NEMMCO

National Electricity Market
Management Company Limited
ABN 94 072 010 327

Potential Drought Impact on Electricity Supplies in the NEM

Final Report

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FOREWORD

This is a confidential report to the Ministerial Council on Energy Standing Committee of Officials (MCE SCO) on the potential impact of the current drought on electricity supplies in the National Electricity Market (NEM). The estimates in this report are based on data gathered from water authorities and generators during January and February of 2007. The results presented herein should therefore be regarded as a ‘snapshot’ taken at that time. As the drought conditions can change, and as generators investigate alternative mitigation strategies, it is possible that the potential impact of the drought on the NEM could move away from the results contained in this report.

EXECUTIVE SUMMARY

This investigation examines the potential impact of the drought on electricity supplies in the NEM under two scenarios:

- an 'average rainfall' scenario where rainfall patterns return to the average as measured over the past 10 years, and
- a 'low rainfall' scenario where rainfall patterns remain at the level observed during the past 12 months.

A repeat of the past 12 months record low rainfall patterns was selected as an appropriate basis from which to examine the potential implications of the drought rather than, for example, a no rainfall case. This also made available actual data for modelling purposes.

The investigation process for this report commenced in January 2007. NEMMCO is aware that since that time, some rainfall data for the first three months of 2007 have been observed to be lower than the equivalent period in 2006. These observations may suggest that the low rainfall scenario included in this report, is optimistic. However, it is NEMMCO's view that the likelihood of the overall rainfall totals for 2007 continuing to be lower than 2006 are very low. It should be noted, however, that NEMMCO has received some late advice from the Victorian jurisdiction which suggests that the adverse impact of the drought on Victorian base load generators output has been underestimated in this report.

Under these two scenarios, a number of generators have advised NEMMCO that they will need to reduce their generation output to conserve water. Under the low rainfall scenario, up to 2200 MW of generation capacity will be unavailable in late 2008, which is over 5% of the total installed capacity in the NEM. In addition to this, other generators will need to limit the amount of time that they generate, which will restrict total energy available in the NEM by a further 3 - 5%. Under the average rainfall scenario, the expected capacity and energy reductions are less severe, peaking at approximately 2.6% and 1.6% respectively.

The reliability standard applicable in the NEM aims to ensure that no more than 0.002% of customer demand in each region is not met due to shortages in generating capacity. This reports sets out the predicted unserved customer energy for the two scenarios, and has found that under the low rainfall scenario, unserved energy is likely to exceed the required standard. The worst period is expected to be in the summer of 2008 / 09, where the unserved energy in New South Wales could be as high as 0.009% for the low rainfall scenario. All other regions could also experience unserved energy in excess of the reliability standard, with the exception of Tasmania, which is expected to remain within the standard.

The results of this investigation are based on the principle of pain sharing in the NEM[1]. This principle requires that where a supply shortfall exists in one region, the shortfall should be shared as far as interconnector capacity allows, in proportion to the respective regional demands.

Not all of the shortfalls predicted in this report are drought related. The NEM forecasting processes are already forecasting generation shortfalls in Victoria and South Australia for the coming summer.

Although the low rainfall drought scenario is considered very unlikely to occur, NEMMCO will ensure that the relevant details of this investigation are discussed with each effected generator participant to ensure that they are as well prepared as possible. Where applicable, NEMMCO will encourage generators to examine relevant mitigation strategies. As a last resort, NEMMCO can seek additional reserve capacity through the reserve safety net provisions of the National Electricity Rules.

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[1] Established in Rule clause 4.8.9(k), and further outlined in the Reliability Panel "Guidelines for management of electricity supply shortfall events", published by NECA in September 1998.

BACKGROUND

NEMMCO has been asked by the Ministerial Council on Energy Standing Committee of Officials (MCE SCO) to undertake an investigation into the potential impacts of the drought, and to provide a report including:

- a risk analysis of the adequacy of electricity supply for potential drought scenarios in the NEM for at least two years,
- recommendations for any contingency planning required, and
- recommendations to improve monitoring and forward projections of supply adequacy to capture risks associated with drought.

In order to provide an accurate and timely response to the MCE SCO request, a Drought Scenarios Steering Committee (DSSC) was formed comprising of representatives from the NEM jurisdictions and the Commonwealth. The DSSC has agreed that the investigation should focus on those power stations most likely to be affected by the drought, which were identified as follows:

- Western New South Wales (Mt Piper, Wallerawang, Bayswater, Liddell),
- Snowy Hydro & Victorian Hydro,
- South East Queensland (Tarong, Swanbank and Wivenhoe),
- Latrobe Valley (Loy Yang A & B, Yallourn, Hazelwood, Morwell), and
- HydroTasmania.

Given the short time frame for the investigation, the DSSC also decided to focus the investigation on the following two potential drought scenarios:

- an ‘average rainfall’ scenario where rainfall patterns return to the average as measured over the past 10 years, and
- a ‘low rainfall’ scenario where rainfall patterns remain at the level observed during the past 12 months.

NEMMCO and the other Steering Committee members have gathered information from the relevant water authorities about possible water restrictions that may be imposed in the next two years on the power stations under the two drought scenarios, and have also gathered information from the power stations as to the likely impact of these water restriction scenarios on electricity energy and capacity output.

This information has been analysed to understand the potential impact on the NEM by running a number of simulation studies, similar to those that are performed for the Statement of Opportunities / Annual National Transmission Statement (SOO/ANTS) process.

PROJECT ESTABLISHMENT

Previous NEMMCO work

Prior to receiving the request from the MCE SCO to carry out this investigation, NEMMCO had established an internal working group to investigate the potential impact of the drought on electricity supplies in the NEM. As a result, NEMMCO was well placed to commence the formal investigation as requested by the MCE SCO. In particular, NEMMCO had established an understanding of which generating units were likely to be impacted by the drought, and should therefore be the primary focus for the formal investigation.

The NEMMCO internal working group had prepared a document entitled "Potential Impact of Drought on Electricity Supply in the NEM"[2], which outlined the areas of the NEM most likely to be impacted, and proposed two alternative approaches for further work.

Steering Committee

Before commencing the formal investigation requested by the MCE SCO, NEMMCO realised that it would be important to establish and maintain close working contact with the jurisdictions and the Commonwealth. This would enable NEMMCO:

- to ensure that the scenarios being considered were consistent with jurisdictional expectations,
- to agree an appropriate process and work plan,
- to ensure access to relevant information about water storages and usage patterns, and
- to collaborate with jurisdictions to ensure that information was consistent and accurate.

At the Ministerial Council on Energy - Energy Market Reform Working Group (MCE EMRWG) meeting on Thursday 25 January 2007, NEMMCO presented the internal working group paper, and discussed the alternative approaches outlined in that paper. The MCE EMRWG then decided that a steering committee would be established with representatives from each of the NEM jurisdictions, the Commonwealth and NEMMCO.

The members of the Steering Committee were agreed as follows:

Table 1 - Drought Scenario Steering Committee members

QLD	Denis Warburton
NSW	Robert Marlin
VIC	Greg McLeish
TAS	Tony Beaumont
SA	Vince Duffy
Commonwealth	Demus King & Jodi Smith
NEMMCO	Charlie Macaulay & Chris Deague

The DSSC held its first meeting on 7 February 2007. At that meeting the DSSC agreed that the purpose of the Steering Committee was to:

> *"…ensure a coordinated and timely response to the MCE SCO request. NEMMCO will chair the Steering Committee, and will prepare agendas, minutes, and other*

[2] tabled at the MCE Energy Market Reform Working Group meeting on 25 January 2007

documentation as required. NEMMCO will be seeking assistance from the Steering Committee in deciding which drought scenarios should be included in the investigations, and in obtaining relevant information from the various water authorities and generators."

The DSSC also agreed on a work plan as summarised in the following table.

Table 2 - Drought Scenario Steering Committee Work Plan – as agreed by DSSC on 7 February 2007

Step	Task	Who	By When
1	Agree power stations potentially affected by drought.	EMRWG	Done[3]
2	Modelling studies to determine minimum energy required from affected power stations.	NEMMCO	28 Feb
3	Establish Drought Scenarios Steering Committee (DSSC) and confirm drought scenarios to be considered	NEMMCO / DSSC	7 Feb
4	Meet with water authorities and generators to understand affect of drought scenarios	NEMMCO / DSSC	5 Mar
5	Integrate information from step 4 and prepare overall NEM outlook for each scenario	NEMMCO	15 Mar
6	Prepare and submit interim report to MCE SCO	NEMMCO (with input from DSSC)	30 Mar
7	Review results with water authorities and generators based on interim report findings, and determine if any adjustments are possible	NEMMCO / DSSC	17 April
8	Perform additional modelling studies (if needed) based on information contained in interim report	NEMMCO	17 April
9	Prepare and submit final report to MCE SCO	NEMMCO (with input from DSSC)	26 April
10	Consider need for routine assessment and reporting	NEMMCO / DSSC	10 May

Following the completion of the interim report, the DSSC considered a more detailed work plan for the preparation and completion of the final report, which included allowance for ministerial and NEMMCO board review prior to finalisation.

[3] Agreed at ERMWG meeting on 25 Jan 07 to include SE Queensland (Wivenhoe, Tarong, Swanbank), Central New South Wales (Bayswater, Liddell, Wallerawang, Mt Piper), Snowy, Nth Victoria (Eildon, Dartmouth, Kiewa), Latrobe Valley (Loy Yang A, Loy Yang B, Hazelwood, Yallourn, Morwell), and Tasmania.

