unit 1 or 2 and there was therefore no adverse impact on the power system. NPS unit 1 and NPS unit 2 “rode through” this event as required.

Other outcomes of the 6:39am fault

- 22 The loss of the interconnection at 6:39am resulted in the frequency in South Australia falling to 47.61 Hz. Frequency remained in the range 47Hz -49Hz for approximately 9 seconds.
- 23 The Pelican Point Power Station (**Pelican Point**) is a combined cycle unit and is operated by Pelican Point Power Ltd, a company controlled by International Power (Australia) Pty Ltd. This plant, which was generating 155 MW prior to the 6:39am fault, shut down following the frequency excursion. Pelican Point was operating on two turbines at the time. The gas turbine tripped from approximately 100MW approximately 2.5 seconds after the loss of the interconnector while responding to the change in frequency. The steam turbine tripped some two minutes later due to loss of heat input from the gas turbine.
- 24 A large amount of load shedding had occurred prior to the trip by Pelican Point and NECA is informed by NEMMCO that the trip of Pelican Point probably had a minimal impact on the amount of UFLS required in South Australia. Specifically, while the data available was inconclusive, NEMMCO concluded that it was possible that the final 14.5MW of UFLS that occurred (out of a total of around 580 MW) was as a result

of the trip of the gas turbine at Pelican Point. This load was shed as the frequency approached 47.6Hz.

- 25 NECA was informed by Pelican Point Power Ltd that this trip may have been attributable to a sub-optimal version of software being used in the implementation of the digital control system. This system calculates and controls the response of the gas turbine during rapid changes in frequency. NECA was also informed by Pelican Point Power Ltd that, as part of its investigations, the OEM recommended modifications to the software to correctly calculate response to falling system frequency. This modification was implemented on 25 April 2005.
- 26 In addition, two Ladbroke Grove generators operated by Origin Energy, which are connected to 132kV transmission lines that run in parallel to the interconnector shut down following the operation of network protection at Penola West that islanded the units. These generators had been operating at 38MW each prior to the 6:39am fault.

Effect on the market

Action by NEMMCO

- 27 NECA understands that NEMMCO was informed by NRG Flinders at a later point on 14 March 2005 that the OPC system on NPS unit 1 had operated in response to the 6.13am fault in addition to the operation of the OPC system on both NPS units in response to the 6.39am fault. Further, NEMMCO then decided that in order to manage the safe operation of the power system, for a similar fault in the vicinity of NPS, NEMMCO needed to change the operating (technical) envelope.
- 28 NEMMCO decided to treat the loss of both NPS units as a single credible contingency. Thus the critical single credible contingency event for South Australia was increased from 260MW to 520MW. This “reclassification” of the loss of both NPS units as credible was notified to the market through market notice 12628 at 4.21pm on 14 March, which stated “NEMMCO declares the simultaneous trip of both northern PS units as a single credible contingency event from 15:30 until further advice. Constraint set S-NPS_Single-cont is invoked from 16:15 until further advice.”
- 29 In certain circumstances, the effect of this reclassification and the consequent invoking of constraints was, potentially, a reduction in import capability across the Victoria - South Australia interconnector.
- 30 NEMMCO’s choice of constraints saw a trade-off between NPS output and imports from Victoria to meet SA system demand. NECA reasonably considers that this reclassification by NEMMCO led to reduced imports and higher prices in South Australia. The effect of the constraint imposed by NEMMCO was that the dispatched output of NPS unit 1 and NPS unit 2 and the interconnector could not exceed a combined level of around 720MW. When this constraint is invoked, the cheapest source of power from either NPS unit 1 and NPS unit 2 or the interconnector will be dispatched to meet SA demand.
- 31 When the NPS1 and NPS2 dispatch offer was below the Victorian regional reference price, which was the majority of the time, NPS unit 1 and NPS unit 2 would be dispatched in preference to the interconnector.

