Independent Market Operator

# 2007 Statement of Opportunities Report

**July 2007**

## DISCLAIMER

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The purpose of publication is to provide technical and market data and information regarding opportunities in the Wholesale Electricity Market (WEM) in Western Australia.

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# EXECUTIVE SUMMARY

The Statement of Opportunities Report is published each year by the IMO to provide information to participants of the Wholesale Electricity Market and other industry stakeholders on the status of electricity consumption, demand and generation within the South West Interconnected System (SWIS). The main purpose of the Statement of Opportunities Report is to:

- Set the amount of capacity required to be available from 1 October in the 2009/10 Reserve Capacity Year.
- Provide information on maximum demand and electricity consumption within the SWIS over the Long-Term Projected Assessment of System Adequacy (LT PASA) Study Horizon.
- Provide an indication about the level of Demand Side Management (DSM) that can be reliably accommodated within the SWIS.
- Provide information relating to opportunities for investment in generation capacity and DSM capability through the Reserve Capacity Mechanism.

The Statement of Opportunities Report is also intended to provide supporting information about electricity generation within the SWIS, and presents an overview of the methods and assumptions that contribute to the above outcomes.

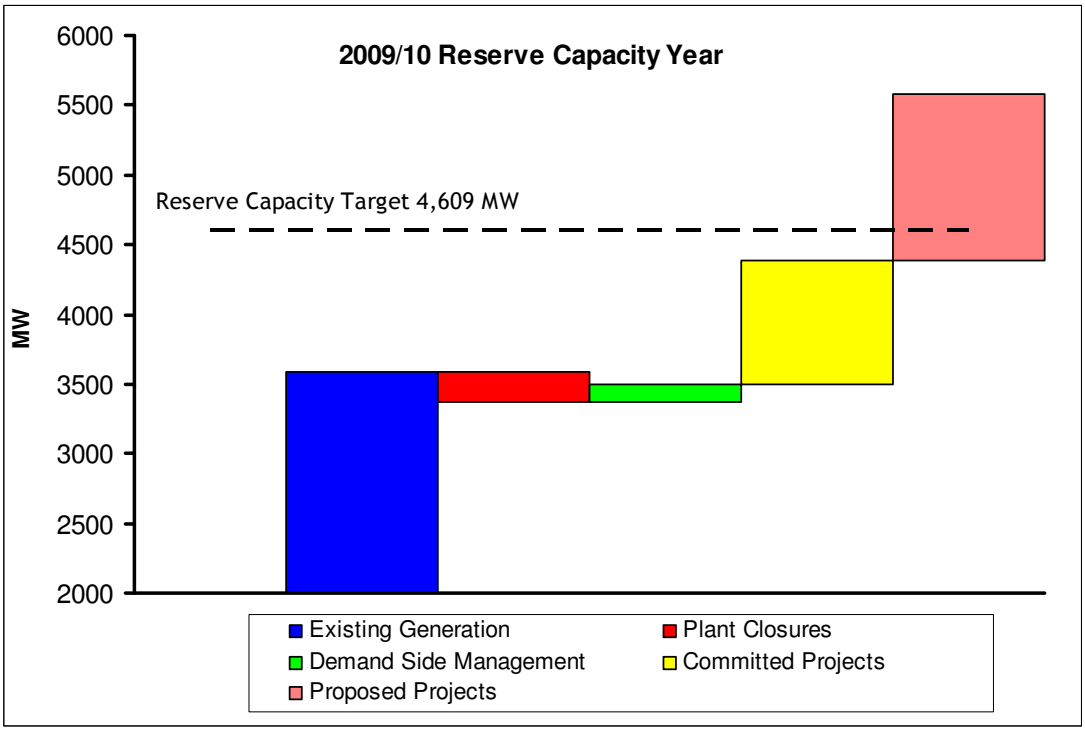
The analysis supporting the 2007 Statement of Opportunities Report indicates the following:

- Economic growth within the State is forecast to remain strong, with an annual average rate of growth of 4.2% in Gross State Product over the period 2007/08 to 2016/17.
- Electricity consumption is forecast to grow at 2.2% per annum on average over the period 2007/08 to 2016/17, while maximum demand is forecast to grow at 3.3% over this period.
- To meet the forecast growth in electricity consumption and maximum demand, 4,609 MW of generation and DSM capacity will be required for the 2009/10 Reserve Capacity Year. This represents an increase of 167 MW from the previous Reserve Capacity Year.

### *Key Results for 2009/10*

The following figure illustrates the expected status of generation and DSM capacity in the SWIS in the 2009/10 Reserve Capacity Year. Generation and DSM capacity expected to be available from existing facilities, and facilities already under construction totals approximately 4,384 MW. The Reserve Capacity Target is 4,609 MW for the 2009/10 Reserve Capacity Year, indicating approximately 225 MW of

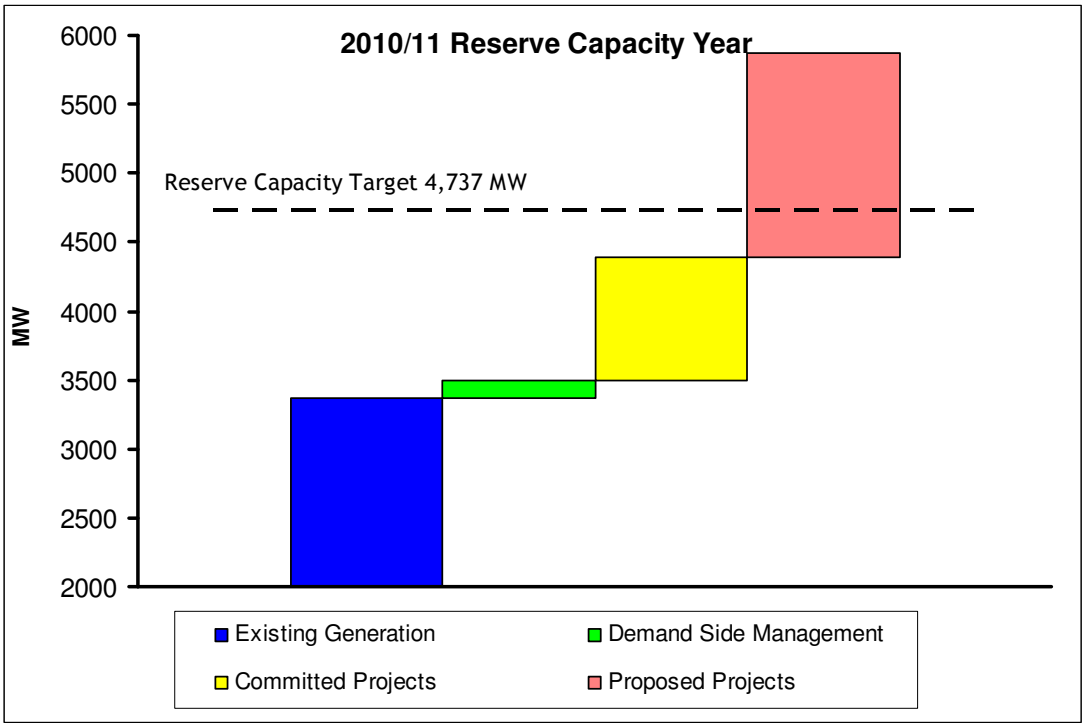
new generation and DSM capacity to be procured through the Reserve Capacity Mechanism.




In addition to facilities already in operation, and facilities that are under construction, 1,192 MW of capacity was identified in the 2007 Expressions of Interest process to potentially be available in 2009/10.

### *Key Results for 2010/11*

For 2010/11, approximately 4,384 MW of generation and DSM capacity is expected to be available from existing plant and plant that is already under construction. In 2010/11, the preliminary Reserve Capacity Target is forecast to be 4,737 MW, resulting in an additional requirement of approximately 353 MW.



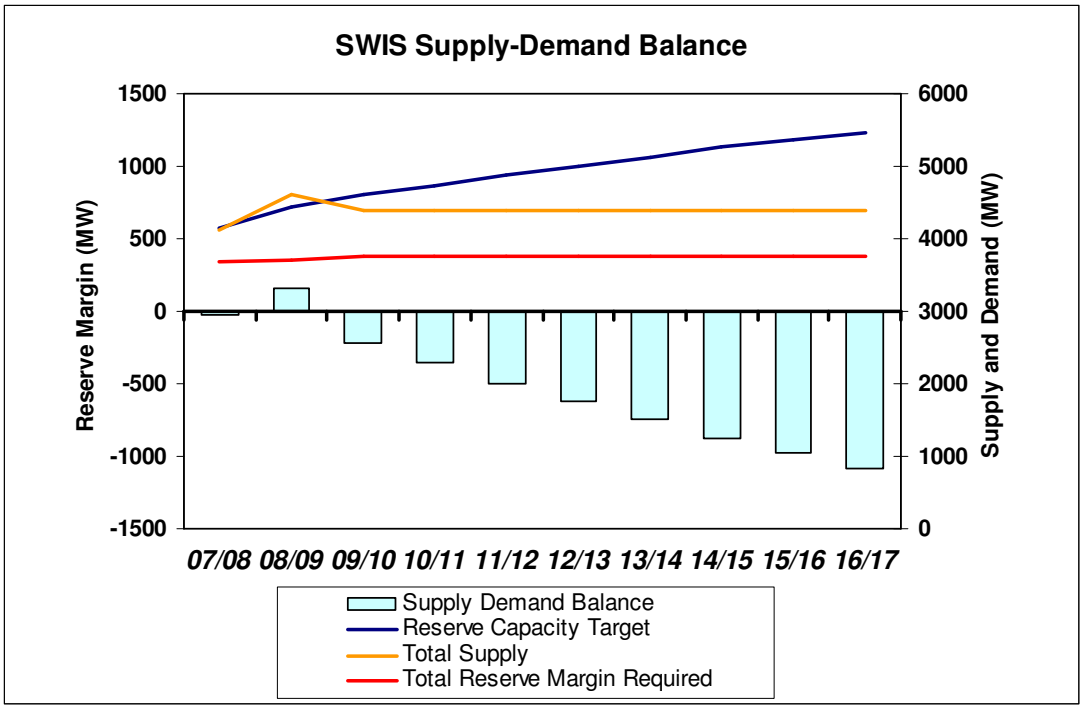

The 2007 Expressions of Interest process identified a further 301 MW of capacity that is under consideration for the 2010/11 Reserve Capacity Year, which is in addition to the 1,192 MW of capacity identified in the 2009/10 Reserve Capacity Year.

***Supply Demand Balance***

The graph below illustrates the supply-demand balance, giving an indication of investment opportunities. This shows:

- A very small deficit in Reserve Capacity with Capacity Credits in 2007/08.
- The Reserve Capacity Target is achieved in 2008/09.
- Sustained opportunities for investment in new generation and DSM facilities from 2009/10 onward.

As no assumptions are made about the introduction of new generation or DSM capacity beyond the 2009/10 Reserve Capacity Year, the supply-demand deficit increases as the load continues to grow over time.




***Next Steps in the Reserve Capacity Mechanism Process***

Supplementary mechanisms exist within the Wholesale Electricity Market Rules to facilitate closing the 25 MW deficit between the updated capacity requirement for 2007/08 and the number of Capacity Credits assigned for this period.

This 25 MW only represents a gap of approximately 0.5% relative to the number of Capacity Credits assigned for the 2007/08 Reserve Capacity Year. While this deficit is small in the context of the overall Reserve Capacity requirement, the IMO is examining options to address this issue. The *Wholesale Electricity Market Rules* provide a structured mechanism to address potential shortages of supply. It is also of note that current actual capacity on the SWIS exceeds the number of Capacity Credits by around 120 MW.

For the 2009/10 Reserve Capacity Year, applications for Certification of Reserve Capacity of generation and DSM capacity are now open.

The next steps in the Reserve Capacity Mechanism for the current Reserve Capacity Cycle are:

- Applications for Certification of Reserve Capacity must be provided to the IMO by 5pm on 20 July 2007.
- Market Participants whose facilities are granted Certified Reserve Capacity must then apply for Capacity Credits, indicating whether they intend to trade their capacity bilaterally or whether they wish to offer their Certified Reserve

Capacity into a Reserve Capacity Auction (if one is required). This process must be completed by 5pm on 10 August 2007.

- On 13 August 2007, the IMO will advise Market Participants who have indicated their intention to trade their capacity bilaterally how many Capacity Credits have been assigned to their Facilities.

- By 5pm on 17 August 2007, the IMO will advise whether sufficient capacity has been secured through bilateral trades. If the Reserve Capacity Target has been met, no Reserve Capacity Auction will be held. If sufficient capacity has not been secured through bilateral trades, the IMO will also advise that it will run a Reserve Capacity Auction to secure the outstanding quantity.