Scenarios

Before any modelling studies could be undertaken, it was necessary to decide on what rainfall scenarios would be assumed. This would determine the amount of water available for generators to use and, therefore, the amount of electricity that they would be able to produce.

In order to meet the MCE SCO deadline for a final report by end of April, the DSSC agreed that the number of scenarios to be examined would be limited to two.

The DSSC discussed the nature of the scenarios, recognising the need to study scenarios that were credible, and at the same time, provided an opportunity to examine the possible impact of continuing dry conditions.

NEMMCO recommended that the two investigation scenarios be as follows:

- An average rainfall scenario – where all relevant areas achieve average inflows based on the past 10 year, for the next 2 years from the end of February 2007;
- A low rainfall scenario – where all areas receive inflows over the next 2 years which are consistent with those received over the past 12 months (calendar year 2006)

The average rainfall scenario was chosen to be based on rainfall over the past 10 years rather than a longer period, as the DSSC members believed that the past 10 years represented a more likely ‘long term’ average than a longer period of time.

The low rainfall scenario was recognised by the DSSC as being very unlikely, given that many regions have experienced the driest year on record in the past 12 months. It is noted that even if certain areas of the NEM do continue to experience record low rainfall levels, the DSSC considered it unlikely that this will be experienced simultaneously across all areas of the NEM. It is also important to note that the low rainfall scenario does not assume no rainfall at all.

The DSSC decided that a repeat of the past 12 months record low rainfall patterns was an appropriate basis from which to examine the potential implications of the drought given that it made available actual data for modelling. The DSSC also recognised that in communicating the modelling results, it was important to emphasise that the low rainfall scenario was being analysed for contingency planning purposes.

INFORMATION GATHERING

Confidentiality

This investigation has required NEMMCO and the DSSC to access certain information from generators and water authorities that is regarded by them to be confidential and/or commercially sensitive. Generators and water authorities have been willing to provide this information to NEMMCO as they are supportive of the effort to gain a NEM wide understanding of the potential drought impact. However, many generator businesses and some water authorities have asked NEMMCO to regard the information provided as confidential. When questioned further, most generators accepted that NEMMCO was able to share the information provided with their relevant jurisdictions.

This presented a challenge for NEMMCO and for the DSSC. It was very important that the results of this investigation be clearly and accurately reported to the MCE SCO so that the appropriate jurisdictional response can be managed. At the same time, NEMMCO was very mindful of the importance to the competitive electricity market that commercially sensitive information would not be inappropriately shared amongst competing businesses.

For these reasons, the information contained in both the interim and the final reports to the MCE SCO has been aggregated to the regional level.

Water Authorities

The DSSC recognised the importance of obtaining information from the relevant water authorities before approaching the generator businesses. It was expected that the water authorities would be able to advise what (if any) water restrictions were likely to be imposed on the power stations for the two scenarios being considered.

The DSSC agreed that since the jurisdictions had better access to the water authorities than NEMMCO, the jurisdictional representatives of the DSSC took the lead role in establishing contact with the relevant water authorities.

To ensure that all water authorities were asked the same set of questions, an agreed set of questions were prepared by NEMMCO and approved by the DSSC. The questions put to the water authorities sought to understand what water restrictions were likely to be imposed on generators under the two scenarios being considered. The water authorities questioned are outlined in the following table.

Table 3 - Water Authorities involved in investigation

State	Water Authority
Queensland	Queensland Water Commission
New South Wales	State Water Corporation – Hunter Valley
	State Water Corporation – Fish River
Victoria	Gippsland Water
	Southern Rural Water
Tasmania	Hydro Tasmania
Snowy Mountains	Snowy Hydro

The information obtained from the water authorities was then used to guide NEMMCO and the DSSC in the subsequent questions that were put to the affected generator businesses.

Generators

Having established from the water authorities the likely water restrictions to be applied under the two scenarios being considered, NEMMCO then asked the affected generators to advise what would be the impact on their generation output during the coming two year period. In particular, NEMMCO asked the generators what, if any, reductions they anticipated in the capacity and / or energy output from their power stations.

To ensure that all generators were responding to the same set of questions, NEMMCO and the DSSC prepared a generic questionnaire, which was sent to the relevant generators.

The following generator businesses were asked to complete the questionnaire for their affected power stations:

Table 4- List of Generators Included in the Investigation

Generator Business	Power Stations
AGL Hydro	Dartmouth, Eildon, Kiewa
CS Energy	Swanbank
Delta Electricity	Wallerawang, Mt Piper
Hydro Tasmania	All Tasmanian Hydro, Bell Bay
International Power	Hazelwood, Loy Yang B
Lymmco	Loy Yang A
Macquarie Generation	Bayswater, Liddell
Snowy Hydro	Murray, Tumut, Upper Tumut
Tarong Energy	Tarong, Tarong North
TRU Energy	Yallourn

NEMMCO was asked by many of the generator businesses to treat the information provided in response to the drought questions as confidential. The responses provided to NEMMCO by the generators has therefore been aggregated by region to protect the confidentiality of the individual responses.

GENERATION REDUCTIONS

This section of the report provides a summary of the information provided by the generators in response to the questions outlined above. The reductions on generator output arising out of the drought can be divided into two different categories as follows:

1. **Capacity Reductions**: meaning a reduction in the ability of the generator to produce electrical power output. For example, a generator that is normally able to produce 200 MW of power output might only be able to produce 150 MW due to the drought. In this case, the generator is subject to a 50 MW capacity reduction.
2. **Energy Reductions:** energy is a measure of power delivered over a period of time, and is typically measured in GWh. Although a generator might be capable of generating up to its normal full power output, it might need to limit the amount of time that it operates at its full power output to conserve water. This gives rise to an energy limitation, rather than a power capacity limitation.

Note that when a generator is subject to a capacity reduction, the energy output from that generator will also be limited. For example, if a 500 MW generator is limited to 400 MW capacity for a total of 10 days, then the energy output of that generator is limited as a consequence by (500-400) x 24 x 10 = 24 GWh. However, in order to avoid double counting, where a generator indicated to NEMMCO that it would be subject to a capacity limit, this has been accounted for as a reduction of generation capacity in the NEMMCO model (see tables 5 & 6), and not included in the totals for energy limits. Where a generator advised NEMMCO that it was not limited in terms of its capacity, but was limited in terms of energy, then this was included in the totals for energy limits (tables 7 & 8).

In providing their responses to NEMMCO, many of the generator businesses indicated that there were a number of assumptions that they needed to make. Where appropriate, the specific details of these have been brought to the attention of the relevant jurisdictional representative on the DSSC.

Capacity Reductions

The aggregate reductions to generation capacity in the NEM regions due to the drought are presented in the tables 5 and 6 below. The capacity reductions are expressed as total MW reduction for each region, as well as a percentage of the total current installed capacity.

Note that the total installed generation capacities for the regions in the NEM as of winter 2007[4] are:

Region	**MW**
QLD[5]	10586
NSW	12481
Snowy	3426
VIC	8983
SA	3485
TAS	2509
Total NEM	41470

[4] Figures obtained from NEMMCO Statement Of Opportunities 2006

[5] This figure does not include Kogan Creek power station (750 MW)

Table 5 - Aggregate Capacity Reductions per Region (Low rainfall scenario)

Capacity Reductions – Low rainfall Scenario									
		2007			2008				2009
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
QLD	**MW**	**810**	**810**	**810**	**700**	**810**	**110**	**110**	**0**
	%	**7.7%**	**7.7%**	**7.7%**	**6.6%**	**7.7%**	**1.0%**	**1.0%**	**0%**
NSW	**MW**	**0**	**0**	**0**	**0**	**0**	**800**	**1800**	**1800**
	%						**6.4%**	**14.4%**	**14.4%**
Snowy	**MW**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
VIC	**MW**	**240**	**250**	**260**	**270**	**270**	**270**	**270**	**270**
	%	**2.7%**	**2.8%**	**2.9%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**
TAS	**MW**	**0**	**30**	**30**	**30**	**30**	**60**	**60**	**60**
	%		**1.2%**	**1.2%**	**1.2%**	**1.2%**	**2.4%**	**2.4%**	**2.4%**
NEM Total	**MW**	**1050**	**1090**	**1100**	**1000**	**1110**	**1240**	**2240**	**2130**
	%	**2.5%**	**2.6%**	**2.7%**	**2.4%**	**2.7%**	**3.0%**	**5.4%**	**5.1%**

Under the low rainfall scenario there are generation capacity reductions in Queensland commencing immediately, and continuing through the two year outlook. The improvement in Q3 of 2008 is due to the benefit of the recycled water project reaching Tarong in mid 2008, as advised by the Queensland jurisdiction.

The capacity reduction figures for Queensland include up to 700 MW of generation capacity which is in ‘standby’ mode with recall times ranging from 36 hr to 5 days. This capacity is not counted as available as the NEM Rules regard generation with a recall time greater than 24 hr as unavailable. However NEMMCO understands that this standby plant could be brought back into service if customer electricity supplies were threatened.

The low rainfall scenario includes a large reduction in capacity in New South Wales in the later part of 2008. This is a result of three large generating units having to be shutdown due to insufficient water, and capacity restrictions applying to a further three units.