-
- 32 These constraints on the maximum flow allowed across the Victoria to South Australia interconnector resulted in a limit of around 150MW of flows for most of the time NEMMCO had the constraint in place. Thus, if there were to be further simultaneous failures of the NPS units from full load then sufficient headroom on the interconnector could be maintained without the interconnector also tripping due to overload. The impact of the new constraint on market participants was that there were lower imports to South Australia and correspondingly increased spot prices. Perversely, it is highly likely that NRG Flinders was not adversely impacted by the imposed constraint and even may have benefited through increased prices in South Australia.
- 33 An alternative choice of constraint, (which NEMMCO has used in the past) may have seen NPS backed off ahead of imports from Victoria – therefore potentially impacting NPS before other participants and not potentially allowing NRG Flinders to benefit from an increased South Australian spot price.
- 34 This alternative, which could be achieved by NEMMCO requiring a generator to operate at a particular generated output, is available to NEMMCO under clauses 5.7.3 (e) of the Code in circumstances where each of the three limbs of clause 5.7.3(e) are met (one of which is NEMMCO being satisfied that a generating unit does not comply with one or more technical requirements). We understand that NEMMCO was not satisfied that the three limbs of clause 5.7.3(e) were met in the present case.
- 35 On 1 June 2005, NEMMCO revoked the constraint on the Victoria - South Australia Interconnector following advice from NRG Flinders that the problem had been resolved.

Impact on pricing

- 36 The spot price in South Australia on 14 March 2005 fell from around \$20/MWh prior to the 6:39am fault to -\$989/MWh at 7:05am. We note that at 7:05am, the power system was affected by the loss of around 580MW of demand due to UFLS.
- 37 NEMMCO set the price in South Australia to VoLL during the dispatch interval ending at 7:05am. The VoLL flag was in place for 4 dispatch intervals (ending at 7:10, 7:15, 7:20 and 7:25am) after which the price returned to \$13/MWh (for the dispatch interval ending at 7:30am).
- 38 NECA was informed that NEMMCO determined that the system had returned to a secure operating condition during the dispatch interval ending at 6:55am. As such, the dispatch interval ending at 7:05am was the second dispatch interval since the system had returned to a secure operating state.
- 39 The interconnector was restored at 7:01am, NEMMCO advised ElectraNet that all load could be restored at 7:16am and all interrupted load was restored by 8:25am.
- 40 Clauses 3.9.2(e) and (f) of the Code relevantly provide that:
- (e) Notwithstanding clauses 3.9.2(c) or (d), for any *dispatch interval* if:
 - (1) the *dispatch price* for that *dispatch interval* has not already been set by the *central dispatch* process and *NEMMCO* reasonably determines that the *central dispatch* process may determine that:

-
- (i) all *load* in a *region* could not otherwise be supplied and *NEMMCO* issues *instructions* that are current for that *dispatch interval* to *Network Service Providers* or *Market Participants* to shed *load*, or
- (ii) no more *interruptible load* that had been shed as a result of a *contingency event* can be restored in a *dispatch interval* immediately following the restoration of the frequency of the *power system* to within the normal band of the *frequency operating standards*,

then, subject to 3.9.2(f), *NEMMCO* must set the *dispatch price* at that *region's regional reference node* to equal *VoLL*;

(2) *NEMMCO* has declared a *dispatch interval* to be an *intervention price dispatch interval* under clause 3.9.3(a), then subject to clauses 3.9.3(a2) and 3.9.3(a3) *NEMMCO* must set the *dispatch price* in accordance with clause 3.9.3;

(f) If *interruptible load* is shed as a result of a *contingency event* and *NEMMCO* has not set the *dispatch price* to equal *VoLL* pursuant to clause 3.9.2(e)(1)(i), *NEMMCO* must not set the *dispatch price* to *VoLL* pursuant to clause 3.9.2(e)(1)(ii) prior to the commencement of the third *dispatch interval* following the restoration of the *power system* to a *secure operating state* and the restoration of the *frequency of the power system* to the normal band of the *frequency operating standards*.

- 41 NECA considers that the intent of clauses 3.9.2(e) and (f) is that pricing at VoLL should be restricted to situations where demand has increased above supply. This may happen suddenly or over a longer period, such as a period of days. However, a supply shortage of this type (ie. where demand has increased above supply) is distinct from a situation where automatic under frequency load shedding has curtailed supply in order to protect the security of the power system as occurred in the present instance.
- 42 NECA considers that setting the price to VoLL is inappropriate in circumstances where load shedding has occurred solely to ensure the security of the power system following a contingency event.