- If a Reserve Capacity Auction is required, Market Participants must provide their offers between 20 and 29 August 2007 and the IMO will run the Reserve Capacity Auction on 3 September 2007.

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# 1. INTRODUCTION

The past twelve months has been significant for the reform of the electricity industry in Western Australia. On 21 September 2006 the energy market commenced, the last major step in the transition to the Wholesale Electricity Market. While energy trading in the Wholesale Electricity Market is relatively new, the publication of this Statement of Opportunities Report (SOO) is part of the third Reserve Capacity Cycle.

The SOO is a key step in the Reserve Capacity Mechanism, a series of processes through which the IMO identifies the requirement for additional generation and DSM capacity and facilitates the introduction of this capacity onto the SWIS. The processes of the Reserve Capacity Mechanism are set out in Chapter 4 of the Wholesale Electricity Market Rules (Market Rules) and the preparation of the SOO is undertaken in accordance with section 4.5 of the Market Rules.

This SOO provides updated expectations on capacity available on the SWIS from that provided in the 2006 SOO and updated in the Request for Expressions of Interest in March 2007. It provides maximum demand and electricity consumption forecasts (energy forecasts) that may be used by generators, retailers and investors to assess the outlook for the SWIS and identifies opportunities for investment. Energy consumption and demand forecasts are provided for the Long-Term Projected Assessment of System Adequacy (LTPASA) Study Horizon, which extends to 2016/17.

This year, the SOO provides more information than has previously been published. This new information includes:

- Generation facility information.
- Details on the Reserve Capacity Mechanism market shares by participant and fuel types.
- Characteristics of SWIS load profiles.
- More information on the load forecasts.
- Increased transparency in the planning and forecasting processes and assumptions.
- The timetable of events for the 2007 Reserve Capacity Mechanism.

The additional information published this year is intended to improve the transparency of the Reserve Capacity Mechanism and to increase understanding of the specific characteristics of electricity generation and consumption within the SWIS.

Growth in the national economy continues on a sound basis and State outcomes are projected to be even more positive. These buoyant economic conditions support continued strengthening of electricity demand and consumption within the SWIS.

Consequently, interest in the development of electricity generation projects is likely to remain strong over the next few years.

A major milestone in this year's Reserve Capacity Mechanism was the publication of the 2007 Request for Expressions of Interest on 31 January 2007. The Request for Expressions of Interest process identified a preliminary additional capacity requirement of approximately 80 MW for the 2009/10 Reserve Capacity Year.

Submissions for 21 projects were received through the Expressions of Interest process. These projects covered 1,707 MW of generation and DSM capacity for the 2009/10 and 2010/11 Reserve Capacity Years. The strong response to the Request for Expressions of Interest suggests that project developers and investors have confidence in the Wholesale Electricity Market. More information on the results of the Request for Expressions of Interest process can be found on the IMO website[1].

While economic and development indicators support a positive outlook for additional electricity generation and DSM capacity within the SWIS, two factors that have the potential to influence longer-term generation investment prospects are:

- The introduction of new generation requires access to the transmission system and ongoing investment in the network infrastructure is therefore essential.

- The ability of project proponents to secure natural gas supplies is reportedly constrained at present. This has the potential to restrain or delay the development of gas-fired power station project options within the SWIS.

[1] http://www.imowa.com.au/rc_eoi.htm

# 2. ELECTRICITY GENERATION AND CONSUMPTION IN THE SWIS

This section of the SOO provides information on electricity generation and consumption characteristics within the SWIS. Historically, electrical output from power stations has been measured at two distinct points:

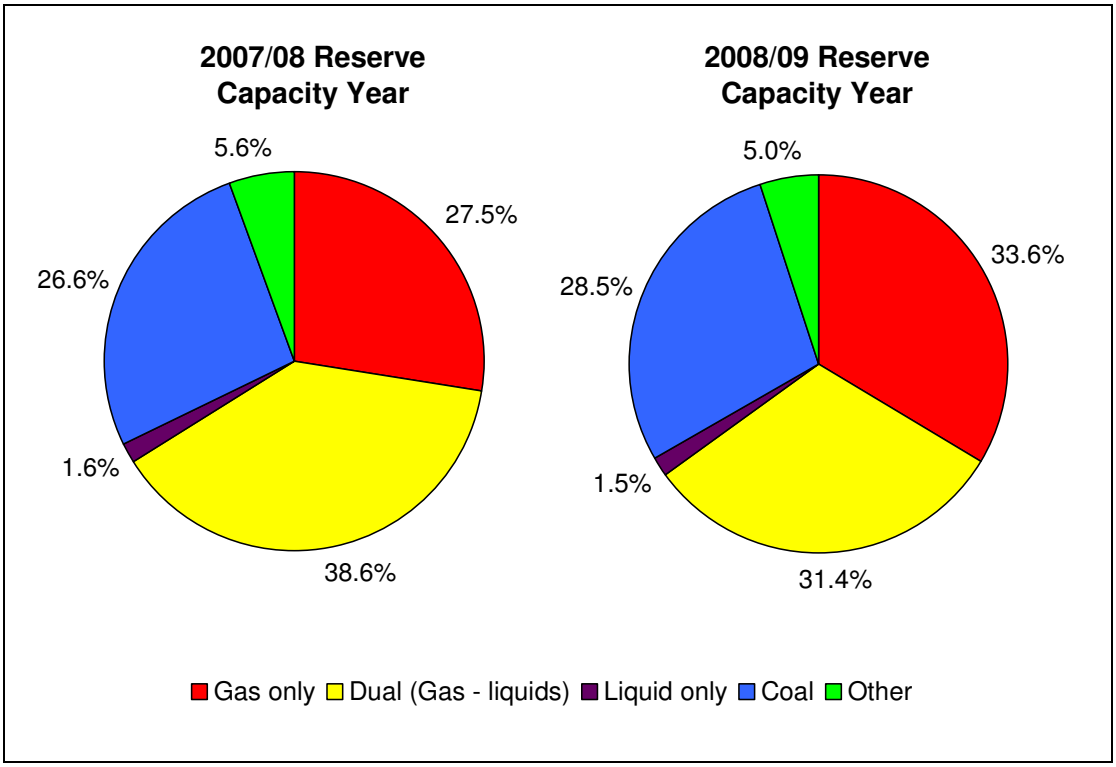
- At the generator terminals (which is a measure of the gross production level).
- At the point where the electricity is sent out from the power station (the net amount of electricity exported into the grid).

As the Wholesale Electricity Market uses sent out capacity quantities, the information provided in the SOO is presented in terms of sent-out capacity expressed in megawatts (MW), unless otherwise specified. Energy production is also presented in sent-out terms and is measured in gigawatt-hours (GWh). This means that some of the figures presented in this report may differ from those prepared by other entities.

## *2.1 Capacity Credits by Fuel Type*

Electricity generation within the SWIS is mainly fuelled by gas (both gas-only and dual fuelled plant) and coal. Figure 1 below illustrates the proportion of SWIS Capacity Credits as a function of fuel type in the Wholesale Electricity Market expected at the beginning of the 2007/08 and 2008/09 Reserve Capacity Years.

**Figure 1 Capacity Credits by Fuel Type**

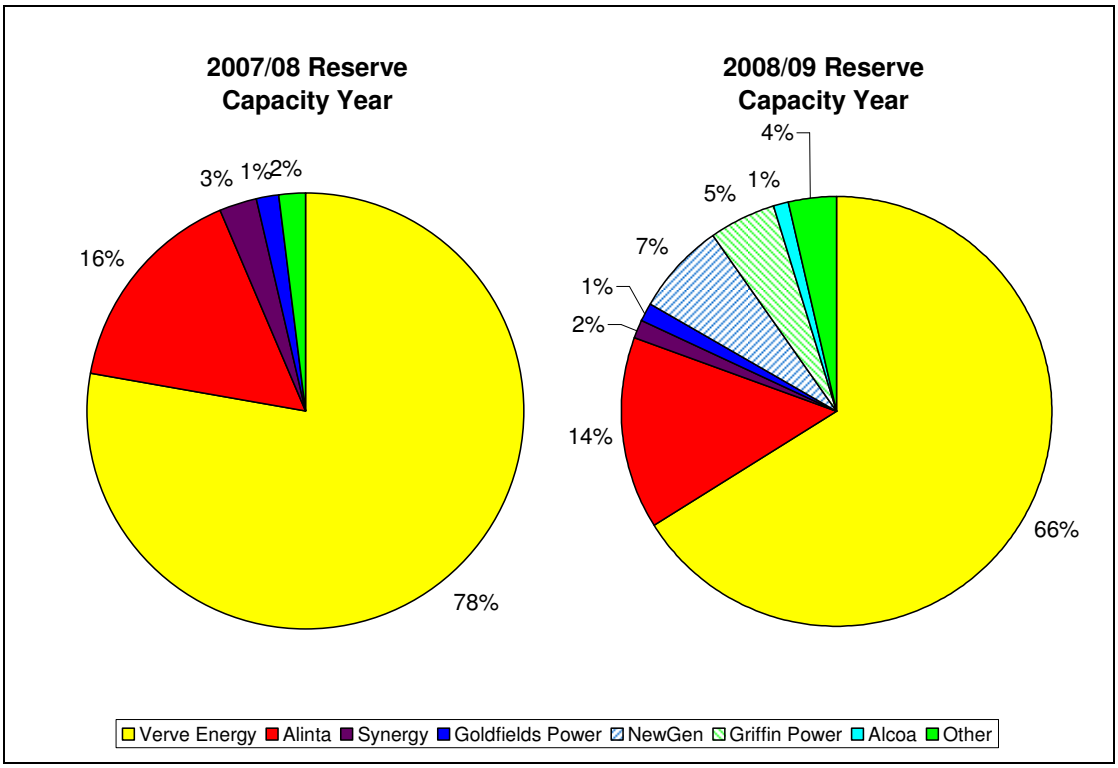


As can be seen from Figure 1, approximately 65% of the generation capacity is provided by gas and dual-fuel plant. Coal plant comprises around 25% of installed capacity and this proportion is expected to increase with the commissioning of Griffin's Bluewaters 1 facility in 2008/09. Wind farms and other renewables (mostly landfill gas plant) make up around 5% of the generation profile.

### *2.2 Capacity Credits by Market Participant*

The following figure shows the Capacity Credits assigned to Market Participants as a percentage of the total number in the SWIS for the 2007/08 and 2008/09 Reserve Capacity Year.

**Figure 2 Capacity Credits by Market Participant**




As can be seen from Figure 2, Verve Energy holds the largest share of Capacity Credits in 2007/08 and 2008/09, although their share reduces from around 78% to 66%. This is due to the commissioning of new facilities owned by NewGen Power and Griffin Power.

Alinta is the next largest participant with around 15% of the total Capacity Credits in 2007/08 and 2008/09. Alinta's share also falls slightly as a result of NewGen Power and Griffin Power entering the market in 2008/09.

Only Market Participants with more than 1% of the total number of Capacity Credits are shown in Figure 2. A complete listing can be found in Appendix 1.

### *2.3 Recent SWIS Maximum Demand and Energy Consumption*

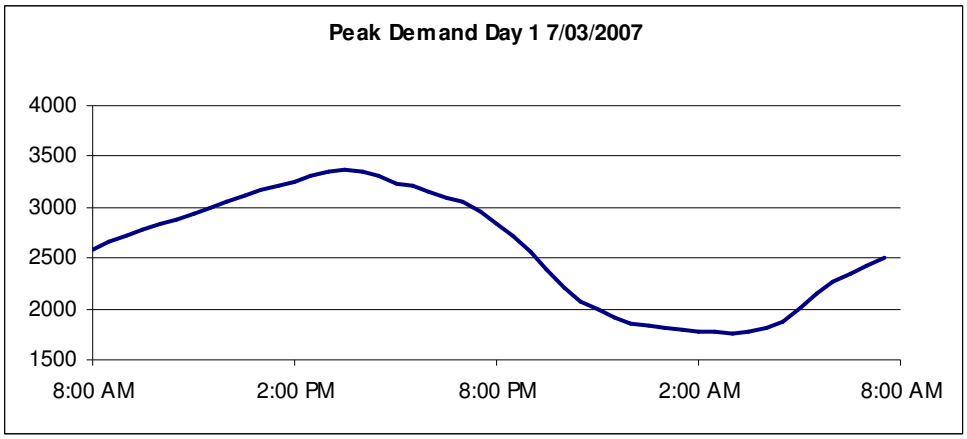
Peak electricity demand within the SWIS occurs in the summer and is driven largely by temperature dependent loads. These loads are predominantly air conditioning and space cooling appliances used in both the residential and commercial sectors.