Table 6 - Aggregate Capacity Reductions per Region (Average rainfall scenario)

Capacity Reductions – Average rainfall scenario									
		2007			2008				2009
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
QLD	**MW**	**810**	**810**	**810**	**700**	**810**	**110**	**110**	**0**
	%	**7.7%**	**7.7%**	**7.7%**	**6.6%**	**7.7%**	**1.0%**	**1.0%**	**0%**
NSW	**MW**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	%								
Snowy	**MW**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
VIC	**MW**	**240**	**250**	**260**	**270**	**270**	**270**	**270**	**270**
	%	**2.7%**	**2.8%**	**2.9%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**	**3.0%**
TAS	**MW**	**0**	**0**	**0**	**15**	**15**	**0**	**0**	**0**
	%				**0.6%**	**0.6%**			
NEM Total	**MW**	**1050**	**1060**	**1070**	**985**	**1095**	**380**	**380**	**270**
	%	**2.5%**	**2.6%**	**2.6%**	**2.4%**	**2.6%**	**0.9%**	**0.9%**	**0.7%**

Similar comments apply to the Queensland figures as for the low rainfall scenario. The Queensland and Victoria figures are the same for both the low rainfall and average rainfall scenarios, as even if rainfall were to return to previous 10 year average levels, the recovery to normal generation patterns for affected generation is expected to require continued reduced levels of operation for the upcoming 2 years.

Under this average rainfall scenario there are no capacity reductions expected in New South Wales.

Energy Reductions

In addition to the reductions in generation MW capacity outlined in the previous section, some generators will be subject to limitations in the amount of energy[6] that they can deliver due to the drought. These generators are still able to provide full generation capacity for short periods of time, but cannot sustain full power output continuously due to the water restrictions.

Note that to avoid double counting, the capacity restrictions as outlined in tables 5 & 6 have not been included as energy restrictions in the following tables.

The aggregate reductions to generation energy in the NEM regions due to the drought are presented in the tables 7 and 8 below. The regional energy reductions are expressed as GWh reduction for each quarter, as well as a percentage of the total scheduled energy supplied per quarter in that region during 2005 / 06.

Note that the total scheduled energy supplied from within each region of the NEM during 2005 / 06[7] was:

Region	**GWh per annum**	**GWh per quarter**
QLD	47,322	11,830
NSW	72,990	18,247
Snowy	4,198[8]	1,050
VIC	46, 211	11,553
SA	12,021	3,005
TAS	10,274	2,569
Total NEM	193,016	48,254

[6] Electrical energy delivered by a generator is equal to the power output (in MW) multiplied by the time that the power is delivered. So for example, if a generator provides 200 MW for 5 hours, then it delivers 200 x 5 = 1000 MWh. If another generator provides 50 MW for 4 hours, and then it increases output to 200 MW for a further 1 hour, then it will have delivered (50 x 4) + (200 x 1) = 400 MWh.

[7] Figures obtained from NEMMCO Statement Of Opportunities 2006

[8] Energy output for Snowy in 2006 was less than normal due to lower than average inflows.

Table 7 - Aggregate Energy Reductions per Region (Low rainfall scenario)

Energy Reductions – Low rainfall Scenario									
		2007			2008				2009
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
QLD	**GWh**	**410**	**410**	**410**	**410**	**410**	**0**	**0**	**0**
	%	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**			
NSW	**GWh**	**0**	**0**	**200**	**600**	**600**	**0**	**0**	**0**
	%			**1.1%**	**3.3%**	**3.3%**			
Snowy	**GWh**	**780**	**780**	**780**	**780**	**780**	**780**	**780**	**780**
	%	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**
VIC	**GWh**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
	%	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**
TAS	**GWh**	**550**	**550**	**550**	**550**	**550**	**625**	**625**	**625**
	%	**21%**	**21%**	**21%**	**21%**	**21%**	**24%**	**24%**	**24%**
NEM Total	**GWh**	**1760**	**1760**	**1960**	**2360**	**2360**	**1425**	**1425**	**1425**
	%	**3.6%**	**3.6%**	**4.1%**	**4.9%**	**4.9%**	**3.0%**	**3.0%**	**3.0%**

The largest energy reduction under the low rainfall scenario is at Snowy. The reduction is a comparison to the total scheduled energy output from the Snowy region during 2006, which was 4,198 GWh. Although this represents a significant reduction in energy output, the total generation capacity from Snowy is expected to be available to be utilised during short duration demand peaks.

There is also a significant reduction of energy under the low rainfall scenario in Tasmania, but only small capacity reductions. The simulation results indicate that these energy reductions are able to be accommodated through increased import into Tasmania via Basslink, and/or additional running of Tasmanian thermal plant.

Table 8 - Aggregate Energy Reductions per Region (Average rainfall scenario)

Energy Reductions – Average rainfall scenario									
		2007			2008				2009
		Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
QLD	**GWh**	**410**	**410**	**410**	**410**	**410**	**0**	**0**	**0**
	%	**3.5%**	**3.5%**	**3.5%**	**3.5%**	**3.5%**			
NSW	**GWh**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	%								
Snowy	**GWh**	**150**	**150**	**150**	**150**	**150**	**150**	**150**	**150**
	%	**14%**	**14%**	**14%**	**14%**	**14%**	**14%**	**14%**	**14%**
VIC	**GWh**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	%								
TAS	**GWh**	**0**	**200**	**200**	**200**	**200**	**125**	**125**	**125**
	%		**7.8%**	**7.8%**	**7.8%**	**7.8%**	**4.9%**	**4.9%**	**4.9%**
NEM Total	**GWh**	**560**	**760**	**760**	**760**	**760**	**275**	**275**	**275**
	%	**1.2%**	**1.6%**	**1.6%**	**1.6%**	**1.6%**	**0.6%**	**0.6%**	**0.6%**

Under the average rainfall scenario the energy reduction at Snowy is not as severe as the low rainfall scenario, with a 14% reduction compared to a 75% reduction in the low rainfall scenario. Similarly, the energy reduction in Tasmania is approximately 8%, compared to up to 24% in the low rainfall scenario.

ANALYSIS

Modelling Approach

Having captured all the relevant information from the water authorities and from the generators, NEMMCO used this information in a series of modelling studies to ascertain the likely impact on electricity supplies in the NEM. Before examining the results of these studies, it is important to understand the nature of the modelling approach used by NEMMCO.

When considering what approach should be taken with the modelling NEMMCO considered the Projected Assessment of System Adequacy (PASA), which is published regularly to indicate forecast potential supply shortfalls for the coming 2 year period. These projections are based on bid information that is entered by the market participants and updated each week. Participants are required to enter into the PASA the generation capacity that they expect will be available during the coming 2 year period.

The PASA is essentially limited to assessment of generation capacity, and has limited ability to analyse the impact of energy restrictions. Because the impact of the drought is a combination of both generation capacity and energy limits, the PASA is unlikely to be the most appropriate tool for this analysis.[9]

NEMMCO also uses a probabilistic analysis tool called Prophet, which uses Monte Carlo computational algorithms to simulate the dispatch of the generators in the NEM, including the effect of random events such as generator and transmission line trips. Within the Prophet model, generator capacity limits are modelled as constraints on the generator output. This affectively prevents these generators from being dispatched above their advised limit. Generators with energy limitations are modelled with a high bid price for their generation, so that they are only dispatched if other lower priced generation has been fully utilised. A simple hydrological model is also used for the Hydro generators.

NEMMCO decided to use the Prophet model for these studies due to the ability to model energy limitations more accurately than the PASA.

NEMMCO established the Prophet base model using data from the previous ANTS simulation studies, which includes both 10% and 50% probability of exceedance (POE) demand forecasts for all NEM regions.

Approximately 30 simulation studies were performed using the 10% POE demand forecasts, and a further 30 simulation studies were also done using the 50% POE demand. A weighted average of all results is then determined as follows:

Weighted result = 0.7 x 50% POE result + 0.3 x 10% POE result.

This 70 / 30 weighting is similar to that used for the SOO/ANTS studies, and provides a balance by giving higher weighting to the more expected 50% POE results, whilst still capturing the influence of the more pessimistic 10% POE results.

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[9] Even though the PASA tool was not used for the investigation work in this report, Appendix 1 includes a summary of the recent outlook as published in the PASA. The PASA results have been included in this report to indicate to the MCE SCO, the information that is currently being published to the NEM.

The simulations include the following new generators which are due for commissioning in the upcoming two year period:

Station	State	Output	Category	Due
Kogan Creek	QLD	750 MW	Base-load	September 2007
Tallawarra	NSW	400 MW	Peaking	July 2008

Limitations

The Prophet modelling used by NEMMCO is the same model that is used for the SOO / ANTS simulations, and is therefore well understood and robust. However, there are some limitations that should be recognised for this drought modelling and analysis.

For example, the simulation model does not include any generation capacity that is available with a recall time in excess of 24 hours. NEMMCO decided to take this modelling approach due to the expectation that any generators that have been shutdown to conserve water, would only be brought back online for short periods where interruption to customer supply were imminent. Under this approach, it will be possible for NEMMCO to identify the potential periods in the 2 year outlook where un-served energy might occur, which would then be an early signal that some of the standby generation might be needed at that time.

A further limitation of the model is the hydrological modelling. Although the NEMMCO Prophet model does include reasonably accurate modelling of the Snowy hydrological scheme, it does not include fully detailed hydrological modelling for all hydro schemes in the NEM.

