

# POWER SYSTEM INCIDENT REPORT NORTHERN POWER STATION STABILISER OUTAGE – APRIL AND MAY 2010

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FINAL

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## 1 Introduction

In order to maintain power system security a sufficient number of power system stabilisers (PSS) must be in service in NEM power system. If a sufficient number of PSSs are not in service in South Australia then power transfer between Victoria and South Australia on the Heywood interconnector must be constrained. The secure power transfer limit on Heywood interconnector from Victoria to South Australia is 350 MW and South Australia to Victoria is 250 MW when an insufficient number of PSSs are in service.

The number of PSSs required in service to maintain power system security is dependent on the generating units that are operating. If one of the generating units at Northern Power Station is operating then at least one of the PSSs at Northern Power Station needs to be in service.

The Attachment 1 of this report covers the relationship between the power system security requirements associated with the number of PSSs in service at relevant power stations in South Australia.

In the periods from 4 April to 20 April 2010 and 29 April to 5 May 2010 an insufficient number of PSSs were in service in South Australia as a result of Northern Power Station PSSs not being in service. During these periods the power transfers on Heywood interconnector were observed to be exceeding 350 MW from Victoria to South Australia on a number of occasions.

AEMO conducted detailed investigations on potential violations of the power system security in periods where the power transfers on Heywood interconnector exceeded the secure power transfer limits during the two identified periods with insufficient number of PSSs were in service. Findings of this investigation are covered in this report.

## 2 Summary of Events

As part of an approved and agreed arrangement with Alinta Energy Limited, the instrumentation and control panel on Northern Power Station generating unit 1 was replaced during an outage in October 2009, which also included replacing the power system stabiliser (PSS). The generating unit was then returned to service on 31 October 2009, as approved by AEMO, and agreed by ElectraNet. The PSS of the No.1 generating unit was installed but not commissioned at this time as the settings were still being modelled by ElectraNet. The PSS of the generating unit 2 was in service at the time.

At 16:22 hrs on 4 April 2010 Northern Power Station generating unit 2 was taken out of service due to a boiler tube leak and remained out of service until 02:40 hrs on 20 April. During this period Northern Power Station generating unit 1 remained in service, but with its PSS switched off. However, no constraints were invoked to limit the power transfer on the Heywood interconnector to within secure limits.

Between 16:22 hrs on 4 April and 02:40 hrs on 20 April 2010 the power transfer from Victoria to South Australia on the Heywood interconnector exceeded 350 MW for a cumulative time duration of approximately 24 hours and 5 minutes. Power transfer from South Australia to Victoria on Heywood interconnector remained within the 250 MW limit for the entire period. Power flow on the Heywood interconnector from 4 and 20 April 2010 is shown in Figure 1.