Investigation

NECA Investigation

- 43 On 23 March, NECA announced an investigation into the events of 14 March, in particular to determine whether there had been any breaches of the Code. The investigation focussed on a number of provisions including:
- compliance with registered performance standards (as required by clauses 5.2.5 and 4.15 of the Code);
 - the performance requirements of schedule 5.1 and 5.1a of the Code;
 - the pricing outcomes in the market and the pricing provision of clause 3.9.2 of the Code; and
 - the steps taken with respect to Power System Security and chapter 4.
- 44 NECA conducted a preliminary review of the event, as part of its routine market monitoring arrangements. NECA's analysis suggested that on 14 March, the two generating units at Northern Power Station and the generating unit at Pelican Point

Power Station all appeared to have failed to respond in accordance with schedule 5.2.5.3 of the Code following a disturbance in the power system. Each generating unit has a registered performance standard with NEMMCO outlining the technical performance expectations with respect to this provision. NECA's investigations sought to confirm whether those performance standards were satisfied.

45 NECA wrote to the relevant parties in accordance with its investigation guidelines, requesting information to clarify its preliminary findings including:

- NRG Flinders on 4 April 2005, 11 May 2005 and 30 June 2005;
- International Power on 4 April 2005 and 14 July 2005;
- ElectraNet SA on 23 May 2005; and
- NEMMCO on 3 June 2005.

46 NECA received responses to each of these letters (where a response was required) from the respective parties.

47 NECA also sought copies of all of the South Australian generators' performance standards registered with NEMMCO.

48 Network Service Providers are required to provide sufficient primary and back-up protection systems to ensure that a fault of any fault type anywhere on its transmission system is automatically disconnected in accordance with the system standards. Clarification from ElectraNet SA was required to ensure that the protection systems on the Playford to Davenport line, following the three transmission faults, and the protection associated with the loss of the Heywood interconnector, all operated reliably and in accordance with the performance requirements of schedule 5.1 and 5.1a. ElectraNet SA was able to confirm that this was the case.

Background to performance standards

49 In March 2003 major and extensive Code changes were introduced which became effective on 16 November 2003.

50 It is stated in the ACCC Determination dated 26 February 2003 that these Code changes were "developed from a review by NECA of technical standards required to maintain the security and integrity of the power system". NECA's review:

"concluded that the overriding imperative of maintaining the security and integrity of the power system means that there needs to be clear and clearly defined standards for the overall performance of the network and the power system itself".

51 Furthermore:

"NECA's report recommended that the Reliability Panel should be responsible, following further consultation, for determining two separate sets of standards to be incorporated into the market rules:

- **system standards**, based on consolidating and where necessary updating existing standards within the code, that will establish the target performance of the power system overall

-
- **access standards** that will define the range within which plant operators could negotiate with NEMMCO and network service providers for access to the network. NEMMCO and the relevant network service provider would need to be satisfied that the outcome of those negotiations was consistent with their achieving the overall system standards. The access standards would also need to include minimum standards below which access to the network would be prohibited."
- 52 The new technical standards regime established clearer compliance obligations including a requirement for compliance monitoring programmes. In order to accomplish this, the concept of registered performance standards was introduced.
- 53 The performance of all plant must be registered with NEMMCO as a "*performance standard*". Registered performance standards represent binding obligations upon generators.
- 54 The aim of the registered performance standards and the requirement for generators to adhere to these standards is to ensure they contribute to satisfying the system standards and prevent the power system cascading into an uncontrolled collapse. All parties (generators, customers and network service providers) rely upon the system staying within given standards for their own needs and so that equipment is not damaged. All parties have certain responsibilities to contribute toward meeting these standards.
- 55 The new regime imposed no new obligations upon existing plant. The performance of existing plant was "grandfathered"; that is, existing plant was able to treat its current performance as its registered performance standard. This means that capability defined through any existing derogations, or connection agreements or the designed plant performance became registered performance standards.
- 56 A plant's performance standards, once set, do not vary unless an upgrade is required.
- 57 In the period between November 2003 and 2004 all the generators had to register their existing technical performance with NEMMCO.
- 58 NRG submitted performance standards to NEMMCO within this time period and submitted amended performance standards to NEMMCO on 9 February 2005.
- 59 It should be noted that the new Technical Standards Code changes were **not** in effect on 8 March 2004 when a similar double unit trip occurred at NPS. However, the new Code changes were in effect on 14 March 2005.