RESULTS

The simulation studies provide forecasts of how much customer load might not be able to be met during the upcoming two year period. As the studies are probabilistic in nature, a number of simulation studies have been performed, and the results are then averaged, using the 70% / 30% weighting as previously described. The average regional results are then summed for each month in the outlook period, and displayed as the total forecast energy that was unserved in the simulation for each month.

The figures in the following tables represent the average monthly regional energy demand that was not able to be met in MWh. A blank cell indicates that all of the regions demand was able to be met in that month. The forecast monthly unserved energy per region in MWh is an energy amount, not a capacity. For example, a monthly unserved energy of 400 MWh could indicate that a 400 MW peak of 1 hour duration was not met, or a 200 MW peak of 2 hour duration was not met, or 4 separate 100 MW peaks each of 1 hour duration were not met, etc.

The NEMMCO modelling is probabilistic in nature, as it is not possible to be certain about future customer demand or generator failures etc. As a result, the forecast unserved energy figures presented in this report should not be interpreted as certainty of blackouts, but rather a prediction of what could occur. If customer demand is moderate to low, or generator failures do not occur at critical times, then the unserved energy predictions contained in this report are unlikely to eventuate.

It should be noted that the simulations used to derive these results have used as a starting point, the up to date forecasts of generator availability, and then reduced the generation availability to reflect the impact of the drought. Prior to these drought studies, NEMMCO was already forecasting potential generation reserve shortfalls for the coming summer and beyond. As a result, some of the generation shortfalls outlined in this report, particularly in Victoria and South Australia, reflect a general generation reserve shortfall, and not a drought related shortage.

The first set of results presented below are for the low rainfall scenario, followed by the average rainfall scenario results. Shaded cells indicate where the reliability standard of 0.002% unserved energy has not been achieved[10]. Since the study has been carried out in April 2007, the 12 month figures are based on the period April 2007 to March 2008, and April 2008 to March 2009.

[10] The Reliability Panel establish the standard for supply reliability in the NEM, which is 0.002% unserved energy in each region. This standard requires that no more than 0.002% of each regions energy demand should be unserved due to supply shortfalls. Note that this does not include customer interruptions due to distribution and transmission failures.

Adequacy Of Electricity Supply – Low rainfall scenario

The following table summarises the low rainfall scenario results for the first year in the outlook period.

Table 9: Low Rainfall Scenario Forecast Unserved Energy (MWh) – April 2007 to March 2008

	NSW	QLD	SA	TAS	VIC	NEM
Apr-07	-	-	-	-	-	-
May-07	-	-	-	-	-	-
Jun-07	-	-	-	-	-	-
Jul-07	-	-	-	-	-	-
Aug-07	-	-	-	-	-	-
Sep-07	-	-	-	-	-	-
Oct-07	-	7	-	-	-	7
Nov-07	-	-	-	-	-	-
Dec-07	46	-	15	-	15	76
Jan-08	21	180	387	-	996	1,584
Feb-08	854	1,601	18	-	18	2,491
Mar-08	195	92	-	-	-	287
Total MWh	1,116	1,881	420	-	1,029	4,446
Region %	0.001 %	0.004 %	0.003 %	-	0.002 %	0.002 %

These results for 2007 / 08 suggest that under the low rainfall scenario, the 0.002% reliability standard for unserved energy would not be achieved in either Queensland or South Australia.

The bulk of the forecast unserved energy in 2007 / 08 occurs during the summer months, with the largest energy shortfalls in Queensland[11]. The relatively large share of unserved energy in Queensland is due in part to the large reduction of Queensland capacity and energy compared with other regions for this period for the low rainfall scenario.

It is also apparent from these results that some unserved energy is forecast in South Australia, even though no drought related generation reductions are expected in that region. This is partly a function of the pain sharing principle of the NEM, where energy shortfalls in one region are shared across other regions in proportion to the relative demands, and to the extent that the interconnector capacity allows. In addition, this also reflects the pre-existing generation reserve shortfall in Victoria and South Australia.

Although the low rainfall scenario would result in a substantial reduction in energy available in Tasmania (see table 7), the simulation results indicate that there would be no unserved energy in Tasmania. This is due to the ability use Bell Bay and Basslink import to alleviate the reduced generation output from the Hydro stations.

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[11] Note that as discussed earlier, the generation reduction modelled for Queensland assumes that 700 MW of generation capacity on 'standby' is not available. However, NEMMCO understands that this generation could be made available if there were clear risk of customer load shedding, which would substantially reduce the amount of unserved energy in Queensland.

The following table summarises the low rainfall scenario results for the second year in the outlook period.

Table 10: Low Rainfall Scenario Forecast Unserved Energy (MWh) – April 2008 to March 2009

	NSW	QLD	SA	TAS	VIC	NEM
Apr-08	-	3	-	-	-	3
May-08	-	-	-	-	-	-
Jun-08	-	-	-	-	-	-
Jul-08	-	-	-	-	-	-
Aug-08	-	-	-	-	-	-
Sep-08	-	-	-	-	-	-
Oct-08	-	-	-	-	-	-
Nov-08	-	-	5	-	-	5
Dec-08	36	36	37	-	47	157
Jan-09	596	120	629	-	1,396	2,741
Feb-09	5,413	2,904	135	-	260	8,712
Mar-09	678	252	-	-	-	929
Total MWh	6,723	3,314	807	-	1,703	12,547
Region %	0.009 %	0.006 %	0.007 %	-	0.004 %	0.006 %

The above table shows that in 2008 / 09 under the low rainfall scenario, the overall amount of unserved energy across the NEM increases to even higher levels than the 2007 / 08 year. This is due to the generation capacity reductions becoming worse in the second half of 2008, especially in New South Wales (see table 5).

Although the capacity reductions in Queensland are expected to be largely resolved by July 2008 due to the recycled water pipeline completion, under the pain sharing principles of the NEM, the simulation predicts unserved energy in Queensland during summer 2008 / 09. South Australia and Victoria also contribute substantially to the unserved energy in this period. The modelling suggests that Tasmania might avoid any unserved energy. This would require more detailed examination of the results to confirm, but suggests that at the times of energy shortfall, there was not additional capability on the interconnectors from Tasmania to the effected region.

Adequacy Of Electricity Supply – Average rainfall scenario

The following table summarises the average rainfall scenario results for the first year in the outlook period.

Table 11: Average Rainfall Scenario Forecast Unserved Energy (MWh) – April 2007 to March 2008

	NSW	QLD	SA	TAS	VIC	NEM
Apr-07	-	-	-	-	-	-
May-07	-	-	-	-	-	-
Jun-07	-	-	-	-	-	-
Jul-07	-	-	-	-	-	-
Aug-07	-	-	-	-	-	-
Sep-07	-	-	-	-	-	-
Oct-07	-	7	-	-	-	7
Nov-07	-	-	-	-	-	-
Dec-07	28	-	15	-	15	57
Jan-08	-	-	354	-	936	1,290
Feb-08	29	29	8	-	8	73
Mar-08	44	-	-	-	-	44
Total MWh	101	36	376	-	959	1,471
Region %	-	-	0.003%	-	0.002%	0.001%

As expected, the total amount of unserved energy predicted under the average rainfall scenario is much less than for the low rainfall scenario. The results suggest that in 2007 / 08, only Victoria and South Australia would suffer substantial unserved energy. As discussed previously, this is largely due to a pre-existing generation reserve shortfall in those two regions, which has been forecast for some time in NEMMCO's medium term PASA.

The following table summarises the average rainfall scenario results for the second year in the outlook period.

Table 12: Average Rainfall Scenario Forecast Unserved Energy (MWh) – April 2008 to March 2009

	NSW	QLD	SA	TAS	VIC	NEM
Apr-08	-	-	-	-	-	-
May-08	-	-	-	-	-	-
Jun-08	-	-	-	-	-	-
Jul-08	-	-	-	-	-	-
Aug-08	-	-	-	-	-	-
Sep-08	-	-	-	-	-	-
Oct-08	-	-	-	-	-	-
Nov-08	-	-	-	-	-	-
Dec-08	-	10	30	-	30	70
Jan-09	-	65	536	-	1,206	1,807
Feb-09	21	922	62	-	104	1,109
Mar-09	23	3	-	-	-	26
Total MWh	44	1,000	628	0	1,340	3,012
Region %	-	0.002%	0.005%	-	0.003%	0.001%

Similar to the previous table, the predicted unserved energy in Victoria and South Australia for the average rainfall scenario is largely due to the pre-existing generation shortfall for those two regions.

Generation Capacity Factors

Generation capacity figures provide an indication of the extent to which a generator is being used. For example, a generator operating to a 100% capacity factor over a certain period, would be generating at its full rated power output for the entire period. It is important to note that not all generators are capable of operating at their full output for extended periods of time. For example, many hydro generators must restrict their generation period to ensure that storage levels are maintained appropriately, and many gas turbines are limited by various things such as fuel availability, maintenance requirements and Environment Protection Authority (EPA) controls. Even baseload generators must be shut down occasionally to carry out maintenance.

It is useful to examine the generator capacity factors resulting from the drought studies, as they provide an indication of how generators might be dispatched in order to meet customer demand under the two drought scenarios. The following series of graphs indicate how the drought studies suggest that generation patterns could vary due to the impact of the drought. Each main generator in the NEM has been grouped into one of the three main generation classifications:

1. Baseload,
2. Intermediate, or
3. Peaking.

Appendix 2 sets out how each of the generators in the NEM has been classified into these three groups.