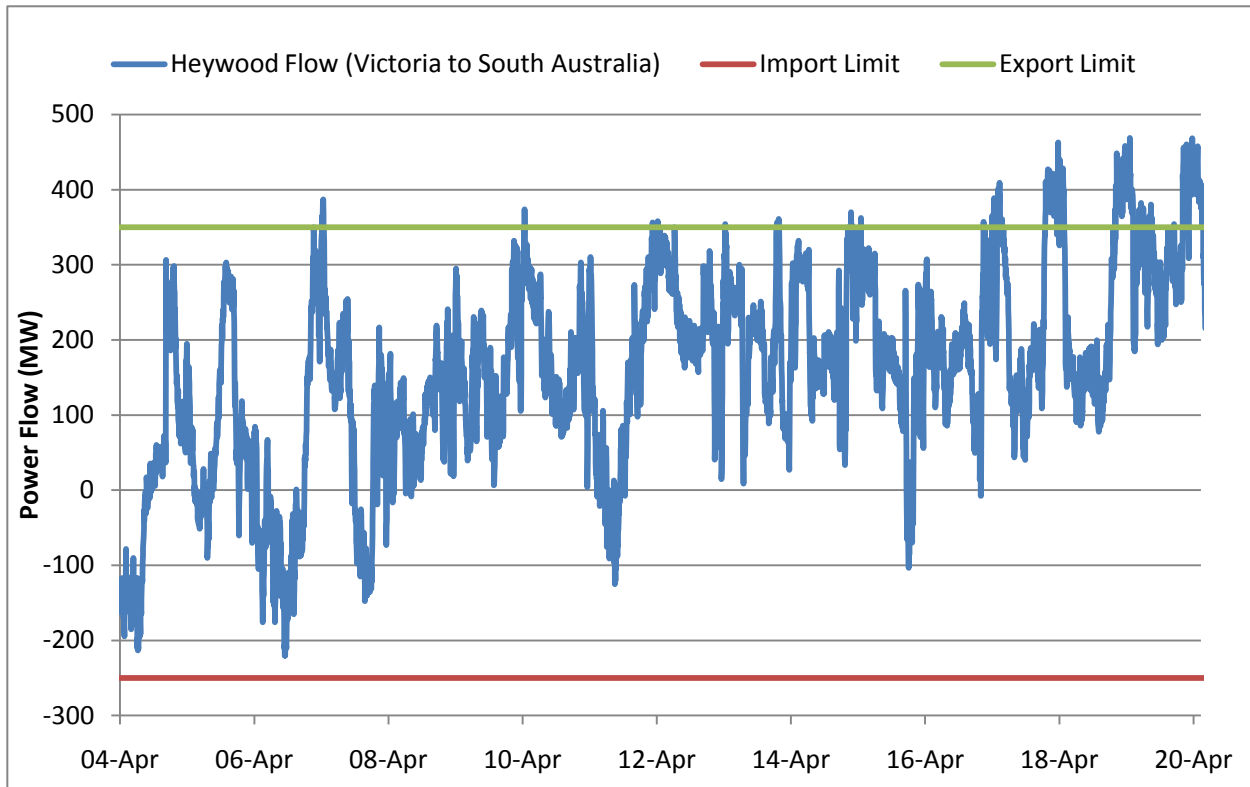


Figure 1 – Power Flow on the Heywood Interconnector 4 April to 20 April 2010

AEMO is required to report on all instances where the power system was not in a secure state for more than 30 continuous minutes. Between 16:22 hrs on 4 April and 02:20 hrs 20 April 2010 the power transfer to South Australia on the Heywood interconnector exceeded 350 MW for over 30 minutes continuously on eight occasions. These occasions are described in Table 1.

Table 1 Heywood Interconnector Export over 350 MW for over 30 minutes: 4 April to 20 April 2010

Start Time	End Time	Total Time	Average Export	Maximum Export
17 April 2010 00:35	17 April 2010 01:05	30 minutes	368 MW	389 MW
17 April 2010 19:00	17 April 2010 23:10	4 hours 10 minutes	397 MW	427 MW
17 April 2010 23:20	17 April 2010 23:55	35 minutes	396 MW	463 MW
18 April 2010 00:05	19 April 2010 01:45	1 hour 40 minutes	410 MW	440 MW
18 April 2010 20:10	19 April 2010 02:25	6 hours 15 minutes	407 MW	469 MW
19 April 2010 08:40	19 April 2010 09:15	35 minutes	362 MW	380 MW
19 April 2010 20:05	19 April 2010 22:10	2 hours 05 minutes	413 MW	460 MW
19 April 2010 22:20	20 April 2010 03:30	4 hours 15 minutes	411 MW	469 MW

At approximately 11:34 hrs on 29 April 2010 the PSS on Northern Power Station generating unit 2 failed but AEMO was not informed until 17:00 hrs on 4 May. Constraints were applied to the Heywood interconnector at 17:50 hrs on 4 May and revoked at 13:40 hrs on 8 May when AEMO was advised that the PSS had been repaired. There was a deficit of PSS adequacy at Northern power station during this period until the constraints were applied.

During this period where constraints had not been applied the power transfer to South Australia on the Heywood interconnector exceeded 350 MW for a cumulative time duration of approximately 8 hours and 30 minutes. Power transfer to Victoria on the Heywood interconnector remained within the 250 MW limit for the entire period. Power flow on the Heywood interconnector from approximately 11:34 hrs 29 April and 17:50 hrs on 4 May 2010 is shown in Figure 2.