Compliance programmes to ensure plant meets performance standards

- 60 The Code provides that a generator to whom a performance standard applies must, within six months of the approval of the performance standard, establish, and lodge with NEMMCO, a compliance programme.
- 61 Following the lodgement of performance standards, compliance programmes in respect of generators were required around June 2005.
- 62 Neither NRG Flinders nor any other generator achieved an agreed compliance programme to ensure that the generators actually perform to their stated performance standards prior to 30 June 2005.

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- 63 Pelican Point Power Ltd advised NECA that it was not obliged to have a compliance program in place until 2 June 2005. Pelican Point Power Ltd submitted a compliance program to NEMMCO, for NEMMCO's consideration, on 13 May 2005 and has advised NECA that it has not received a response to this compliance program from NEMMCO.

Potential non-compliance with Code

- 64 Failing to comply with performance standards constitutes a breach of the Code pursuant to clauses 5.2.5(a)(ii) and 4.15(a)(1). These clauses of the Code are set out below.

- 65 Clause 5.2.5(a) of the Code states that:

"A *Generator* must plan and design its *facilities* and ensure that its *facilities* are operated to comply with:

(i) its *connection agreement* with a *Network Service Provider*;

(ii) subject to clause 5.2.5(a)(i), its *performance standards* registered with NEMMCO; and

(iii) subject to clause 5.2.5(a)(ii), the *system standards*."

- 66 Clause 4.15(a) requires that:

'A Code Participant must:

- (1) ensure that its plant meets or exceeds the performance standard applicable to its plant'

Interpretation of Northern Power Station performance standards

Performance standard 3.3(3)

- 67 The Northern Power Station performance standards are derived from Schedule 5.2 of the Code and, by virtue of performance standard 3.3(3), require that:

'3.3 Response to Disturbances

...

(3) Each *generating unit* must be capable of continuous uninterrupted operation during the occurrence of a voltage dip caused by a *transmission system* fault involving a two phase to ground condition which causes the voltage at Davenport Substation (275kV Section) to drop to zero on any two phases for a period of 175 milliseconds, followed by a period of ten seconds where voltage may vary in the range 80 - 110 percent of the nominal voltage, and a subsequent period of three minutes in which the voltage may vary within the range 90-110 percent of the nominal voltage.'

- 68 NECA considers that this performance standard has the following meaning:

(a) Each *generating unit* must be capable of continuous uninterrupted operation during the occurrence of a *normal voltage fluctuation* caused by a *transmission system* fault involving a single phase or two phase to ground condition with a *loading level* after the

fault is cleared that is at, or reasonably about, the *loading level* immediately prior to the fault.

(b) For the purpose of subsection (a), *normal voltage fluctuation* means voltage remaining within a band for 3 minutes, ten seconds and 175 milliseconds following a fault. The band has an upper boundary of 110% of nominal voltage at all times. The band has a lower boundary of 0% of nominal voltage for the first 175 milliseconds during the fault, 80% of nominal voltage for the first 10 seconds after the fault is cleared and 90% of nominal voltage for the next 3 minutes. Nominal phase to phase voltage is 275kV.

Interpretation of continuous uninterrupted operation

69 The phrase continuous uninterrupted operation is not defined in the performance standards or in the Code. In NECA's view, the reason that the Code uses this undefined phrase is to allow this concept some flexibility.

70 Nevertheless, the phrase 'continuous uninterrupted operation' must be interpreted purposively. This is clearly set out in section 7(1) of Schedule 1 of the National Electricity Law (**NEL**) which states that:

'the interpretation that will best achieve the purpose or object of the NEL is to be preferred to any other interpretation.'