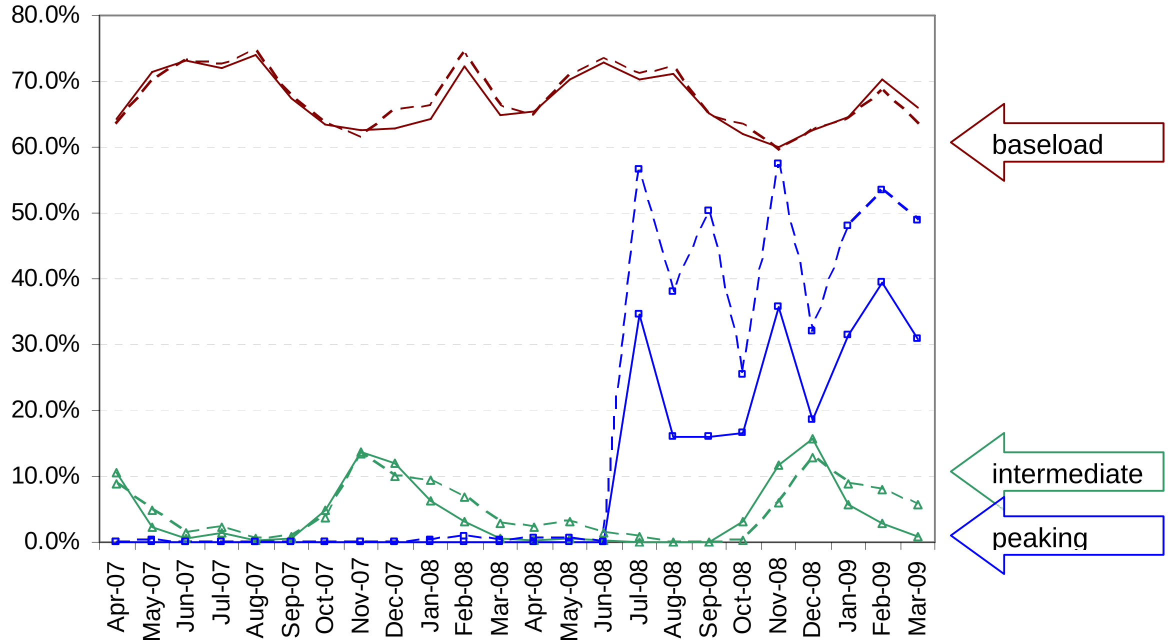
The capacity factor results presented in this report are aggregated results which represent the average for all generators in the particular category. These aggregated results can sometimes be heavily influenced by one or two large generators in their class. As a result, the aggregated result does not always provide a good estimate of the impact on each generator in that class. In addition to these aggregated results, NEMMCO will review the individual generator predictions, and discuss these where necessary with the relevant generator participants.

The following series of graphs compare the capacity factors from the simulations for both the average and the low rainfall scenario, using the following legend:

Baseload – Average	Baseload – Low
Intermediate – Average	Intermediate – Low
Peaking – Average	Peaking - Low

In addition, each graph includes three marker arrows on the right hand side, which indicate the annual average capacity factor for the generator classification, based on actual generation data for 2006.

Figure 1: Generation Capacity Factors - NSW



New South Wales baseload generation operates at near to the average value, except for the summer 2008 / 09 period, where it reduces due to the drought capacity reductions.

The increase in the capacity factor for peaking plant in July 2008 is due to the commissioning of the Tallawarra power station. As this is a new power station, it has been classified as a 'peaking' plant. However, in future assessments, this would be classified as 'intermediate'. If the effect of Tallawarra is removed, there are only marginal changes in the peaking and intermediate capacity factors.

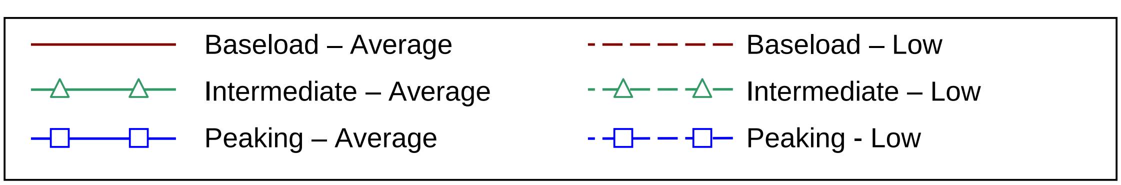
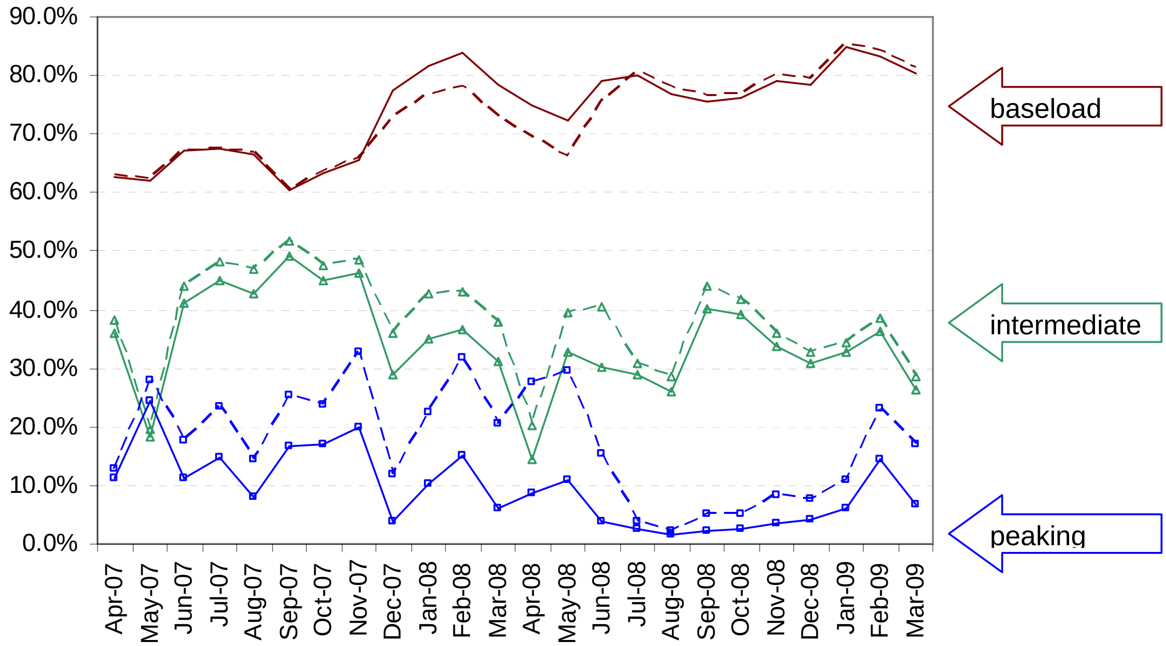


Figure 2: Generation Capacity Factors - QLD



The baseload capacity factors from the studies are trending higher than the annual average figure. This is due to the influence of Kogan Creek coming on line, which is tending to balance out the impact of the drought.

The capacity factors for both intermediate and peaking plant in Queensland increase substantially in the low rainfall scenario compared with the average rainfall scenario, particularly prior to the completion of the recycled water pipeline in mid-2008. NEMMCO will need to discuss these results with the relevant generator participants to ascertain whether these increased capacity factors, particularly for the peaking plant, are feasible.

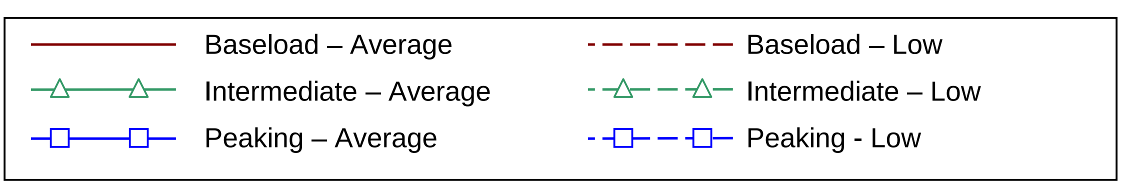
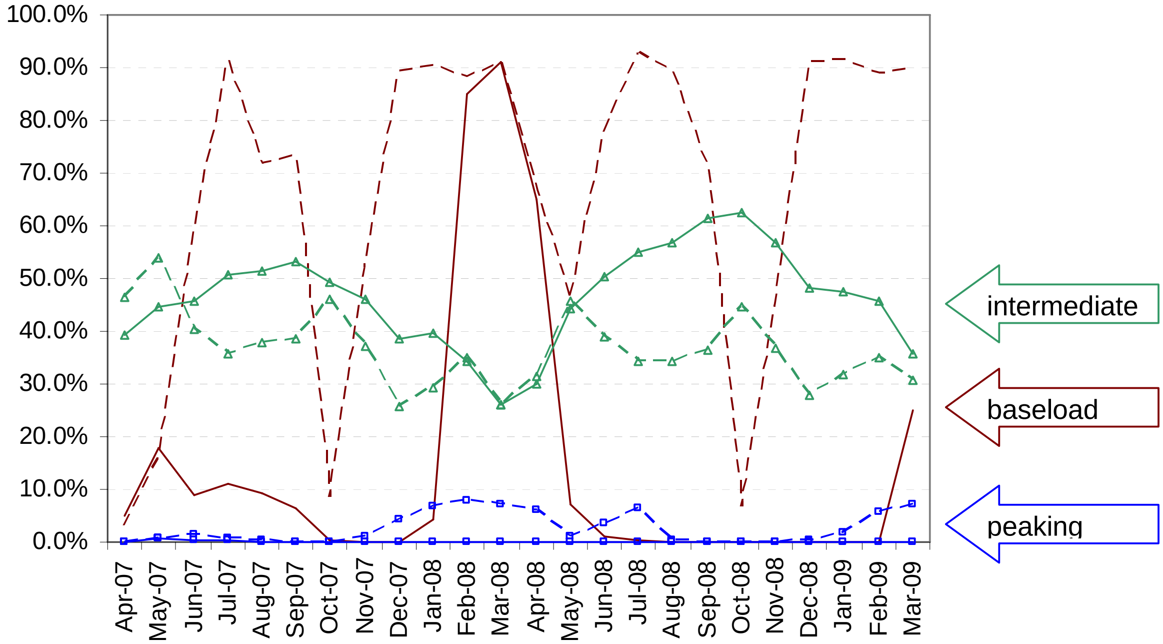


Figure 3: Generation Capacity Factors - TAS



The low rainfall scenario would see much greater reliance on the ‘baseload’ classified Bell Bay power station in Tasmania, and reduced output from the hydro scheme, which is classified as ‘intermediate’. Note also that the peaking plant is being dispatched up to approximately 9% capacity factor during the summer months.