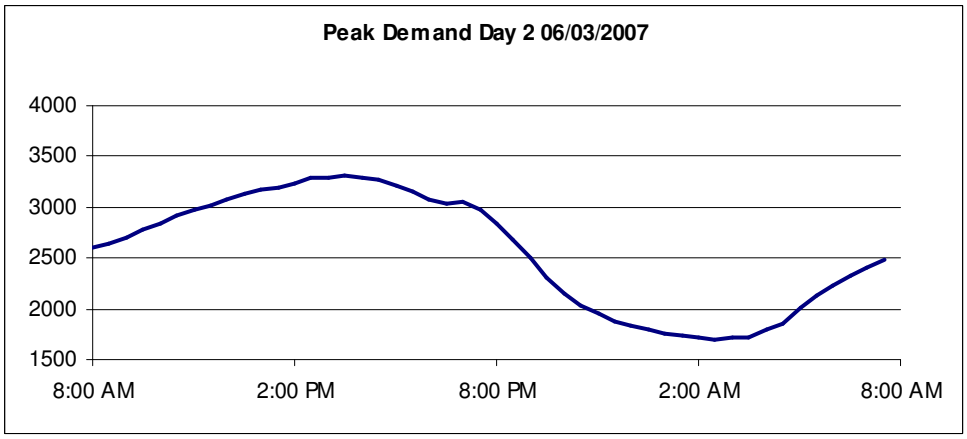
For the 2006/07 summer, the maximum demand within the SWIS was 3,364 MW. This occurred on Wednesday 7 March 2007 in the 15:30 Trading Interval (the Trading Interval commencing at 15:30 WST). The maximum temperature recorded by the Bureau of Meteorology for the Perth Metro area was 42.4ºC and this occurred at 15:49 WST. The figure of 3,364 MW is the SWIS sent-out value and is the highest demand ever recorded on the SWIS.

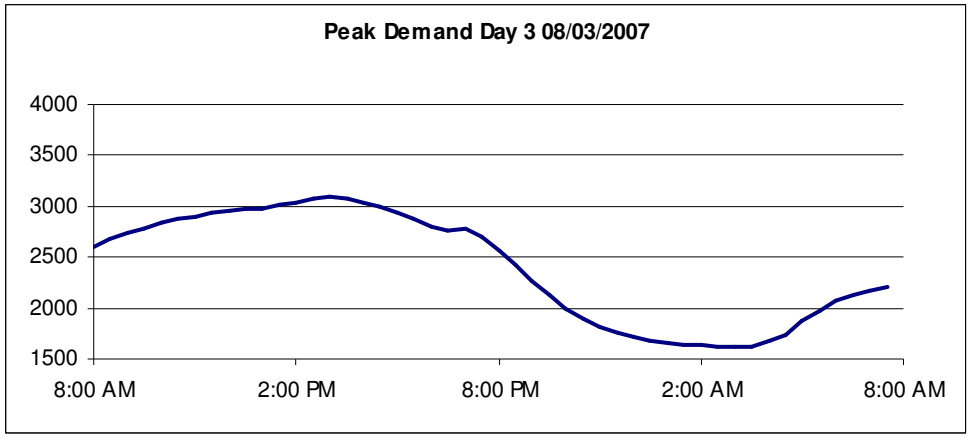
The load profile for the day of maximum demand for the 2006/07 summer is presented in Figure 3 together with next highest three days of system demand. These occurred on the following days:

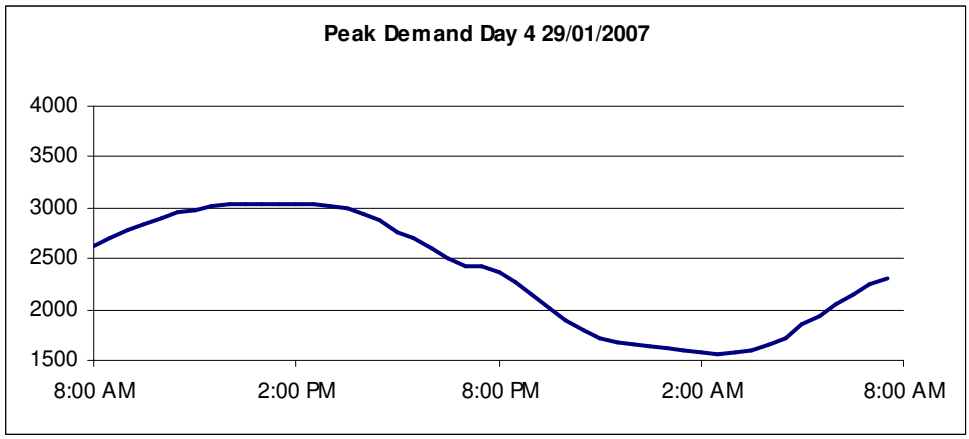
- 6 March 2007 with a maximum demand of 3,301 MW at 15:30.
- 8 March 2007 with a maximum demand of 3,094 MW at 15:00.
- 29 January 2007 with a maximum demand of 3,073 MW at 13:30.

**Figure 3 Maximum Demand (in MW) for the Highest Demand Days for the 2006/07 Summer**






### *2.4 Generation and DSM Facilities within the SWIS*

The Reserve Capacity Mechanism provides Market Participants with the opportunity to be assigned Capacity Credits in respect of their generation and DSM capacity.

When a facility has been assigned Capacity Credits, it is obliged to offer its full capacity into the market unless it is undergoing approved maintenance. There is currently around 120 MW of capacity available to the SWIS which has not been assigned Capacity Credits. While this may be asked to run, there is no obligation for it to respond unless a High Risk or Emergency Operating State is declared. In reality, it is expected that this capacity will generally be available as it would assist the participant's commercial position, however, this capacity is not formally taken into account by the IMO in determining the capacity available on the SWIS.

The Market Rules require the IMO to categorise capacity based on the level of certainty that the facility will be in service. Existing Generation is the capacity of generation Facilities in existence and expected to be operating for the 2009/10 Reserve Capacity Year.

Committed generation represents generation that is under construction and has been assigned Capacity Credits in the previous Reserve Capacity Cycle.

No projects have been classified as 'Probable Generation' for 2009/10, that is, projects which have been granted Conditional Certified Reserve Capacity in respect of the current Reserve Capacity Cycle.

Table 1 summarises the quantities of each category for the period commencing in October of 2009/10[2]. These figures are used to assess compliance with the Planning Criterion and the determination of the Reserve Capacity Target.

**Table 1 Capacity Assumptions for 2009/10 Onwards**

| | Capacity Credits | Nameplate Capacity |
|---|---|---|
| Existing Generation | 3,372 MW | 4,626 MW |
| Committed Generation | 884 MW | N/A |
| Probable Generation | 0 MW | N/A |
| DSM | 128 MW | 0 MW |

Values are provided in terms of both Capacity Credits and nameplate capacities as the latter are used for the reliability modelling. The nameplate capacities contributing to the above aggregates have been supplied by Market Participants as part of their registration data.

### *2.5 Plant Closures*

Plant closures that have been included in the forecasting and subsequent analysis are the decommissioning of:

- The Verve Energy Kwinana B Facilities in the 2007/08 Reserve Capacity Year (KWINANA_G3 and KWINANA_G4).
- The Verve Energy Kwinana A Facilities in the 2008/09 Reserve Capacity Year (KWINANA_G1 and KWINANA_G2).

[2] Provided in accordance with clause 4.5.13(a) of the Wholesale Electricity Market Rules (Market Rules)

# 3. IMO FORECASTING PROCESS

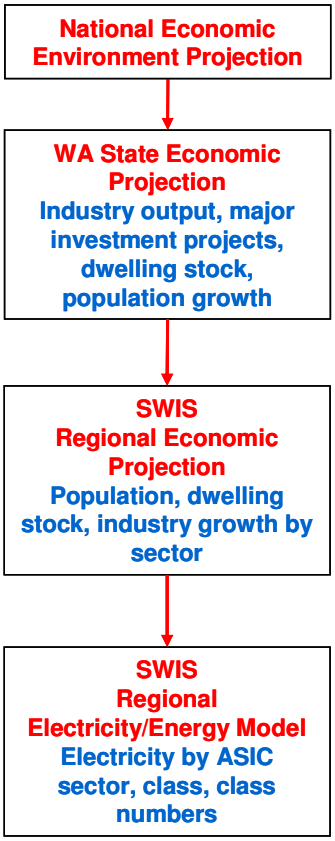
The bulk of the work in developing the forecasts presented in this SOO has been undertaken by the National Institute of Economic and Industrial Research (NIEIR). NIEIR produce electricity consumption and maximum demand forecasts for many of the electricity jurisdictions within Australia.

For the SWIS, NIEIR has provided forecasts for electricity demand and consumption for the past five years. Initially these forecasts were prepared for Western Power Corporation and published in the 2003 and 2004 Generation Status Review. From 2005 through 2007, NIEIR has provided these forecasts for inclusion in the IMO's SOO.

## *3.1 General Forecasting Methodology*

The forecasting process used by NIEIR is comprised of a number of different econometric forecasting modules. Figure 4 shows the relationships between the major components of NIEIR's integrated energy modelling systems.

**Figure 4 NIEIR Energy and Electricity Forecasting Systems**




The core tool used by NIEIR is its national econometric model of the Australian economy. This provides projections of national economic growth using inputs from

various statistical sources including the Australian Bureau of Statistics and the Australian Taxation Office.

The national economic projections are used as input into a state economic projection model which provides an estimate of Gross State Product and other indicators. The State model is then further disaggregated into the statistical subdivisions that make up the region served by the SWIS.

The economic forecasts of the SWIS include projections of population growth, dwelling stock composition and industry growth by sector. This portion of the forecasting system then links the SWIS regional economic forecast with electricity use based on assumptions about appliance penetration and efficiency, weather conditions and separate forecasts of major industrial loads.

The IMO publishes two sets of forecasts each year within the SOO. These forecasts cover:

- The maximum demand, which is the measure of the highest level of power consumption at any point in time over the year. This is measured in MW.

- Electricity consumption which is the amount of energy sent-out and consumed within the SWIS over a financial year. This is measured in GWh over the full year.

Electricity consumption is driven, to a large extent, by underlying economic-based drivers. Maximum demand, while also partially dependent on economic growth, is highly correlated with ambient temperatures.

### *3.2 Data Provision*

Each year, the IMO provides NIEIR with base data relating to historical electricity consumption and demand, and sales information identified by tariff class. Previously, this data has been sourced from Western Power Corporation. With the commencement of energy trading, the IMO now has direct access to load data. As a result, the IMO will in future be able to supply NIEIR with most of the data directly. As trading with the Wholesale Electricity Market Systems (WEMS) has only been operational since 21 September 2006, Western Power has provided part of the generation data this year, with the remainder coming directly through the WEMS.

Electricity sales information has been provided by Synergy for the end-use mapping of electricity demand within NIEIR's econometric models.

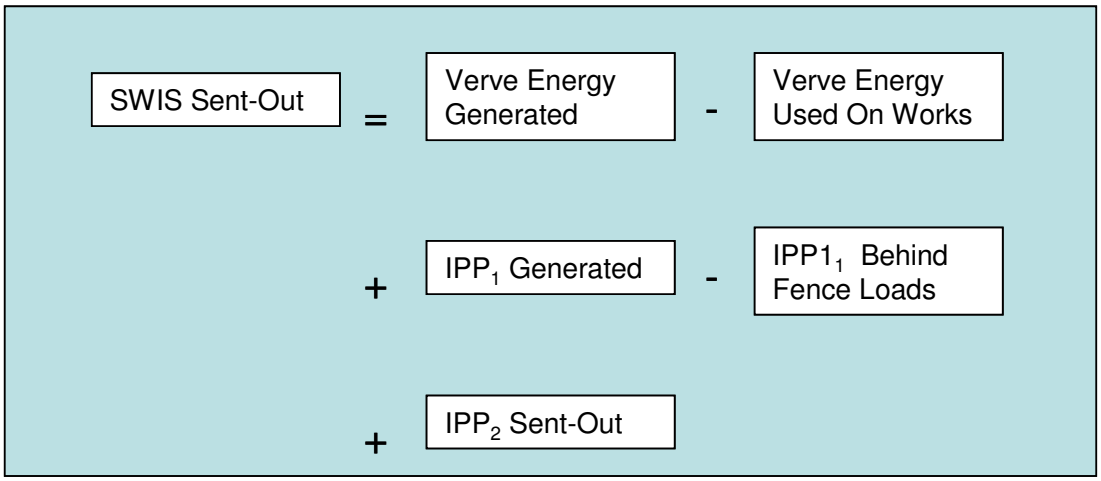
The transition of data sources is being actively managed by the IMO. To facilitate this process, the IMO has conducted a review of load forecasting processes and the Planning Criterion, the results of which will be published in separate reports.