71 In the present case, NECA considered three possible interpretations of continuous uninterrupted operation:

71.1 Option A

Generating unit must remain synchronised to the power system; or

71.2 Option B

Generating unit must remain synchronised to the power system and maintain power output above zero MW; or

71.3 Option C

A generating unit continuously operating with a *loading level* after the fault is cleared that is at, or reasonably about, the *loading level* immediately prior to the fault.

72 NECA concluded that continuous uninterrupted operation has the meaning given by option C. This interpretation is consistent with the operation of the performance standards to ensure that the system standards are achieved, power system security is maintained and, to the extent practicable, that all demand for electricity at the prevailing price is met at all times.

73 NEMMCO in their letter to NECA dated 10 June 2005 *prima facie* indicated that they support this interpretation, both in respect of the intent of Schedule 5.2.5.3 of the Code, and the fact that this schedule is drafted in an ambiguous manner.

Specifically, NEMMCO stated that

'Although it would appear logical that the "intent" of s5.2.5.3 would be that generating units do not substantially reduce their power output during the specified fault conditions, NEMMCO is of the view that the wording of the clause is such that it could be read to exclude any such obligation on generating units'.

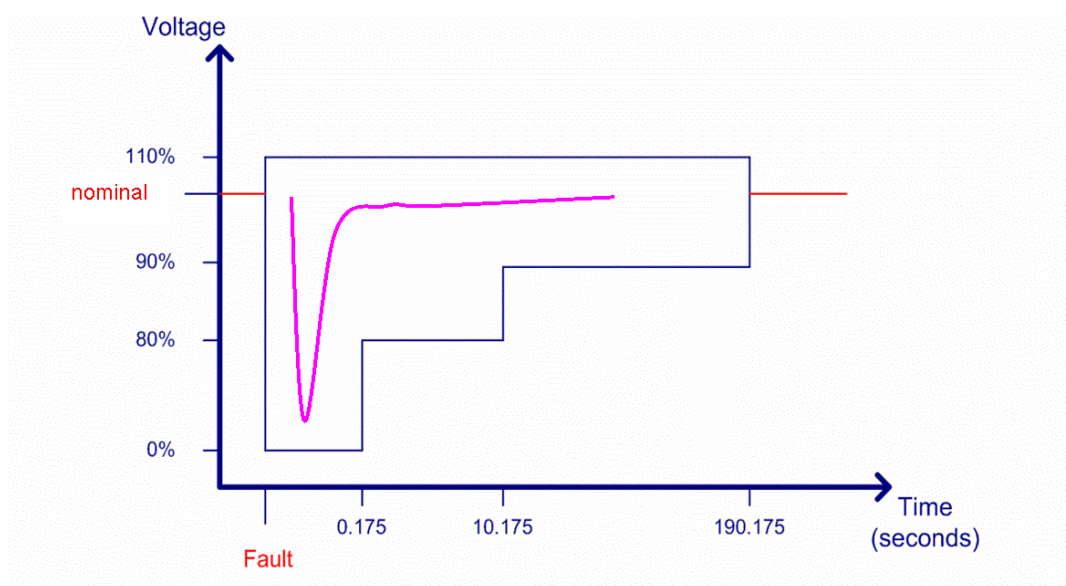
This ambiguity, in NECA's view, supports the proposition that the clause requires an interpretation in accordance with the agreed intent.

- 74 NRG Flinders contended, in its letter to NECA dated 12 April 2005, that this phrase requires only that a generator remains synchronised and connected to the transmission system. The consequence of this interpretation is that a relatively high likelihood of interruptions to the electricity supply would exist despite Code participants complying with the performance standards. Therefore, NECA concluded that this interpretation cannot be correct.

Interpretation of voltage dip

- 75 Performance standard 3.3(3) requires continuous uninterrupted operation during the occurrence of a specified voltage dip.
- 76 NECA concluded that this specified voltage dip is defined by the profile set out in performance standard 3.3(3). As such, Figure 11 represents the range over which the voltage at Davenport Substation may vary, and during which entire time (following the clearance of the fault) the NPS units must be capable of continuous uninterrupted operation.