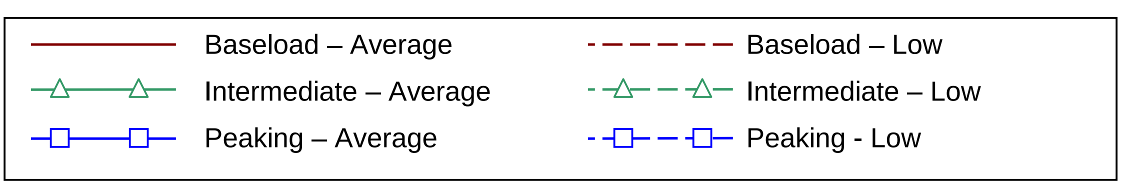
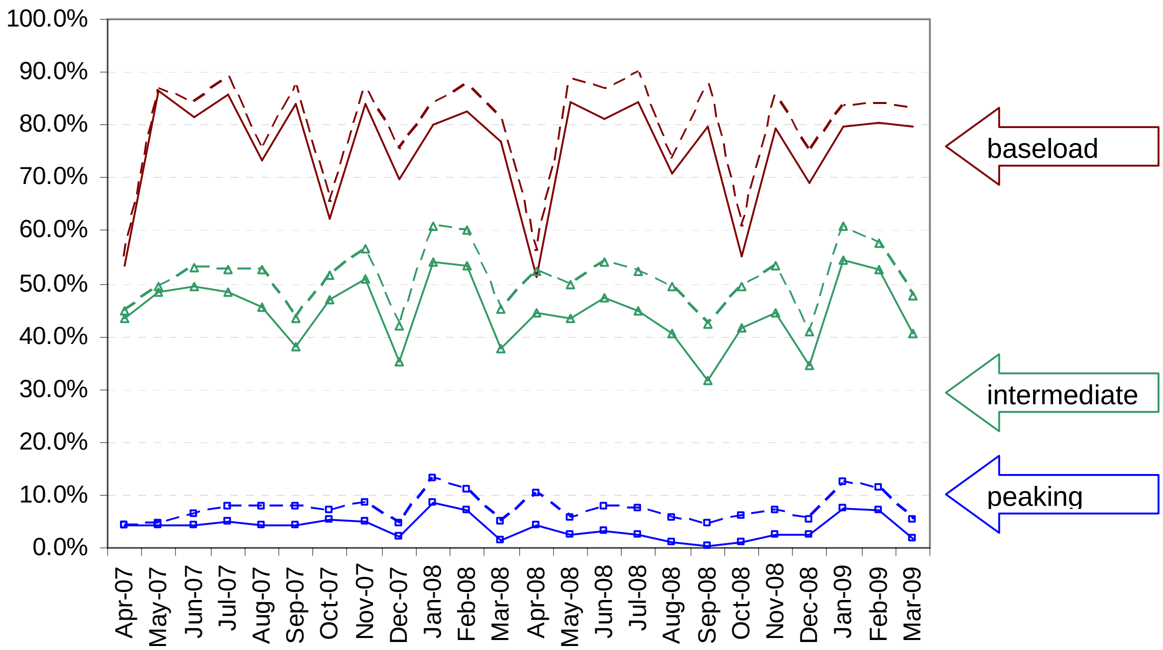


Figure 4: Generation Capacity Factors - SA



As South Australia plant is not significantly impacted by the drought, the results indicate that as the drought impact in the other regions worsens, there are slight increases in the capacity factors for all plant in South Australia, as this plant is run harder to compensate for reduced generation output in other regions.

As there are only two power stations in South Australia that are classified as baseload (see Appendix 2), the actual capacity factor will be heavily influenced by the performance of these two power stations.

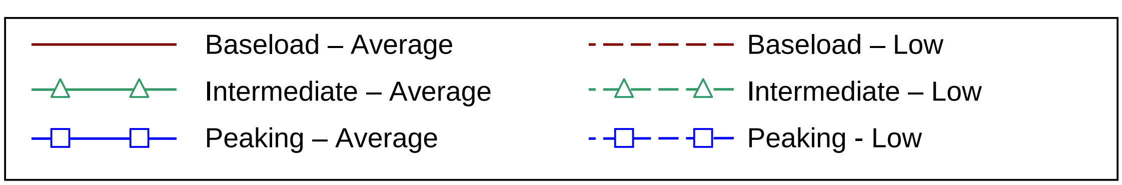
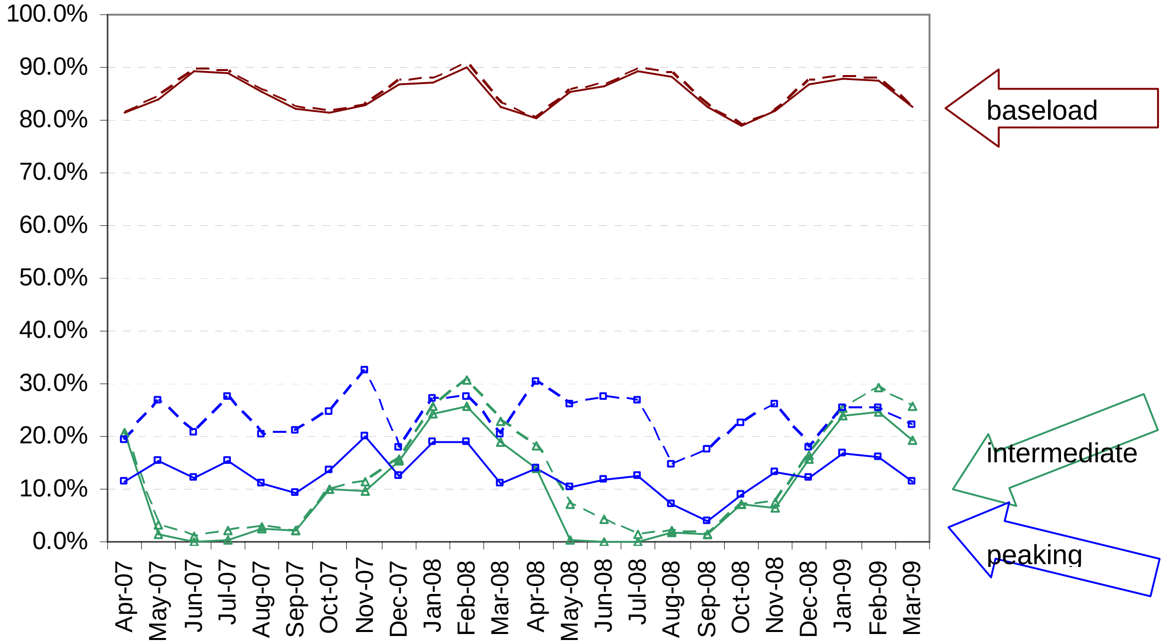
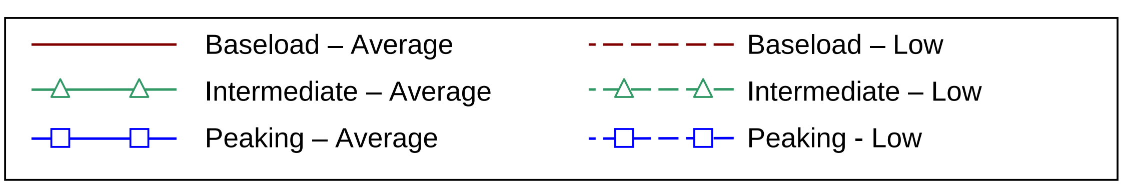


Figure 5: Generation Capacity Factors - VIC



The baseload capacity factor in Victoria is largely unchanged from the actual average. This is reasonable as the drought is not expected to impact significantly on Victoria baseload plant on the coming 2 years.

There is little change in the capacity factors for the intermediate plant in Victoria, as this plant is essentially the Victoria hydro which is constrained by the drought. However, there are substantial increases in the capacity factors for ‘peaking’ plant in Victoria. NEMMCO will need to confirm with the relevant generator participants that these capacity factors are feasible.



RESPONSE

The following section contains a brief summary of the actions that NEMMCO intends to pursue in response to the results of this investigation. At the time of writing, NEMMCO is giving further consideration to its response options, and may identify additional steps to take, or refinements to those listed here.