### *3.3 Definition of the SWIS for Load Forecasting*

As noted in Section 2, all references to energy and capacity within the SOO are in terms of sent-out quantities. However, historically, the load forecasting was conducted on a generated basis and then converted to sent-out quantities. In preparing the forecasts in this report, it has been necessary to use both methods.

Prior to the commencement of the Wholesale Electricity Market, it was necessary to prepare estimates of sent-out data by using the generated data for Verve Energy and some independent power producers (IPPs) and subtract the energy used on works or behind the fence. However, sent-out data was directly available from some IPPs. The data arrangements for forecasting of sent-out demand and energy in the SWIS are shown in Figure 5.

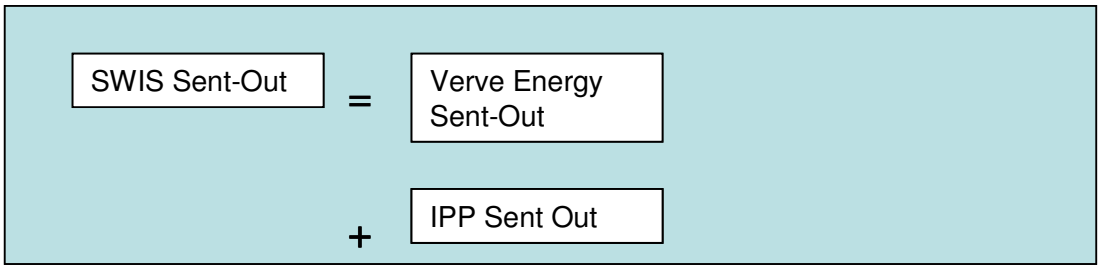
**Figure 5 Load Forecasting of Sent-Out Energy and Demand in the SWIS prior to Energy Market Commencement**




With the introduction of the Wholesale Electricity Market, the output from all facilities is measured as sent-out values, either loss-adjusted or non-loss-adjusted, as is required. For the purposes of the SOO non-loss adjusted quantities are used because the framework of the Reserve Capacity Mechanism relies largely on the certification of generation facilities on their non-loss-adjusted capacities.

The WEMS directly records sent-out generation information for all Facilities (both IPPs and those of Verve Energy), which yields a much simpler data structure shown in Figure 6.

**Figure 6 Load Forecasting of Sent-Out Energy and Demand in the SWIS after Energy Market Commencement**

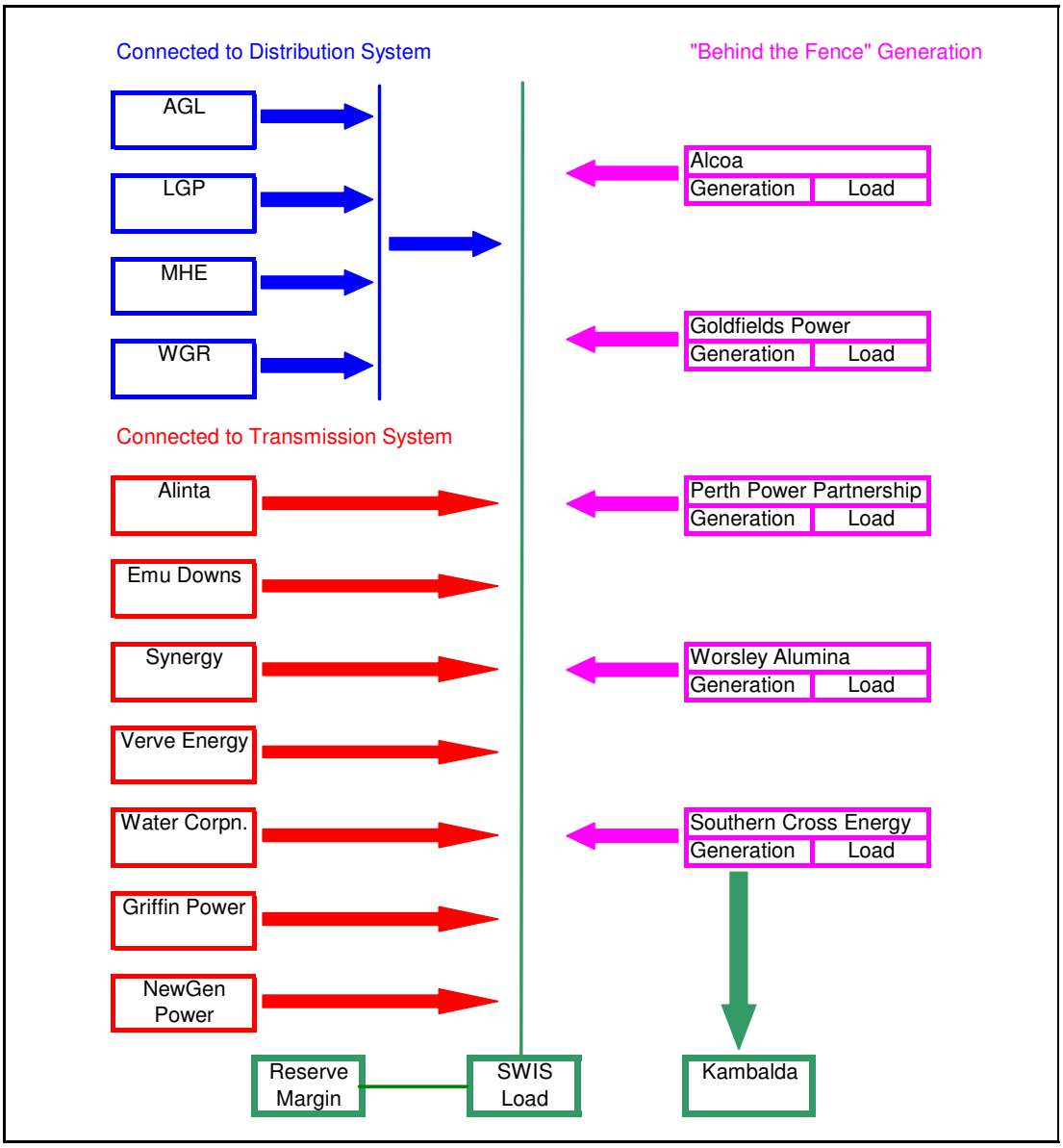



The generation Facilities that comprise the SWIS for the purposes of the SOO are listed in Appendix 2. The generation information included in Appendix 2 provides a snapshot of the types and sizes of generators operating in the SWIS. This information is collected and published in accordance with clause 10.5.1(c) of the Market Rules and can be found on the IMO website[3].

Figure 7 illustrates the definition of the SWIS used for the purposes of load forecasting. As new participants enter the market and introduce new generation facilities, their data will be captured in a similar way and provided in subsequent SOOs. This way it is possible for Market Participants and stakeholders to keep track of the status of the SWIS from year to year. It is also possible, and likely, that the physical definition of the SWIS will change over time. For example, participants with generation and behind-the-fence loads may choose to be either included in, or excluded from, the definition of the SWIS.

[3] http://www.imowa.com.au/PUB_RulePartFacilityInfo.htm

**Figure 7 Definition of Generation in the SWIS as Expected for 2009/10 Reserve Capacity Year**




## *3.4 Accommodation of Temperature Effects*

As noted in section 2.5, the peak or maximum demand in any year is strongly influenced by the ambient temperatures so a number of forecasts are prepared for each year. Each group of forecasts is based on three sets of temperature conditions:

- The 10th percentile temperature condition which is expected to be exceeded only once in every ten years.
- The 50th percentile temperature condition which is expected to be exceeded only once in every two years.

- The 90th percentile temperature condition which is expected to be exceeded nine times in every ten years.

These sets of conditions are referred to as the 10%, 50% and 90% probability of exceedance (POE) conditions and correspond respectively to hot, average and cool weather conditions. To ensure that there is sufficient capacity to meet the peak demand during a hot summer, the Market Rules specify that the 10% POE temperature conditions be used for planning purposes.

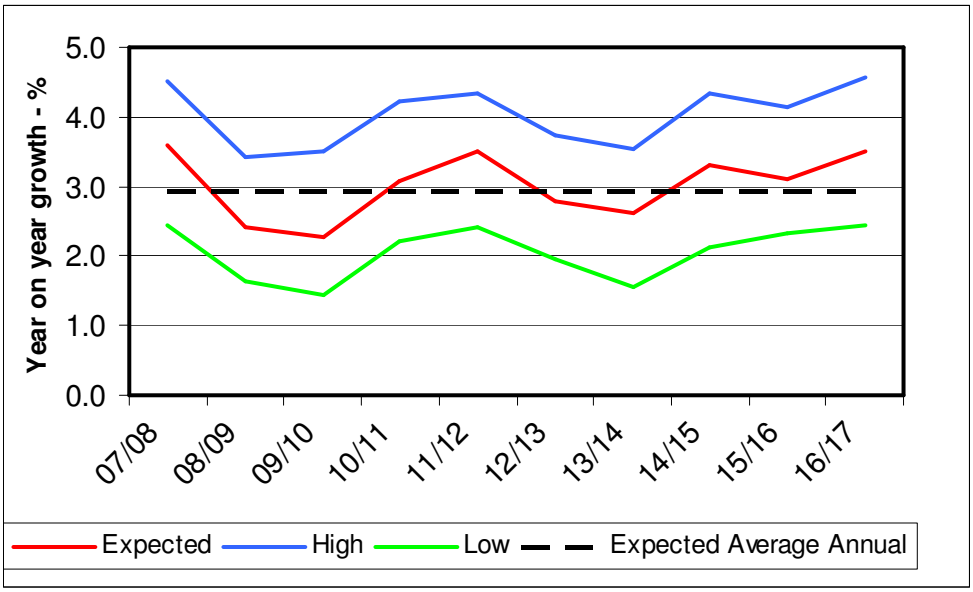
# 4. FORECASTS FOR 2007/08 TO 2016/17

## *4.1 Economic Forecasts*

### Gross Domestic Product

NIEIR estimates that Gross Domestic Product growth will continue to be strong over the LT PASA Study Horizon. Over this ten-year horizon, GDP is forecast to grow at approximately 2.9% per annum on average (see Figure 8). The high case forecast by NIEIR is for an average annual growth of approximately 3.8%, while the low forecast is for 2.1% growth over the period to 2016/17. The GDP forecasts are tabulated in Appendix 3.

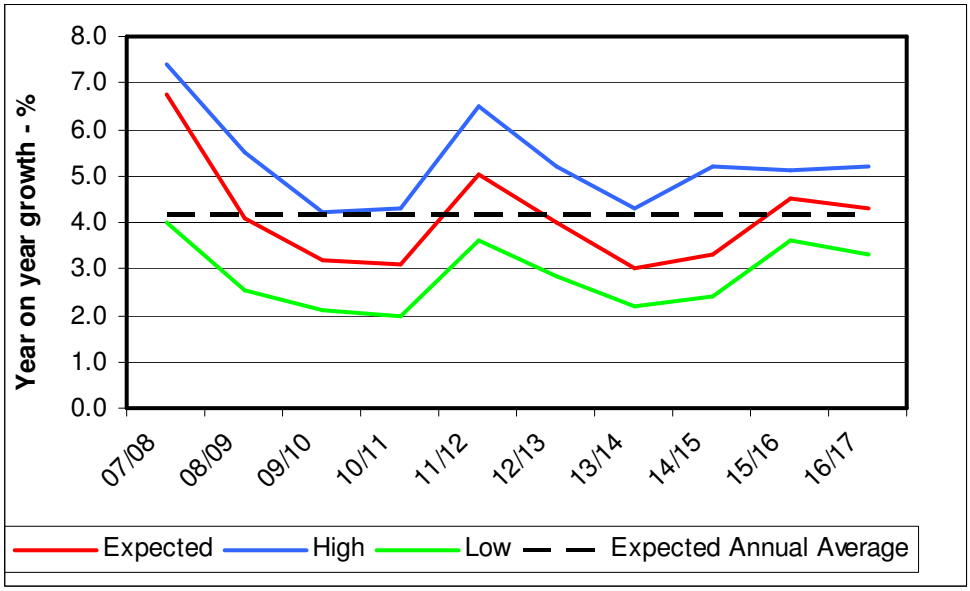
**Figure 8 Forecast Growth in GDP**




### Gross State Product

The growth in economic activity in Western Australia as measured by Gross State Product (GSP) is expected to be stronger than GDP. Average growth of 4.2% per annum is expected to 2016/17. While NIEIR expect a downturn in economic activity from 2007/08 through to 2010/11 GSP growth is not expected to fall below 3%. The forecast GSP is presented in Figure 9 below and also provided in Appendix 3.