Figure 11: Voltage profile at Davenport specified in the performance standards for Northern power station with actual voltage dip during the fault at 6.39am superimposed.



- 77 Given that the fault at 6.39am was cleared in 60-100 msec, with voltage at Davenport reduced to around 10 per cent and restored to within 80 per cent within 100 msec, it is apparent that the voltage dip at Davenport on 14 March, following the transmission faults, was within this range specified in the registered performance standards of Northern Power Station. This is evident from Figure 11 (as the actual voltage at Davenport, which is shown by the thick line, remains at all times within the box, which is the profile described in performance standard 3.3(3)).

Interpretation of Pelican Point performance standards

Performance standard 3.3(1)

78 Clause 3.3 of the Pelican Point performance standards requires that:

'Each *generating unit* is capable of continuous uninterrupted operation during the occurrence of:

(1) *Power system frequency* at any level within the following ranges for the given duration:

Frequency range (Hz)	Duration
47 to 49	2 minutes
51 to 52	2 minutes
49 to 49.5	8 minutes
50.5 to 51	8 minutes
49.5 to 50.5	continuous

79 NECA considers that Pelican Point performance standard 3.3(1) is to be interpreted as follows:

'The generating unit is capable of providing continuous uninterrupted operation at all times unless any one of the following occurs:

- The frequency is below 49.5Hz for a continuous period of more than 8 minutes;
- The frequency is above 50.5Hz for a continuous period of more than 8 minutes;
- The frequency is below 49Hz for a continuous period of more than 2 minutes;
- The frequency is above 51Hz for a continuous period of more than 2 minutes;
- The frequency is below 47Hz for any period of time; or
- The frequency is above 52Hz for any period of time.'

80 As shown in Figure 8, the frequency disturbance on 14 March 2005 consisted of the frequency in South Australia falling to a minimum of 47.61Hz, and remaining in the range 47Hz - 49Hz for a period of only approximately 9 seconds. Consequently, we consider that the Pelican Point performance standards require continuous operation during such a disturbance.

Deliberation on prosecution of Code breach

Transitional period

81 In June 2005 NECA was requested by the members of NECA (the respective energy Ministers of each State) to cease its dissolution activities and to continue to investigate any Code breach incidents that occurred prior to 1 July 2005 and

potentially prosecute them, if appropriate, through the National Electricity Tribunal (NET).

- 82 NECA understands that this circumvented some potential legal issues that may have faced the AER if it had sought to deal with any Code breach matters that occurred prior to 1 July 2005.

Legal position in relation to NRG Flinders

- 83 Phillips Fox advised NECA in the interpretation of the Code and the legal consequences of the events of 14 March 2005. The following is a summary of their advice in relation to the operation of NPS.

83.1 Breach of the performance standards is a per se offence. As such, a Code breach is established where a generating unit fails to provide continuous uninterrupted operation during a voltage dip or a frequency disturbance and irrespective of the reasons why the generating unit reduced power output.

83.2 There was a strong legal argument that NRG had breached clause 5.2.5(a)(ii) of the Code on 14 March 2005 by reason of its failure to comply with the NPS performance standards. In total, this clause was potentially breached on three occasions. The maximum penalty for three breaches of this clause is \$300,000.

Decision to prosecute NRG Flinders

- 84 The NECA board considered whether to exercise its discretion under section 12 of the NEL and clause 8.5.4(a) of the Code to refer NRG Flinders' conduct to the NET.

- 85 In the interests of the market, and taking into account the advice on the strength of the legal position, the NECA board determined that it was appropriate to bring proceedings against NRG Flinders in the NET for the following reasons:

85.1 The consequence of NPS's actions was a large blackout in South Australia.

85.2 The failure to provide continuous uninterrupted operation on this occasion was in clear breach of the performance standards that had been registered with NEMMCO in accordance with the Code.

85.3 The performance standards play a critical role in ensuring that the system standards are achieved and in maintaining the security of the power system.

85.4 Both units at Northern Power Station reduced output to almost zero as a result of the operation of the OPC system following a previous incident (on 8 March 2004).