Report Results

NEMMCO will provide market participants with information about the potential drought impact on the NEM to ensure that the market is aware of any potential shortfalls. To the extent possible, NEMMCO will continue to endeavour to ensure that the PASA results correctly reflect the drought impact. Where necessary, NEMMCO will provide additional explanatory material to ensure that any significant issues are understood.

Continued Monitoring

NEMMCO intends to continue the process of monitoring and reporting on the potential impact of the drought beyond the end of April this year, at least until the major effects of the drought have dissipated. This monitoring becomes increasingly more detailed as the planning horizon shortens. For example, the short term PASA forecasts 2 weeks in advance, and the pre-dispatch forecasts 2 days in advance with a greater level of detail. These forecasting tools are used continuously and where necessary, NEMMCO can intervene in the market in an endeavour to maintain sufficient generation reserve.

As discussed earlier in this report, there are two generating units in Queensland that are currently in stand-by mode to conserve cooling water. NEMMCO understands that these generating units could be brought back into service with a notice time of between 36 hr and 5 days. NEMMCO will liaise with the relevant generator participant and jurisdictional representatives in Queensland to agree an operational protocol which ensures that the recall of available standby units is managed effectively, in an endeavour to avoid customer load shedding.

Maximise Availability Of Non Drought Affected Plant

Where the study results indicate that intermediate or peak generation is required to generate more frequently to make up for a deficit due to the drought, NEMMCO will liaise with these generators to ascertain their ability to accommodate the increase in generation, and to identify issues that may arise (e.g. EPA limits, plant life impacts, etc).

Improve Monitoring And Analysis

It is intended that the monitoring and analysis of the impact of water on generation will become a regular component of NEMMCO reporting. Although NEMMCO has not yet decided formally on how this will be done, it is expected that consideration will be given to incorporating drought information into the SOO on a regular basis, and further thought will be given to how the PASA process can be supplemented or modified to better accommodate restrictions imposed by drought conditions.

NEMMCO is also considering obtaining information from the Bureau of Meteorology to understand more fully, the likelihood of occurrence of the scenarios outlined in this report.

Contingency Planning Recommendations

In addition to the results of these simulation studies, the Medium Term PASA is currently indicating potential reserve shortfalls for Queensland, Victoria and South Australia for the coming summer of 2007 / 08, and further reserve shortfalls for New South Wales in April 2008.

The Medium Term PASA prediction of reserve shortfalls for the coming summer are consistent with the results of this drought simulation studies. It is therefore apparent that unless there is a market response to the predicted reserve shortfall, it is likely that NEMMCO will, in consultation with the relevant jurisdictions, initiate the reliability safety net process. As required by the NEM Rules, NEMMCO will aim to give the market participants and others maximum opportunity to respond before commencing any intervention actions, but at the same time, needs to allow sufficient time to conduct the reliability safety net process, should that be necessary.

NEMMCO estimates that unless there has been a significant improvement to the forecast reserve situation by mid 2007, then it will be necessary to commence a reliability safety net process.

APPENDIX 1 – MEDIUM TERM PASA

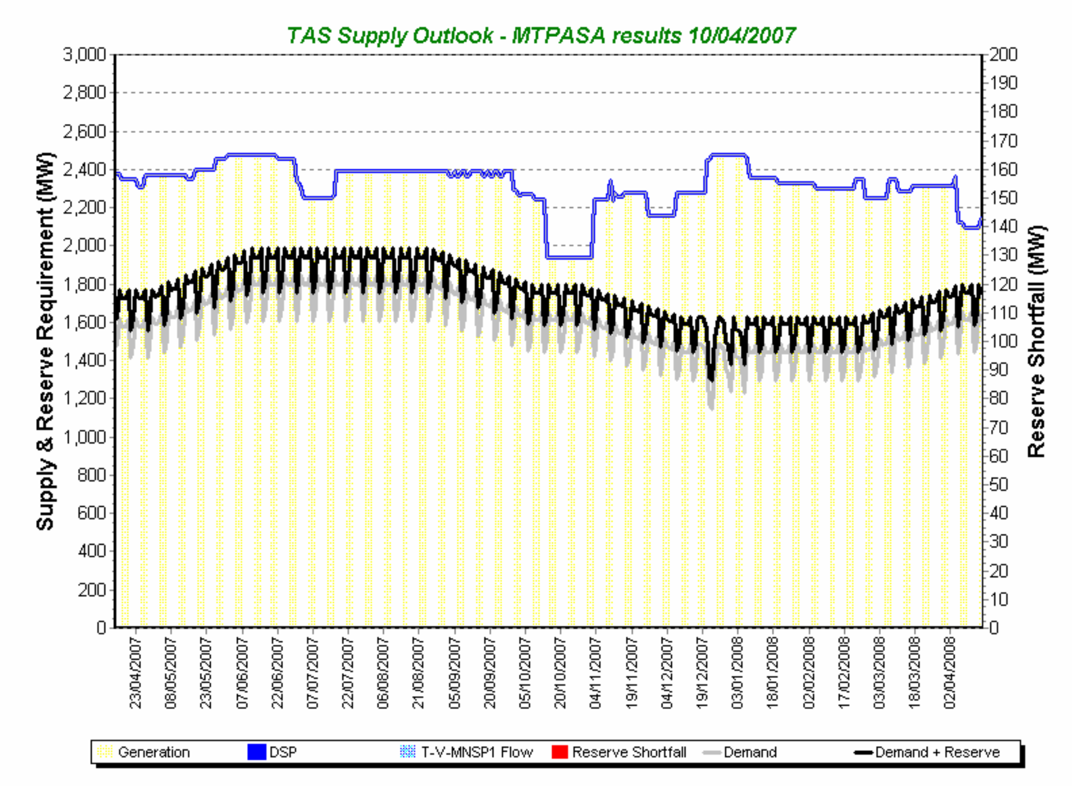
Each week NEMMCO publishes the medium term PASA, which is an assessment of likely generation reserves for the upcoming two year period. The generation forecasts that go into the medium term PASA are provided as bid information by the generator participants, and reflect the generators estimate of their most likely generation level during the upcoming two year period. These forecasts are therefore not optimistic or pessimistic, but are intended to be the most likely result.

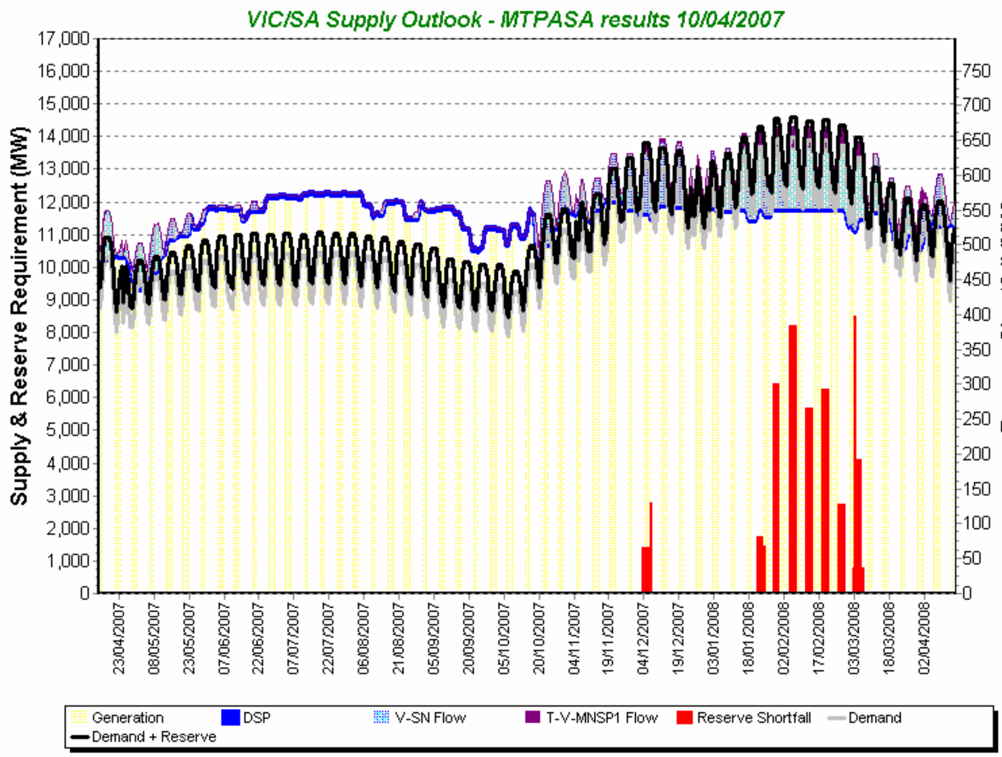
The medium term PASA therefore only includes the generator reductions due to the drought that the generator participants have decided are 'likely' to occur. For this reason, the drought generator reductions in Queensland and Victoria are currently reflected in the medium term PASA as they are considered to by 'likely'. However, the drought reductions for New South Wales and Snowy are not currently included.