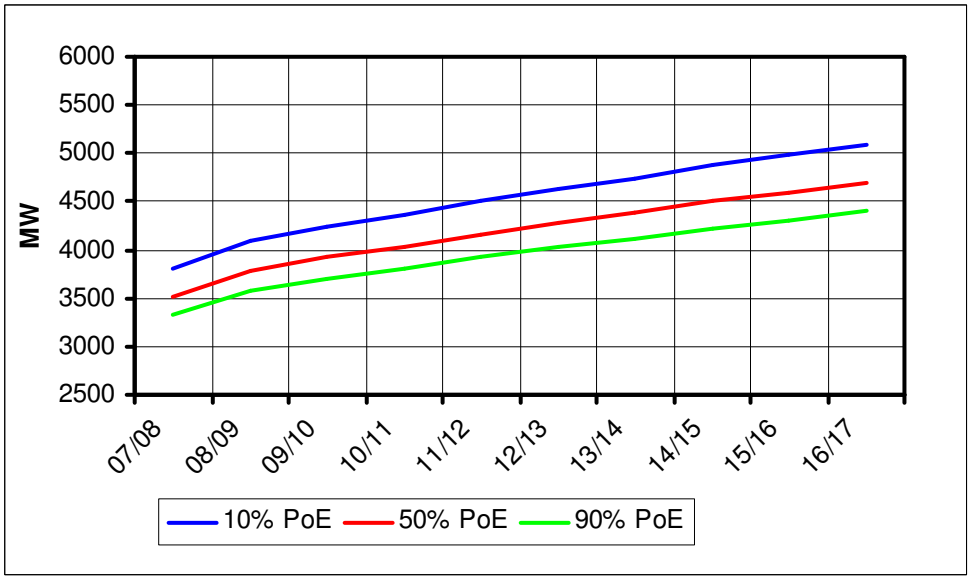
**Figure 9 Forecast Growth in Western Australian GSP**




## *4.2 Maximum Demand Forecast*

Figure 10 below shows the forecast SWIS maximum demand for the period to 2016/17. This figure shows the maximum demands for the three probability levels (10% POE, 50% POE and 90% POE) provided by NIEIR. These forecasts are based on expected economic growth conditions and include the Boddington Gold Mine as a significant load to be introduced in the 2008/09 Reserve Capacity Year.

**Figure 10 Forecast Maximum Demand - Expected Economic Growth**



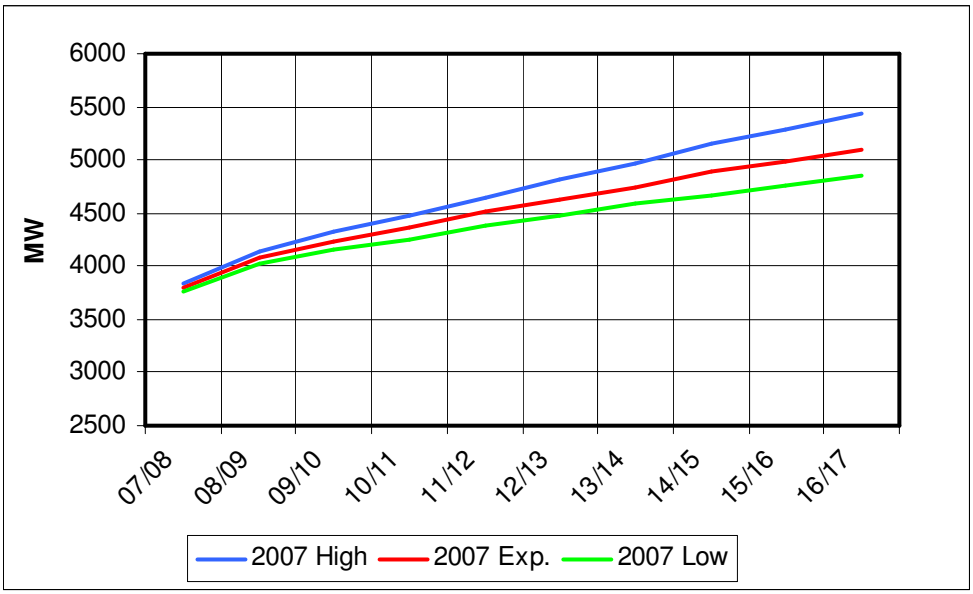

For 2009/10, the 10% POE forecast of maximum demand is 4,233 MW and in 2010/11 is expected to rise to 4,361 MW.

The average annual growth in maximum demand for the 10% POE forecast over the LT PASA Study Horizon is 3.3% However, for the 10% POE demand increases by 7.5% in 2008/09 and by 3.6% in 2009/10. Stronger growth in 2008/09 reflects the introduction of the Boddington Gold Mine.

The temperature effect on maximum demand can be seen in the differences between the POE values in Figure 10. For the 2009/10 Reserve Capacity Year, the maximum demand is forecast to be 7.3% lower (approximately 309 MW) than the 10% POE forecast if average (50% POE) temperature conditions are experienced. Similarly, if the system maximum demand is experienced on a cooler than average day (eg. 90% POE), the system maximum demand is expected to be approximately 12.6% lower (532 MW) than the 10% POE forecast.

The effect of the assumptions about state economic growth (as forecast by GSP) which underpin the maximum demand forecasts is shown in Figure 11. Figure 11 presents the 10% POE forecasts for the expected, high and base economic growth scenarios.

**Figure 11 Impact of Economic Growth on Maximum Demand for the 10% POE Forecast**



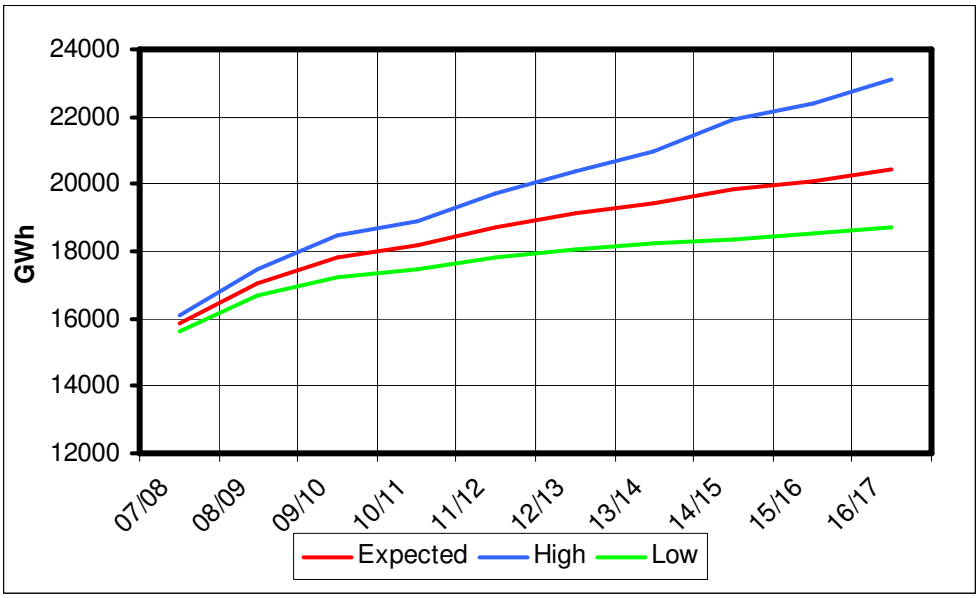

If conditions similar to the high economic case are experienced up to the 2009/10 Reserve Capacity Year, the maximum demand is forecast to be approximately 100 MW (~2.4%) higher than for the expected case. Should the economy slow down in line with the low scenario, the 10% POE forecast would be approximately 85MW lower than expected. The maximum demand and electricity consumption forecasts used in the SOO are based on expected economic growth conditions. Higher or lower growth conditions can be seen to have a significant impact on the forecast outcomes.

The maximum demand forecasts are tabulated in Appendix 4.

### *4.3 Energy Forecast*

Figure 12 presents the forecast sent-out energy in the SWIS over the LT PASA Study Horizon to 2016/17. Over this period, forecast energy is expected to grow at approximately 2.2% on average per annum. Under the high growth scenario, 3.5% growth is forecast, while the low growth scenario would see energy consumption increase at approximately 1.4% per annum on average.

**Figure 12 Forecast Sent-Out Energy**




The expected energy requirements of the SWIS in 2009/10 are forecast by NIEIR to be approximately 17,800 GWh. This represents an increase of approximately 320 GWh from the energy forecast in the 2006 SOO. The energy forecasts can be found in Appendix 5.

### *4.4 Review of Differences Between the 2006 and 2007 Forecasts*

Forecasts will always differ as new information becomes available and a number of differences have been identified in the maximum demand and energy forecasts between the 2006 and 2007 SOO. The main reasons for the differences are:

- Significant growth in air conditioner sales over the 2005/06 period has lead to increased levels of maximum demand beyond that previously forecast.
- The 2005/06 summer was relatively cool in general, which contributed to reduced electricity consumption over the summer months and impacted on the forecasting base.
- The winter of 2006 experienced cooler average minimum temperatures than in the 2005 winter, which may have lead to increased reverse-cycle air conditioning use.

- The adjustment from generated to sent-out energy and maximum demand has changed with the introduction of the Wholesale Electricity Market.

- Generation capability of small embedded generators can now be estimated from meter data under the Wholesale Electricity Market.

The major contributor to the jump in demand forecast by NIEIR in 2007 is air conditioning sales. Each year, NIEIR forecast air conditioner electricity consumption and demand based on actual air conditioner industry sales data. NIEIR report that air conditioner sales have increased substantially over the last twelve months with approximately 200 MW of air conditioner load installed in Western Australia. While some of this new air conditioner load would have been outside the SWIS, and some would have been installed for replacement of older units, it still represents a significant increase in the temperature dependent load in the SWIS.

NIEIR advises that their forecasts for 2006 under estimated new air conditioner installations by approximately 65 MW for the 2006/07 period.

The IMO is keen to ensure electricity demand forecasts are as accurate and reliable as possible. To ensure that the IMO uses the best possible forecasting techniques, a review of electricity demand forecast methodology is currently underway. An Advisory Committee is assisting the IMO in this review. To further enhance the robustness of demand forecast, the IMO will seek an expert independent review of the forecasting methodology employed by NIEIR.

# 5. RESERVE CAPACITY TARGET AND SUPPLY-DEMAND BALANCE

## *5.1 Assessment of the Planning Criterion*

The IMO is required to set the Reserve Capacity Target for each year of the LT PASA Study Horizon. There are two main components of this process:

- Development of the load forecast.
- Application of the Planning Criterion to the load forecast to determine the Reserve Capacity Target.

The load forecasts have been discussed in detail in previous sections. For the purposes of the Reserve Capacity Mechanism, the Planning Criterion is defined in accordance with clause 4.5.9 of the Market Rules as:

> *The Planning Criterion to be used by the IMO in undertaking a Long Term PASA study is there should be sufficient available capacity in each Capacity Year during the Long Term PASA Planning Horizon to:*
>
> *(a) meet the forecast peak demand (including transmission losses and allowing for Intermittent Loads) supplied through the SWIS even after the outage of the largest generation unit and while maintaining the Minimum Frequency Keeping Capacity for normal frequency control. The forecast peak demand should be calculated to a probability level that the forecast would not be expected to be exceeded in more than one year out of ten; and*
>
> *(b) limit expected energy shortfalls to 0.002% of annual energy consumption (including transmission losses).*

The Reserve Capacity Target is set at a level which allows both planning criteria to be met. This means that in any one year the most stringent criterion will be used to determine the Reserve Capacity Target.

The Planning Criterion is limited to the provision of generation and DSM capability and does not include transmission reliability planning.

### Maximum Demand Planning Criterion

Clause 4.5.9(a) of the Market Rules represents a planning standard which relates to the provision of capacity (as opposed to energy) during a maximum demand event.

Accounting for the loss of the largest generation unit and including a provision for maintaining frequency keeping capability allows for demand to be serviced during a one in ten year extreme weather event. Under these circumstances, the Reserve Capacity Margin, which includes the allowance for the loss or the largest generation unit, the frequency keeping capability and the allowance for intermittent loads, is:

- 340 MW in 2007/08.
- 356 MW in 2008/09, increasing as a result of a change in the size of the largest generation unit on the system.
- 376 MW in 2009/10 as the frequency keeping requirement rises.