Prosecution process and outcome - NRG Flinders

- 86 NECA advised NRG Flinders on 8 July 2005 of its intention to make an application to the NET in respect the operation of NPS on 14 March 2005.

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- 87 NRG Flinders elected not to contest this application and agreed to file joint submissions with the NET. This saved considerable costs by avoiding a lengthy court case.
- 88 The NET conducted the matter on the papers and issued a judgment on 15 August 2005. This judgment is available on the AER website.
- 89 In its judgment, the NET made the following declarations and orders:
- 89.1 Declared that performance standard 3.3(3) has the meaning set out at paragraph 68;
 - 89.2 Declared that NRG Flinders had breached clause 5.2.5(a)(ii) of the Code on three occasions on 14 March 2005;
 - 89.3 Ordered NRG Flinders to pay a civil penalty to NECA in the amount of \$300,000 of which 50% was suspended for 12 months on the condition that NRG Flinders does not again breach the National Electricity Rules by failing in any way to comply with the NPS performance standards; and
 - 89.4 Ordered NRG Flinders to give to the NET and the AER an undertaking that it will institute a compliance program within 3 months of the date of the Order.
- 90 NECA considered that this penalty was appropriate for a number of reasons including:
- 90.1 NRG Flinders fully and promptly co-operated with NECA in its investigation of this matter;
 - 90.2 NRG Flinders did not contest the Application;
 - 90.3 NRG Flinders is unlikely to breach clause 5.2.5(a)(2) of the Rules in the future, and the undertaking to be provided by NRG Flinders, together with the suspension of 50% of the penalty is adequate specific deterrence against further breaches of the Rules; and
 - 90.4 The financial penalty, together with the publicity surrounding this action will constitute sufficient general deterrence against further breaches of performance standards.

Legal position in relation to Pelican Point Power Ltd

- 91 Phillips Fox advised NECA in the interpretation of the Code and the legal consequences of the events of 14 March 2005. The following is a summary of their advice in relation to the operation of Pelican Point.
- 91.1 Breach of the performance standards is a per se offence. As such, a Code breach is established where a generating unit fails to provide continuous uninterrupted operation during a voltage dip or a frequency disturbance and irrespective of the reasons why the generating unit reduced power output.

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- 91.2 There was a strong legal argument that Pelican Point Power Ltd breached clause 5.2.5(a)(ii) of the Code on 14 March 2005 by reason of the failure of its generating unit to comply with the relevant performance standards. The loss of this unit was, however, a secondary effect of the major disturbance caused in the first instance by NRG Flinders.

Decision to prosecute Pelican Point Power Ltd

- 92 The NECA board considered whether to exercise its discretion under section 12 of the NEL and clause 8.5.4(a) of the Code to refer Pelican Power Power Ltd's conduct to the NET.
- 93 In the interests of the market, and taking into account the advice on the strength of the legal position, the NECA board determined that it was appropriate to bring proceedings against Pelican Point Power Ltd in the NET for the following reasons:
- 93.1 The failure to provide continuous uninterrupted operation on this occasion was in clear breach of the performance standards that had been registered with NEMMCO in accordance with the Code.
- 93.2 The performance standards play a critical role in ensuring that the system standards are achieved and in maintaining the security of the power system.

Prosecution process and outcome - Pelican Point Power

- 94 NECA advised Pelican Point Power Ltd on 1 August 2005 of its intention to make an application to the NET in respect the operation of Pelican Point on 14 March 2005.
- 95 Pelican Point Power elected not to contest this application and agreed to file joint submissions with the NET. This saved considerable costs by avoiding a lengthy court case.
- 96 The NET conducted the matter on the papers and issued a judgment on 12 September 2005. This judgment is available on the AER website.
- 97 In its judgment, the NET declared that Pelican Point Power had breached clause 5.2.5(a)(ii) of the Code and ordered it to pay a civil penalty to NECA in the amount of \$100,000 of which 80% was suspended for 12 months on the condition that Pelican Point Power does not again breach the National Electricity Rules by reason of failing to meet the requirements of clause 3.3(1) of its performance standards.
- 98 NECA considered that this penalty was appropriate for a number of reasons including:
- 98.1 Pelican Point Power fully co-operated with NECA in its investigation of this matter;
- 98.2 Pelican Point Power did not contest the Application;
- 98.3 The circumstances leading up to the trip of Pelican Point included the non-credible failure of both Northern Power Station units to provide continuous uninterrupted operation and the opening of the Vic-SA (Heywood) Interconnector;