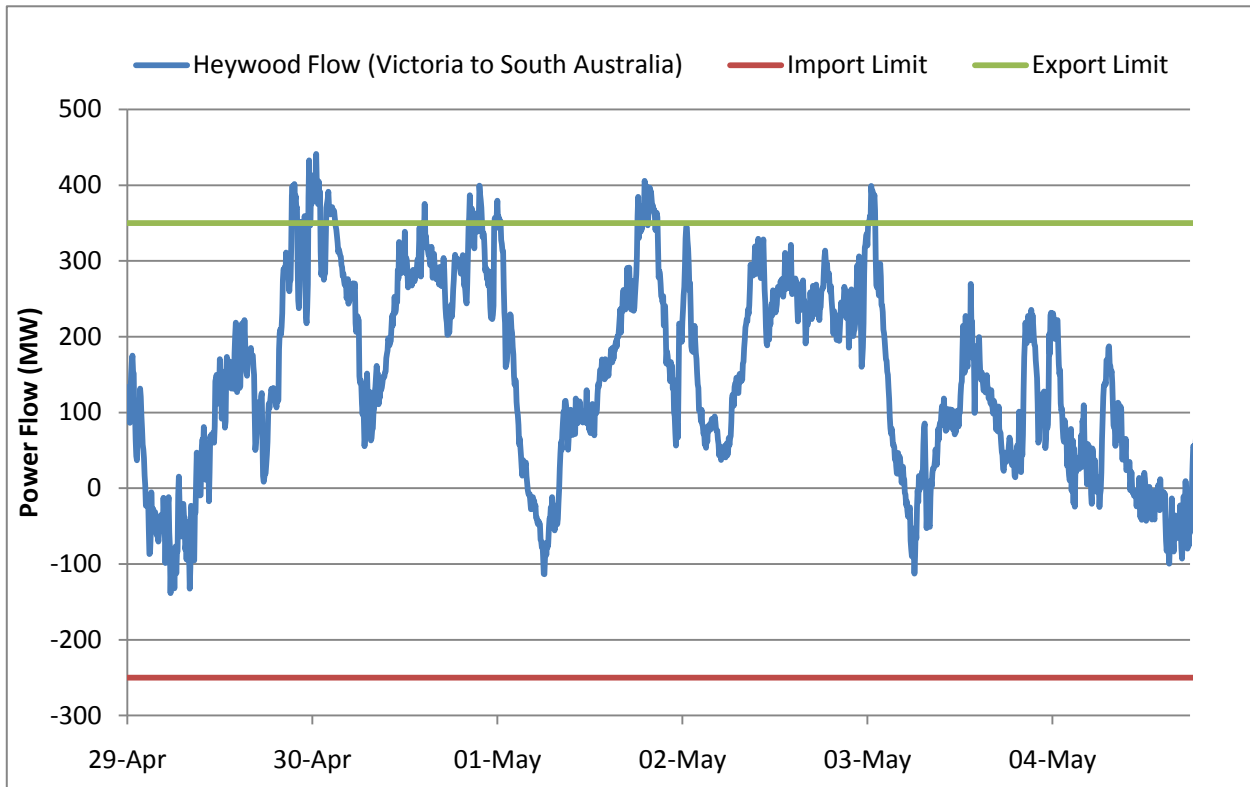


Figure 2 – Power Flow on the Heywood Interconnector 29 April to 4 May 2010

Between approximately 11:34hrs on Thursday 29 April 2010 and 17:50 hrs on 4 May 2010 the power transfer to South Australia on the Heywood interconnector exceeded 350 MW for over 30 minutes continuously on seven occasions. These occasions are described in Table 2.