In addition to the requirement to directly serve the expected level of load in any year, a further factor is included to cover the level of intermittent loads that exist on the system. The IMO determines this quantity from information provided by the appropriate Market Participants.

The Reserve Capacity Target is then calculated by adding the 10% POE load forecast to the sum of the above numbers.

### Energy Served Planning Criterion

The second planning criterion takes account of the ability of generation facilities to deliver energy throughout the year. The IMO has retained McLennan Magasanik Associates (MMA) to conduct reliability modelling of the SWIS to determine the energy served planning criterion and the availability curve. The reliability modelling results indicate that the maximum demand planning criterion is the more stringent criterion over the LT PASA Study Horizon. This is an expected outcome given the high level of thermal plant available on the SWIS. Electricity systems that have a high level of energy-limited generation capability (for example hydro power) are more likely to experience energy based reliability limitations.

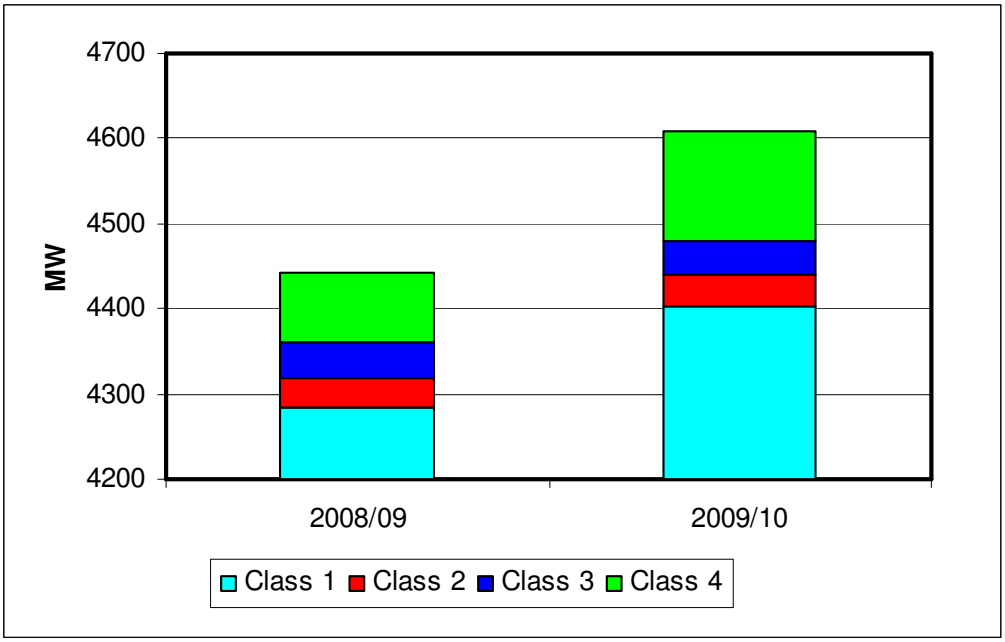
## *5.2 Availability Curve*

In addition to providing modelling and analysis of the Planning Criterion, MMA also provide advice on the Availability Curve, the determination of which is a formal requirement under the Market Rules. The Availability Curve indicates the amount of DSM that can be introduced into the SWIS before the system is unable to supply all of the energy requirements of users.

The Availability Curve is reported in discrete blocks, which are aligned with the Availability Classes under the Market Rules. Class 1 covers DSM facilities that can provide capacity for a minimum of 96 hours per year. Classes 2, 3 and 4 cover facilities that are available for a minimum of 72, 48 and 24 hours respectively.

For 2008/09 and 2009/10, the availability curve is presented in Figure 13 below.

**Figure 13 Scope for DSM and Generation**




For 2008/09, the SWIS can support at total of 159 MW of DSM across Availability Classes 2, 3 and 4. For 2009/10, the SWIS is expected to be able to support a total of 205 MW of DSM capacity.

There is an opportunity for the SWIS to support 129 MW of Class 4 DSM, 39 MW of Class 3 Demand Side Management, and 37 MW of Class 2 DSM in the 2009/10 Reserve Capacity Year. It should be remembered that Facilities that are classified in a higher availability class can be used to contribute to the Demand Side Management opportunity presented for lower availability classes.

### *5.3 Transmission Restrictions on the SWIS*

In April of 2007, Western Power released its Annual Planning Report (APR). The APR is produced by Western Power to provide advice and guidance on the status of the bulk transmission network and distribution system. The report presents the results from scenario-based transmission planning activities conducted by Western Power for their long term planning purposes. The Western Power APR can be downloaded from the Western Power website[4].

The IMO is required to include comments on any constraints on the transmission system within the SOO. In order to provide comment on the status of the transmission system, and any constraints that are likely to affect investment in generation capacity, the IMO has requested input from Western Power on these issues. The IMO requested that Western Power:

[4] http://www.westernpower.com.au/documents/investmentPlanning/apr2007.pdf

- Identify and assess any potential capacity shortfalls isolated to a subregion of the SWIS resulting from expected restrictions on transmission capability or other factors.

- Identify any potential transmission, generation or demand side capacity augmentation options to alleviate capacity shortfalls.

Western Power has provided a written response to this request and a copy of this is included in Appendix 8. The general outcomes from the APR, and the submission made by Western Power are summarised below:

- Scenario-based planning has been conducted for the following regions:
    - Southern generation development scenario.
    - Northern generation development scenario.
    - Metropolitan generation development scenario.
    - Eastern generation development scenario.
- In each of the scenarios considered, significant network upgrades and/or enhancements are required before substantial levels of new generation can be accommodated on the SWIS.
- The development timeframe associated with the introduction of new capacity to the bulk transmission system may be substantial, in the order of six to ten years for some major transmission system developments.

Full details on the possible augmentation options to alleviate the transmission capacity shortfalls that have been identified can be found in the APR.

The outcome of this response is that substantial investment in transmission network funding will be required in order to keep pace with strong development and increasing demand for electricity. Without significant investment in transmission system infrastructure, the introduction of new generation capacity onto the SWIS may be at risk.

From a reliability perspective, under the Reserve Capacity Mechanism plant seeking certification and Capacity Credits must have proof of access to the transmission system as a pre-requisite. Existing generation facilities will only be re-certified on the basis that the Facility has access to the network.

Additionally, applications for all new generation capacity must provide a letter from the Network Operator (Western Power) indicating it has made an access offer and that the Facility can be connected prior to the date at which Capacity Credit Obligations will apply[5]. Applications for Certified Reserve Capacity that do not meet

[5] See Market Rule 4.10.1(c).i

these requirements will not be certified, and will not be eligible to apply for Capacity Credits.

### *5.4 Review of the Reserve Capacity Mechanism Planning Criterion*

In March 2007, the IMO initiated a review of the Planning Criterion. To assist in this review, the IMO has established an industry-based Advisory Committee and has retained the consultancy services of CRA International. The IMO will publish the outcomes of this review on its website and invite public submissions. If, following this review, it appears appropriate that changes be made to the Planning Criterion, these would be pursued through the normal rule change process. Any changes will apply from the year following the introduction of new rules.

### *5.5 Reserve Capacity Target and the Supply-Demand Balance of the SWIS*

#### Reserve Capacity Target

Application of the planning criteria to the load forecasts produces the following Reserve Capacity Target for each year of the LT PASA Study Horizon (Table 2).

**Table 2 Reserve Capacity Target in MW for Each Year in the LT PASA Study Horizon**

| Reserve Capacity Year | Forecast Load | Largest Unit | Intermittent Load | Frequency Keeping Capability | Total Reserve Capacity Target |
|---|---|---|---|---|---|
| 2007/08 | 3,800 | 304 | 6 | 30 | 4,140 |
| 2008/09 | 4,086 | 320 | 6 | 30 | 4,442 |
| 2009/10 | 4,233 | 320 | 6 | 50 | 4,609 |
| 2010/11 | 4,361 | 320 | 6 | 50 | 4,737 |
| 2011/12 | 4,505 | 320 | 6 | 50 | 4,881 |
| 2012/13 | 4,633 | 320 | 6 | 50 | 5,009 |
| 2013/14 | 4,746 | 320 | 6 | 50 | 5,122 |
| 2014/15 | 4,881 | 320 | 6 | 50 | 5,257 |
| 2015/16 | 4,985 | 320 | 6 | 50 | 5,361 |
| 2016/17 | 5,094 | 320 | 6 | 50 | 5,470 |

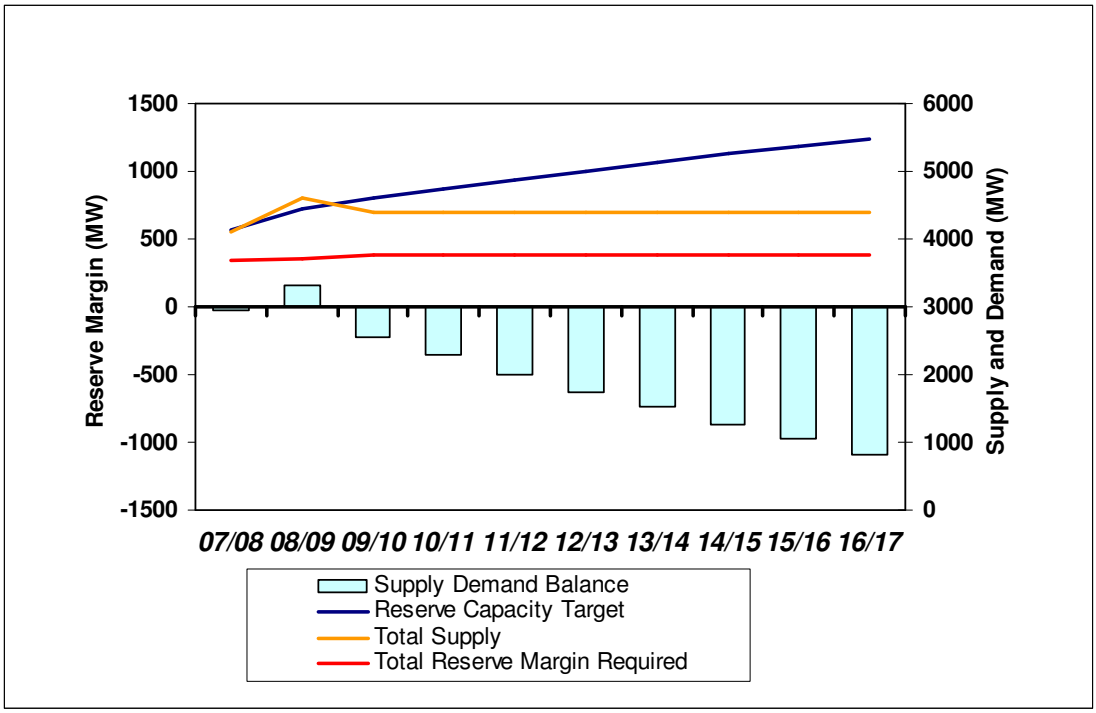
#### Supply-Demand Balance

The supply-demand balance in the SWIS is presented in Figure 14. The supply-demand balance is slightly different to those shown in past SOOs. Previously, the supply-demand figure was based on the format published by Western Power Corporation in the Generation Status Review.

In the previous format, the supply-demand balance equation included only load for the demand portion of the equation (i.e. excluding the Reserve Margin). However,

for the SOO, the figure of interest is the Reserve Capacity Target, which includes the load plus the Reserve Margin. Using this interpretation better captures the requirements of the Wholesale Electricity Market and is therefore presented in preference to the format provided in previous SOOs and Generation Status Review reports.

**Figure 14 Required Generation and DSM Capacity**




From the information available, the supply/demand position over the coming few years is characterised by:

- A gap of approximately 25 MW is now estimated for the 2007/08 Reserve Capacity Year. This results from the higher maximum demand forecasts produced for this SOO. As a result, the IMO is examining available options to address this issue. Note, registered capacity in the SWIS exceeds the number of Capacity Credits by around 120 MW and the Market Rules provide a mechanism to address shortfalls in supply.

- The number of Capacity Credits assigned for the 2008/09 Reserve Capacity Year more than meets the new forecast maximum demand. The surplus is approximately 160 MW.

- For the 2009/10 Reserve Capacity Year, approximately 225 MW of new capacity is required to meet the Reserve Capacity Target.

- Around 353 MW of new generation and/or DSM capacity is expected to be required for 2010/11.

- The supply/demand gap continues to grow through the LT PASA Study Horizon as demand grows.

It should be noted that circumstances may change over the period through to 2016/17 and project proponents, investors and developers should make their own assessment of the possible supply and demand conditions.