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- 98.4 The steam turbine continued in operation for approximately two minutes after the loss of the interconnector, two minutes being the duration of continuous uninterrupted operation required of that generating unit following a reduction in power system frequency to 47.61Hz. As such, the steam turbine was robust enough to 'ride-through' the frequency disturbance that occurred at approximately 6:39am on 14 March 2005. The subsequent shutdown of that generating unit was a consequence of the design of the combined cycle facilities at Pelican Point, not the frequency disturbance, and occurred approximately 1 minute and thirty seconds after system frequency had recovered to normal levels at about 50Hz;
- 98.5 While it is appropriate for the performance standard to apply separately to the steam turbine, because it is capable of independent response when one or both gas turbines is delivering heat for steam, it would be inappropriate to separately penalise Pelican Point Power for a failure of the steam turbine to comply with the performance standard in circumstances where the shut down occurred, not in direct response to the system disturbance, but as a consequence of the steam turbine not having waste heat from one or both of the gas turbines and therefore not being capable of independent response;
- 98.6 In a letter from NEMMCO to NECA, which NECA received on 1 September 2005, NEMMCO concluded in relation to Pelican Point that:
- it is most likely that the whole 240MW load block that was shed at 47.8Hz would have been shed whether or not the gas turbine had tripped; and
 - if the gas turbine had not shut down, it is possible that the last 14.5MW of load actually shed at about 47.62Hz might not have been shed;
- 98.7 Given load shedding of 578MW was required to restore frequency following the separation of South Australia from Victoria, the possibility that 14.5MW was shed in response to the gas turbine trip is not material. Furthermore, NEMMCO has said that there is no guarantee that the conclusions it has reached are correct. Pelican Point Power should be the beneficiary of this doubt.
- 98.8 Following 14 March 2005, Pelican Point Power took immediate steps with the original equipment manufacturer to improve the response of Pelican Point to changes in frequency, and made modifications on 25 April 2005.
- 98.9 Pelican Point Power is unlikely to breach clause 5.2.5(a)(2) of the Rules in the future; and
- 98.10 The financial penalty, together with the publicity surrounding this action will constitute sufficient general deterrence against further breaches of the performance standards.
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Recommendations

- 99 NECA's investigation into the events of 14 March 2005 in South Australia has identified a number of significant issues related to the security of the power system and the obligations of Code participants with respect to technical performance.
- 100 Going forward, NECA recommends that appropriate steps are taken to significantly reduce the risk of a similar power system event having consequences of the magnitude experienced on 14 March. Those steps should include:
- 100.1 NEMMCO, Network Service Providers and generators establishing a common understanding prior to completing negotiation of the compliance monitoring programmes (CI 5.7.3(b)). These programmes should include an agreed method for each generating unit to confirm, and test, ongoing compliance with the applicable technical requirements of the National Electricity Rules;
 - 100.2 NEMMCO ensuring that its investigations, of both major and near-miss events, comprehensively satisfy the requirements of the Rules;
 - 100.3 participants ensuring recommendations arising from any investigation are addressed in a timely manner;
 - 100.4 all participants, including NEMMCO, ensuring that their obligations are satisfied completely, comprehensively and consistently with the precedent set by the National Electricity Tribunal in these 2 cases; and
 - 100.5 an overarching review of the interpretation and operation of the technical performance standards.
- 101 NECA also recommends that:
- 101.1 NEMMCO ensure its procedures are consistent with the requirements and the intent of the Rules, in particular with regard to pricing under extreme conditions;
 - 101.2 participants ensure the ongoing technical performance compliance monitoring arrangements are adhered to; and
 - 101.3 the Australian Energy Regulator clarify the intention of the rules where necessary and consider the development of enforcement guidelines where appropriate.
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