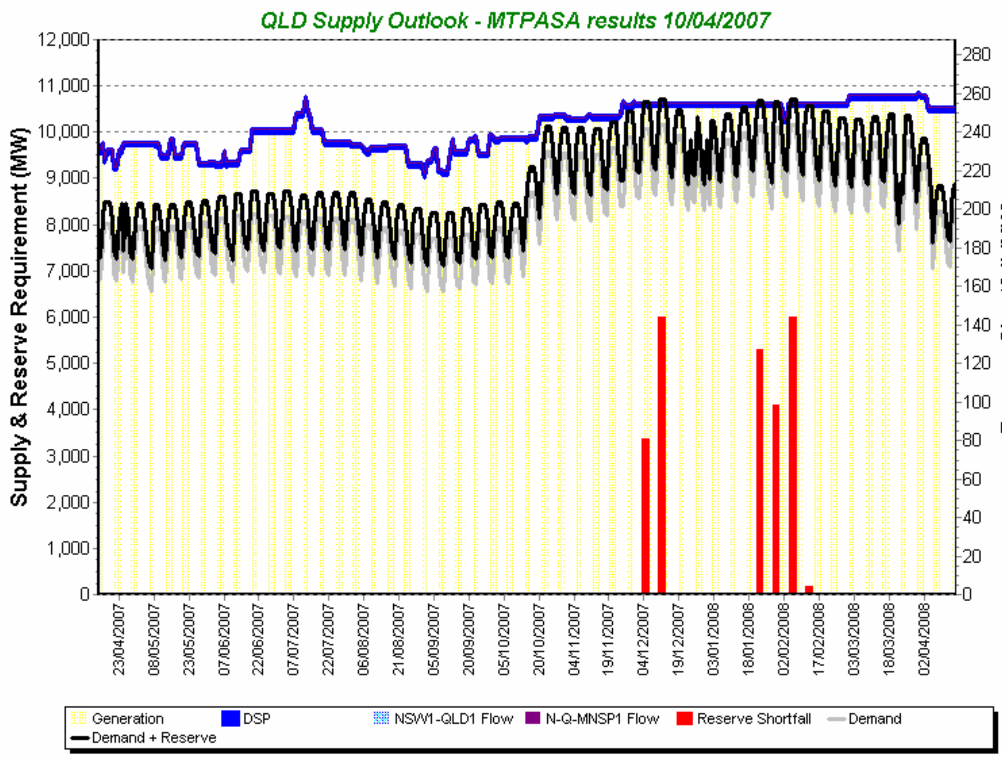
These PASA forecasts are included with this report, so that the MCE SCO are aware of the information that is currently being provided to the NEM participants.

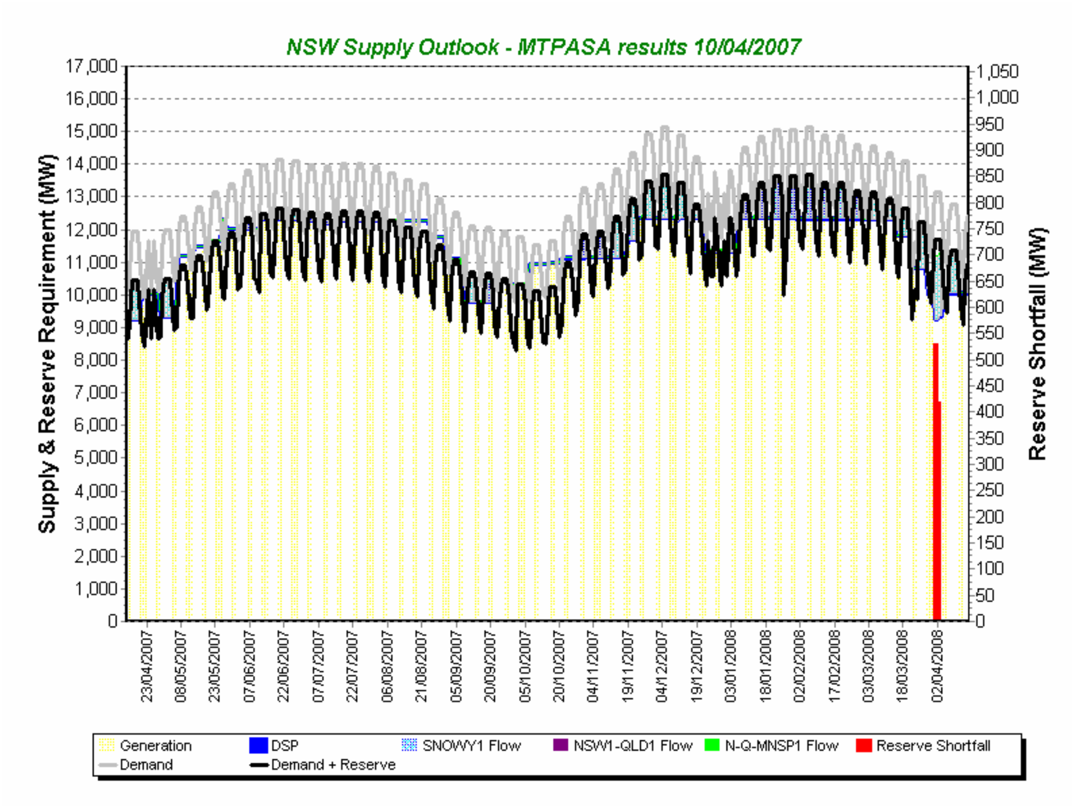
The medium term PASA results below indicate that a significant generation reserve shortfall is being forecast in Victoria, South Australia and Queensland for the coming summer. NEMMCO is continuing to monitor this situation, and if necessary, will consider calling on additional reserve capacity through the reliability safety net provisions of the Rules.

The following diagrams summarise the Medium Term PASA results as of 10 April 2007.




VIC/SA Supply Outlook - MTPASA results 10/04/2007
Supply & Reserve Requirement (MW)
Reserve Shortfall (MW)
Generation
DSP
V-SN Flow
T-V-MNSP1 Flow
Reserve Shortfall
Demand
Demand + Reserve


QLD Supply Outlook - MTPASA results 10/04/2007
Supply & Reserve Requirement (MW)
Reserve Shortfall (MW)
Generation
DSP
NSW1-QLD1 Flow
N-Q-MNSP1 Flow
Reserve Shortfall
Demand
Demand + Reserve


NSW Supply Outlook - MTPASA results 10/04/2007
Supply & Reserve Requirement (MW)
Reserve Shortfall (MW)
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1,050
1,000
950
900
850
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750
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23/04/2007
08/05/2007
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19/11/2007
04/12/2007
19/12/2007
03/01/2008
18/01/2008
02/02/2008
17/02/2008
03/03/2008
18/03/2008
02/04/2008
Generation
DSP
SNOWY1 Flow
NSW1-QLD1 Flow
N-Q-MNSP1 Flow
Reserve Shortfall
Demand
Demand + Reserve

APPENDIX 2 –GENERATOR CLASSIFICATIONS

As discussed earlier in this report, each main generator in the NEM has been grouped into one of the three main generation classifications:

1. Baseload,
2. Intermediate, or
3. Peaking.

The following series of tables set out how the generators within each of the NEM regions has been classified. These classifications are used in the generation capacity factor results in figures 1 to 5.

Table 13: NSW Generators

NSW	Baseload	Bayswater	2760
		Eraring	2640
		Liddell	2030
		Munmorah	600
		Mount Piper	1320
		Redbank	148
		Sithe	160
		Vales Point	1320
		Wallerawang	1000
	Intermediate	Blowering	80
		Shoalhaven	240
	Peaking	Hunter Valley Gas Turbines	51
		Tallawarra	400

Table 14: QLD Generators

Qld	Baseload	Callide B	700
		Kogan Creek	750
		Collinsville	185
		Callide	920
		Gladstone	1680
		Millmerran	860
		Stanwell	1400
		Swanbank B	500
		Tarong	1400
		Tarong North	443
	Intermediate	Swanbank E	385
		Yabulu	223
		Barron Gorge	60
		Kareeya	88
		Wivenhoe	500
	Peaking	Barcaldine	55
		Mackay Gas Turbine	33
		Mount Stuart	294
		Oakey	320
		Roma	60
		Braemar	450

Table 15: SA Generators

SA	Baseload	Osborne	190
		Northern	530
	Intermediate	Ladbroke Grove	84
		Pelican Point	490
		Torrens Island A	504
		Torrens Island B	824
	Peaking	Hallett	183
		Angaston	40
		Dry Creek	147
		Mintaro	88
		Playford B	240
		Port Lincoln	48
		Quarantine	88
		Snuggery	63

Table 16: Snowy Generators

Snowy	Intermediate	Guthega	60
		Murray	1500
		Lower Tumut	1500
		Upper Tumut	616

Table 17: TAS Generators

Tas	Baseload	Bell Bay	228
	Intermediate	Bastyan	80
		Butlers Gorge	12
		Catagunya	48
		Cethana	85
		Cluny	17
		Devils Gate	60
		Fisher	43
		Gordon	432
		John Butters	144
		Lake Echo	32
		Liapootah	84
		Lemonthyme	51
		Mackintosh	80
		Meadowbank	40
		Paloona	28
		Poatina	300
		Reece	231
		Repulse	28
		Rowallan	11
		Tarraleah	90
		Trevallyn	103
		Tribute	83
		Tungatinah	125
		Wilmot	31
		Wayatinah	38
	Peaking	Bell Bay Gas Turbine	95

Table 18: VIC Generators

Vic	Baseload	Anglesea	154
		Hazelwood	1705
		Loy Yang B	1020
		Loy Yang A	2130
		Morwell	143
		Yallourn W	1480
	Intermediate	Dartmouth	145
		Eildon	110
		McKay Creek	150
		West Kiewa	62
	Peaking	Somerton	157
		Bairnsdale	90
		Hume	58
		Jeeralang A	232
		Jeeralang B	255
		Laverton North	312
		Newport	510
		Valley Power	321