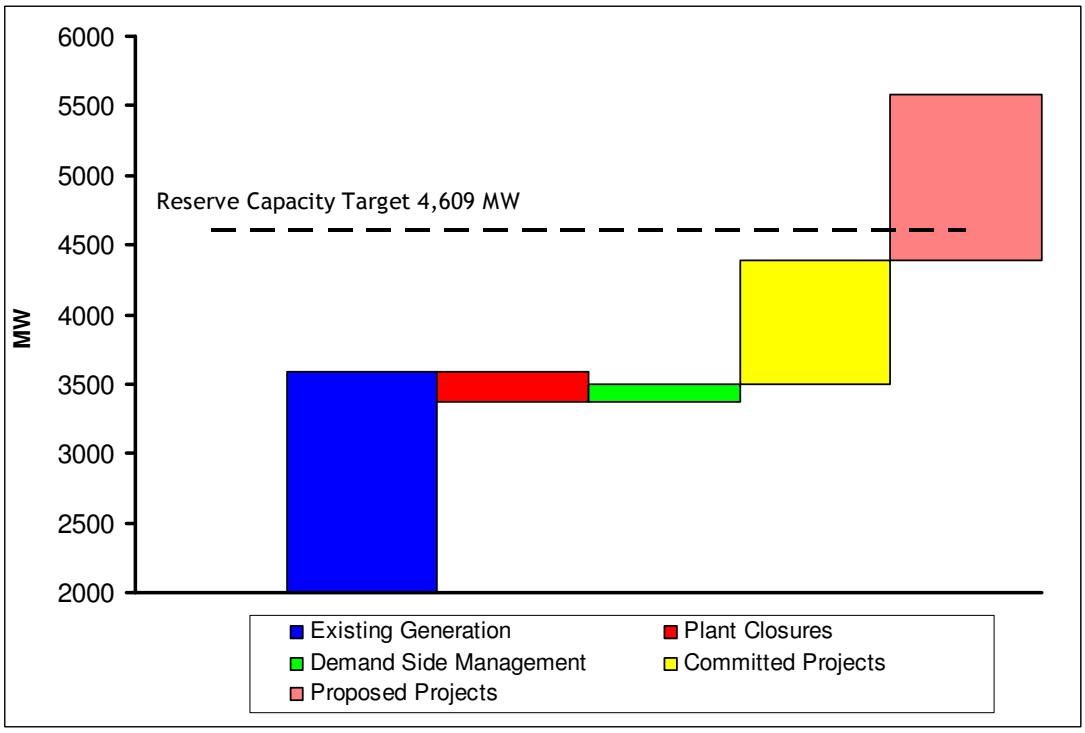
## *5.6 Opportunities for Investment*

### 2009/10 Reserve Capacity Year

The analysis completed for the 2007 SOO indicates that for the 2009/10 Reserve Capacity Year:

- The Reserve Capacity Target of sent out generation and DSM capacity is 4,609 MW.
- Current expectations of existing generation capacity, which will remain in service through to 2009/10, are 3,587 MW.
- Plant closures in the order of 215 MW have been identified between 2008/09 and 2009/10.
- DSM capacity assumes existing figures of approximately 128 MW.
- Approximately 884 MW is classed as committed generation (from previous Reserve Capacity Cycles and other facilities under construction).
- New Generation and DSM capacity identified in the Expressions of Interest process total 1,192 MW.

**Figure 15 Capacity Requirements and Availability for 2009/10**



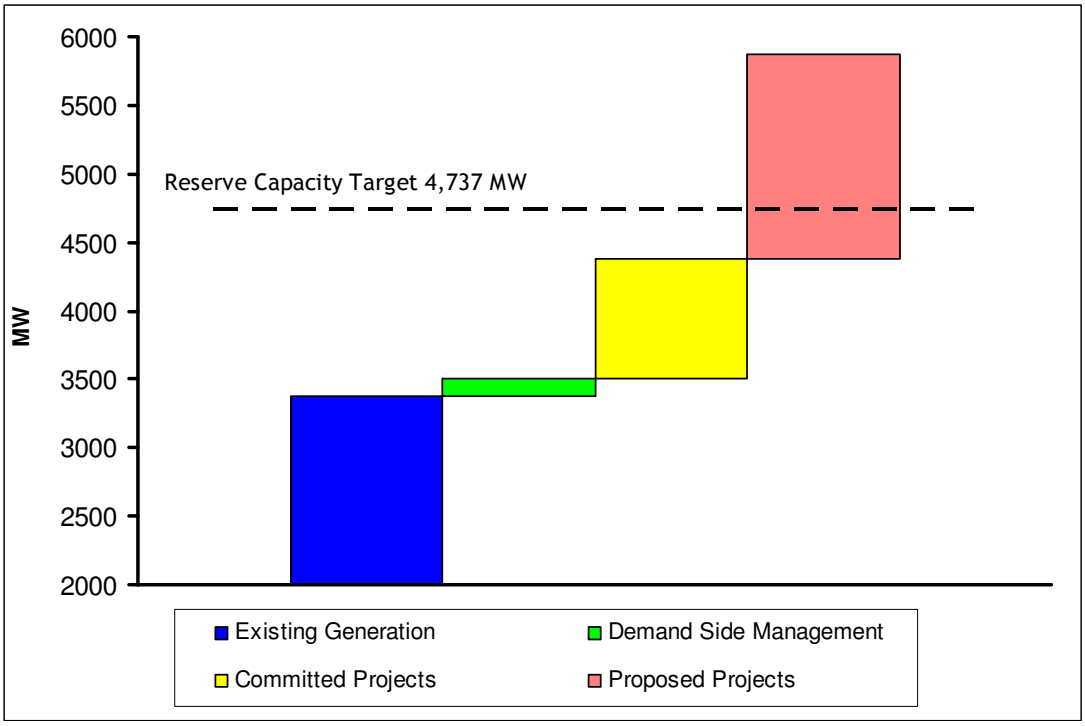

The outcome of this analysis indicates that a total of approximately 4,384 MW of capacity is expected to be available for the 2009/10 Reserve Capacity Year to meet the Reserve Capacity Target of 4,609 MW. Therefore, approximately 225 MW of new capacity will be required to meet the Reserve Capacity Target for the 2009/10 Reserve Capacity Year.

### 2010/11 Reserve Capacity Year

For the 2010/11 Reserve Capacity Year current expectations are:

- The Reserve Capacity Target of sent out generation and DSM capacity is 4,737 MW.
- Existing generation capacity, which is expected to remain in service through to 2010/11, is 3,372 MW.
- No plant closures have been identified between 2009/10 and 2010/11.
- Capacity available from DSM is assumed to be 128 MW.
- Approximately 884 MW is classed as committed generation (from previous Reserve Capacity Cycles and other facilities under construction).
- New Generation and DSM capacity identified in the Expressions of Interest process totals 1,493 MW (comprised of 1,192 MW for 2009/10 and 301 MW for 2010/11).

**Figure 16 Capacity Requirements and Availability for 2010/11**




These results indicate that approximately 353 MW of new capacity will need to be procured to meet the capacity expectations for the 2010/11 Reserve Capacity Year.

# 6. NEXT STEPS IN THE 2007 RESERVE CAPACITY MECHANISM

The next stage within the Reserve Capacity Mechanism process is for Market Participants and project proponents to apply for certification of the Reserve Capacity of their facilities and to then apply for Capacity Credits. The timetable to undertake these processes, which apply to both existing and new facilities, is:

- Applications for Certification of Reserve Capacity must be provided to the IMO by 5pm on 20 July 2007.

- Market Participants whose facilities are granted Certified Reserve Capacity must then apply for Capacity Credits, indicating whether they intend to trade their capacity bilaterally or whether they wish to offer their Certified Reserve Capacity into a Reserve Capacity Auction (if one is required). This process must be completed by 5pm on 10 August 2007.

- On 13 August 2007, the IMO will advise Market Participants who have indicated their intention to trade their capacity bilaterally how many Capacity Credits have been assigned to their Facilities.

- By 5pm on 17 August 2007, the IMO will advise whether sufficient capacity has been secured through bilateral trades. If the Reserve Capacity Target has been met, no Reserve Capacity Auction will be held. If sufficient capacity has not been secured through bilateral trades, the IMO will also advise that it will run a Reserve Capacity Auction to secure the outstanding quantity.

- If a Reserve Capacity Auction is required, Market Participants must provide their offers between 20 and 29 August 2007 and the IMO will run the Reserve Capacity Auction on 3 September 2007.

For a facility to be certified, it is necessary for it to have met the requirements of Market Rule 4.10.1 (c) in respect to network access and environmental approvals. Both of these processes can take considerable time and potential developers are encouraged to contact Western Power and the Department of Environment at the earliest opportunity.

### *6.1 2007 Reserve Capacity Mechanism Timetable*

**Table 3 Timetable for the 2007 Reserve Capacity Cycle**

| 2007 Reserve Capacity Mechanism - Timetable | | | |
|---|---|---|---|
| Wed | 31 Jan | 5.00PM | IMO publishes Request for Expressions of Interest (EoI) |
| Tue | 1 May | 9.00AM | Participants may apply for Certification of Reserve Capacity |
| Tue | 1 May | 5.00PM | Close of EoI |
| Tue | 15 May | 5.00PM | Results of the EoI announced |
| Mon | 2 Jul | 5.00PM | IMO publishes Statement of Opportunities |
| Mon | 2 Jul | 5.00PM | IMO releases Reserve Capacity Information Pack to entities who submitted an Expression of Interest |
| Mon | 16 Jul | 5.00PM | Reserve Capacity Information Pack published on website |
| Fri | 20 Jul | 5.00PM | Applications for Certification of Reserve Capacity close |
| Fri | 3 Aug | 5.00PM | IMO advises assignment of Certified Reserve Capacity |
| Fri | 10 Aug | 5.00PM | Security deposits for bilateral trades |
| Fri | 10 Aug | 5.00PM | Bilateral Trade Declarations |
| Mon | 13 Aug | 5.00PM | IMO assigns Capacity Credits following Bilateral Trade Declarations |
| Fri | 17 Aug | 5.00PM | IMO advises whether a Reserve Capacity Auction is required |
| Mon | 20 Aug | 9.00AM | Reserve Capacity Auction offers open (if auction required) |
| Wed | 29 Aug | 5.00PM | Reserve Capacity Auction offers close (if auction required) |
| Wed | 29 Aug | 5.00PM | Security deposits required for auction |
| Mon | 3 Sep | 5.00PM | Reserve Capacity Auction run (if required) and results published |
| Thu | 20 Dec | 5.00PM | Participants advise IMO how many Capacity Credits each facility will provide |
| Thu | 20 Dec | 5.00PM | Market participants notify IMO of any long-term special price arrangements to be accepted |
| Fri | 21 Dec | 5.00PM | IMO returns security deposits if not required |

# Appendix 1 CAPACITY CREDITS BY MARKET PARTICIPANT

| Participant | 2007/08 | 2008/09 |
|---|---|---|
| AGL | 0.08% | 0.06% |
| Alcoa | 0.00% | 1.14% |
| Alinta | 15.79% | 14.49% |
| Emu Downs Wind Farm Manager | 0.76% | 0.68% |
| Goldfields Power | 1.49% | 1.33% |
| Griffin Power | 0.00% | 4.87% |
| Barrick (Kanowna) | 0.00% | 0.22% |
| Landfill Gas and Power | 0.29% | 0.25% |
| Mount Heron Engineering | 0.03% | 0.03% |
| NewGen Power | 0.00% | 6.96% |
| Perth Power Partners | 0.00% | 1.67% |
| Perth Energy | 0.10% | 0.09% |
| Southern Cross Energy | 0.46% | 0.42% |
| Water Corporation | 0.27% | 0.24% |
| Waste Gas Resources | 0.05% | 0.05% |
| Verve Energy | 77.77% | 66.01% |
| Synergy | 2.92% | 1.52% |
| **Total** | **100.0%** | **100.0%** |