Table 2 Heywood Interconnector Export over 350 MW for over 30 minutes: 29 April to 05 May 2010

Start Time	End Time	Total Time	Average Export	Maximum Export
29 April 2010 21:20	29 April 2010 22:05	45 minutes	384 MW	402 MW
29 April 2010 23:50	30 April 2010 01:05	1 hour 15 minutes	395 MW	441 MW
30 April 2010 01:50	30 April 2010 03:00	1 hour 10 minutes	370 MW	392 MW
30 April 2010 21:35	30 April 2010 22:05	30 minutes	374 MW	400 MW
01 May 2010 18:50	01 May 2010 19:30	40 minutes	381 MW	406 MW
01 May 2010 19:35	01 May 2010 20:30	55 minutes	375 MW	397 MW
03 May 2010 00:10	03 May 2010 01:05	55 minutes	374 MW	399 MW

### 3 Power System Security Assessment

If an insufficient number of PSSs are enabled in the South Australia region and the flow on the Heywood interconnector is not maintained within secure power transfer levels then there is a potential for the power system to become unstable. The potential instability is due to oscillatory stability characteristics of the power system. In particular there is the possibility of uncontrolled oscillations forming between generating units in the South Australia region and the generating units in the other mainland regions. There is also the possibility of uncontrolled oscillations forming between generating units within the South Australian region.

AEMO continually monitors the power system for power oscillations of significant magnitude or persistence. At no time when an insufficient number of PSSs were enabled in the South Australia region were oscillations of significant magnitude or persistence observed.

AEMO has investigated the oscillatory stability of the power system between 4 April and 5 May when there was insufficient number of PSSs enabled and the flow on the Heywood interconnector from Victoria to South Australia exceeded 350 MW. The results of the studies are shown in Table 3.

*Table 3 – Results of power system studies for sample of periods when an insufficient number of PSSs was enabled*

Period Studied	Heywood Flow (From Victoria to South Australia)	South Australia Demand	Results
29-Apr-10 22:00:00	371 MW	1627 MW	No Oscillatory Stability Problems Identified
30-Apr-10 00:30:00	441 MW	1663 MW	No Oscillatory Stability Problems Identified
01-May-10 20:00:00	381 MW	1457 MW	No Oscillatory Stability Problems Identified

The results in Table 3 show that although the power transfer to South Australia on the Heywood interconnector exceeded 350 MW the oscillatory instability was not likely to occur. This was due to the operating conditions of other plant in the power system at times when the secure power transfer limit was exceeded.

#### 4 Follow-up Actions

Northern Power Station has since reviewed its operating procedures to ensure that power station staff inform changes to the availability of their generating unit PSSs to AEMO and ElectraNet as early as possible.

The PSS of Northern Power Station generating unit 1 was returned to service on 10 June 2010 after completion of commissioning.

#### 5 Recommendations

AEMO in consultation with ElectraNet will investigate and confirm the validity of the current operating instruction used at times when there is a reduced number of PSSs in service at Northern power station. AEMO will complete this task by the end of December 2010.

AEMO in consultation with ElectraNet and the relevant power stations in South Australia will investigate the feasibility of receiving the ON/OFF status of PSSs of generating units via the SCADA system. AEMO will complete this action by the end of December 2010.

## Attachment 1: Power system stabilisers in service in South Australia and the secure power transfer limits on Heywood interconnector

The following information is based on the ElectraNet operating instructions effective on 14 October 2010. This information has been included for the completeness of the report. Participants should not use this information for any business decision making without verifying with ElectraNet.

The Table 4 shows the minimum number of PSSs required in service at relevant power stations and substations in South Australia to support secure power transfers (normal power transfer levels) on Heywood interconnector. If the minimum number of PSSs is not in service at any of the stations the power transfer on Heywood interconnector from Victoria to South Australia should be reduced to 350MW and from South Australia to Victoria should be reduced to 250MW.

*Table 4 – Number of PSSs required in service at relevant power stations and substations in South Australia to support secure power transfers (normal power transfer levels)*

Station	Units in service	PSSs required in service
Northern power station	2	1
	1	1
	0	0
Torrens Island B power station	4	3
	3	2
	2	1
	1	1
	0	0
Pelican Point power station	3	2
	2	1
	1	1
	0	0
Osborne power station	2	1
	1	1
	0	0
Static Var Compensators at Para	2	1
	1	1
	0	0