## Appendix 2 PARTICIPANT FACILITY INFORMATION

| Short Name | Resource Name | Resource Type | Max Gen Cap (MW) |
|---|---|---|---|
| Alcoa | ALCOA_KWI | Sched Gen | 5 |
| | ALCOA_PNJ | Sched Gen | 10 |
| | ALCOA_WGP | Sched Gen | 25 |
| Alinta | ALINTA_PNJ_U1 | Sched Gen | 145 |
| | ALINTA_PNJ_U2 | Sched Gen | 145 |
| | ALINTA_WGP_GT | Sched Gen | 380 |
| | ALINTA_WGP_U2 | Sched Gen | 0 |
| | ALINTA_WWF | Intermittent | 89.1 |
| Emu Downs Wind Farm Manager | EDWFMAN_WF1 | Intermittent | 80 |
| Goldfields Power | PRK_AG | Sched Gen | 68 |
| Landfill Gas and Power | CANNING_MELVILLE | Intermittent | 3 |
| | KALAMUNDA | Intermittent | 0.6 |
| | RED_HILL | Intermittent | 2.5 |
| | TAMALA_PARK | Intermittent | 4.5 |
| Mount Heron Engineering | MHPS | Intermittent | 1.416 |
| NewGen Power | NEWGEN_KWINANA_CCG1 | Sched Gen | 310.8 |
| Perth Energy | ATLAS | Intermittent | 1.1 |
| | GOSNELLS | Intermittent | 1.02 |
| | ROCKINGHAM | Intermittent | 2 |
| | SOUTH_CARDUP | Intermittent | 3.3 |
| Southern Cross Energy | STHRNCRS_EG | Sched Gen | 23 |
| Waste Gas Resources | HENDERSON_RENEWABLE_IG1 | Intermittent | 2.13 |
| Verve Energy | ALBANY_WF1 | Intermittent | 21.6 |
| | COCKBURN_CCG1 | Sched Gen | 236.6 |
| | COLLIE_G1 | Sched Gen | 315 |
| | GERALDTON_GT1 | Sched Gen | 20.8 |
| | KEMERTON_GT11 | Sched Gen | 154 |
| | KEMERTON_GT12 | Sched Gen | 154 |
| | KWINANA_G1 | Sched Gen | 111.5 |
| | KWINANA_G2 | Sched Gen | 111.5 |
| | KWINANA_G3 | Sched Gen | 106 |
| | KWINANA_G4 | Sched Gen | 106 |
| | KWINANA_G5 | Sched Gen | 185 |
| | KWINANA_G6 | Sched Gen | 185 |
| | KWINANA_GT1 | Sched Gen | 20.8 |

**Table continued overpage.**

| Short Name | Resource Name | Resource Type | Max Gen Cap (MW) |
|---|---|---|---|
| Verve Energy | MUJA_G1 | Sched Gen | 56 |
| | MUJA_G2 | Sched Gen | 56 |
| | MUJA_G3 | Sched Gen | 56 |
| | MUJA_G4 | Sched Gen | 56 |
| | MUJA_G5 | Sched Gen | 185 |
| | MUJA_G6 | Sched Gen | 185 |
| | MUJA_G7 | Sched Gen | 211 |
| | MUJA_G8 | Sched Gen | 211 |
| | MUNGARRA_GT1 | Sched Gen | 37.2 |
| | MUNGARRA_GT2 | Sched Gen | 37.2 |
| | MUNGARRA_GT3 | Sched Gen | 38.2 |
| | PINJAR_GT1 | Sched Gen | 37.2 |
| | PINJAR_GT10 | Sched Gen | 116 |
| | PINJAR_GT11 | Sched Gen | 123 |
| | PINJAR_GT2 | Sched Gen | 37.2 |
| | PINJAR_GT3 | Sched Gen | 38.2 |
| | PINJAR_GT4 | Sched Gen | 38.2 |
| | PINJAR_GT5 | Sched Gen | 38.2 |
| | PINJAR_GT7 | Sched Gen | 38.2 |
| | PINJAR_GT9 | Sched Gen | 116 |
| | PPP_KCP_EG1 | Sched Gen | 79.2 |
| | SWCJV_WORSLEY_COGEN_COG1 | Sched Gen | 114 |
| | TIWEST_COG1 | Sched Gen | 37.7 |
| | WAPL_WORSLEY_EG1 | Sched Gen | 0 |

The table above provides and overview of the Market Participant Facility information that is published in accordance with clause 10.5.1(c) of the Market Rules. The Resource Type Definitions are as follows:

- Sched Gen is a Scheduled Generator
- Intermittent is an Intermittent Generator

This information was current as at 20 May 2007. The information is published on the IMO website at the following address:

http://www.imowa.com.au/PUB_RulePartFacilityInfo.htm

# Appendix 3 ECONOMIC GROWTH FORECASTS

***Australian GDP Growth Forecasts (%)***

| Year | Expected | High | Low |
|---|---|---|---|
| 2007/08 | 3.6 | 4.5 | 2.5 |
| 2008/09 | 2.4 | 3.4 | 1.6 |
| 2009/10 | 2.3 | 3.5 | 1.4 |
| 2010/11 | 3.1 | 4.2 | 2.2 |
| 2011/12 | 3.5 | 4.3 | 2.4 |
| 2012/13 | 2.8 | 3.7 | 2.0 |
| 2013/14 | 2.6 | 3.5 | 1.5 |
| 2014/15 | 3.3 | 4.3 | 2.1 |
| 2015/16 | 3.1 | 4.1 | 2.3 |
| 2016/17 | 3.5 | 4.6 | 2.5 |

***Western Australia GSP Growth Forecasts (%)***

| Year | Expected | High | Low |
|---|---|---|---|
| 2007/08 | 6.8 | 7.4 | 4.0 |
| 2008/09 | 4.1 | 5.5 | 2.5 |
| 2009/10 | 3.2 | 4.2 | 2.1 |
| 2010/11 | 3.1 | 4.3 | 2.0 |
| 2011/12 | 5.0 | 6.5 | 3.6 |
| 2012/13 | 4.0 | 5.2 | 2.9 |
| 2013/14 | 3.0 | 4.3 | 2.2 |
| 2014/15 | 3.3 | 5.2 | 2.4 |
| 2015/16 | 4.5 | 5.1 | 3.6 |
| 2016/17 | 4.3 | 5.2 | 3.3 |

# Appendix 4 FORECASTS OF MAXIMUM DEMAND

***Maximum Demand Forecasts with Expected Economic Growth (MW)***

| Year | 10% POE | 50% POE | 90% POE |
|---|---|---|---|
| 2007/08 | 3,800 | 3,521 | 3,320 |
| 2008/09 | 4,086 | 3,791 | 3,580 |
| 2009/10 | 4,233 | 3,924 | 3,701 |
| 2010/11 | 4,361 | 4,037 | 3,803 |
| 2011/12 | 4,505 | 4,166 | 3,923 |
| 2012/13 | 4,633 | 4,281 | 4,027 |
| 2013/14 | 4,746 | 4,380 | 4,116 |
| 2014/15 | 4,881 | 4,501 | 4,228 |
| 2015/16 | 4,985 | 4,593 | 4,311 |
| 2016/17 | 5,094 | 4,691 | 4,400 |

Note: 2008/09 Reserve Capacity Year is impacted by the introduction of the Boddington Gold Mine.

***Maximum Demand Forecasts with High Economic Growth (MW)***

| Year | 10% POE | 50% POE | 90% POE |
|---|---|---|---|
| 2007/08 | 3,838 | 3,556 | 3,353 |
| 2008/09 | 4,142 | 3,844 | 3,629 |
| 2009/10 | 4,333 | 4,019 | 3,792 |
| 2010/11 | 4,476 | 4,145 | 3,907 |
| 2011/12 | 4,648 | 4,302 | 4,053 |
| 2012/13 | 4,809 | 4,447 | 4,187 |
| 2013/14 | 4,956 | 4,580 | 4,309 |
| 2014/15 | 5,158 | 4,767 | 4,485 |
| 2015/16 | 5,287 | 4,883 | 4,592 |
| 2016/17 | 5,438 | 5,020 | 4,719 |

***Maximum Demand Forecasts with Low Economic Growth (MW)***

| Year | 10% POE | 50% POE | 90% POE |
|---|---|---|---|
| 2007/08 | 3,767 | 3,490 | 3,291 |
| 2008/09 | 4,033 | 3,743 | 3,534 |
| 2009/10 | 4,148 | 3,843 | 3,624 |
| 2010/11 | 4,258 | 3,940 | 3,711 |
| 2011/12 | 4,376 | 4,045 | 3,807 |
| 2012/13 | 4,485 | 4,141 | 3,893 |
| 2013/14 | 4,581 | 4,225 | 3,968 |
| 2014/15 | 4,673 | 4,304 | 4,039 |
| 2015/16 | 4,767 | 4,387 | 4,113 |
| 2016/17 | 4,856 | 4,465 | 4,183 |

# Appendix 5 FORECASTS OF SENT-OUT ENERGY

***Forecasts of Sent-out Energy for the SWIS (GWh)***

| Year | Expected | High | Low |
|---|---|---|---|
| 2007/08 | 15,878 | 16,112 | 15,597 |
| 2008/09 | 17,072 | 17,443 | 16,665 |
| 2009/10 | 17,822 | 18,479 | 17,201 |
| 2010/11 | 18,173 | 18,911 | 17,447 |
| 2011/12 | 18,741 | 19,708 | 17,795 |
| 2012/13 | 19,145 | 20,390 | 18,061 |
| 2013/14 | 19,417 | 20,970 | 18,223 |
| 2014/15 | 19,819 | 21,905 | 18,355 |
| 2015/16 | 20,075 | 22,374 | 18,553 |
| 2016/17 | 20,437 | 23,123 | 18,725 |

# Appendix 6 GENERATION AND DSM CAPACITY

***Generation and DSM Capacity from 2009/10 to 2016/17***

| Year | Existing Generation | Existing DSM | Committed Generation | Proposed New Generation | Total |
|---|---|---|---|---|---|
| 2009/10 | 3,371 | 128 | 1,088 | 1,192 | 5,779 |
| 2010/11 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2011/12 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2012/13 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2013/14 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2014/15 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2015/16 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |
| 2016/17 | 3,371 | 128 | 1,088 | 1,493 | 6,080 |

## Appendix 7 AVAILABILITY CURVE

| Year | Class 1 | Class 2 | Class 3 | Class 4 |
|---|---|---|---|---|
| 2008/09 | 4,283 | 37 | 42 | 80 |
| 2009/10 | 4,404 | 37 | 39 | 129 |

# Appendix 8 TRANSMISSION SYSTEM STATUS –WESTERN POWER SUBMISSION

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Our ref: 3797240
Your ref: RSC 093
Contact: Hai Bui / 9326 6446

28 May 2007

Patrick Peake
Manager, System Capacity
Independent Market Operator
PO Box 7096, Cloisters Square
PERTH WA 6850

Dear Patrick,

**INFORMATION FOR THE 2007 STATEMENT OF OPPORTUNITIES**

In response to your request for information as outlined in the letter dated 23rd April 2007, we have prepared the following comments which could be included in the 2007 SOO:

Forecast load growth over the next 10 years will drive the need to connect new generation to the system. The transmission network will require reinforcement to accommodate this new generation plant. Historically the network was developed to accommodate long-term generation forecasts and new generation was accommodated at irregular intervals by large network investments. With the move to a competitive generation market it is anticipated that the connection of new generation will be more frequent, and for long term planning purposes there will be less certainty regarding the timing, size and location of new plant. The location of this new generation within the network will affect the extent and form of network reinforcement that is required.

As Western Power is a regulated entity and can only proceed with network investment that is shown to be efficient and necessary via the Regulatory test, there is little scope for investment in spare network capacity to accommodate all potential new generation connections. Consequently, there is little spare capacity within any part of the network to accommodate new generation plant and it is reasonable to anticipate that any new generation proposal will require some form of network reinforcement.

Western Power provides non-discriminatory access to the SWIS and pricing signals to Users of the network are intended to aid in the optimisation of the development of the system, including the location of new generation sources. However, as Western Power may not direct the location for new generation, it must make prudent assumptions regarding possible generation development scenarios in its network development planning process.

Western Power relies on proponents providing details of their projects early enough to allow these projects to be incorporated in scenario planning and therefore enable efficient and timely network reinforcement to be planned. However, while proponents provide

information in good faith, there are a range of factors that can change the feasibility, timing, size and location of such projects. Moreover, in some instances, proponents only provide details of their intentions once the projects are nearly committed, to minimise the commercial risk to a project. Each of these factors will affect Western Power's ability to accommodate all new generation proposals in the most timely and economically efficient manner.

Western Power's planning process must manage the high levels of uncertainty associated with the timing, size and location of potential future generation sources. The impact of this uncertainty is exacerbated by the time taken to complete major transmission network augmentation projects required to accommodate large new generation sources, such as the construction of 330 kV transmission lines. While the construction phase of a generation project can take as little as two years, establishing a new transmission line can take seven to ten years from conception to commissioning.

To enable unconstrained access of new generators to the network (and thereby encourage the development of a competitive generation market), new infrastructure to provide minimum levels of power transfer capability will be required. Consequently, Western Power's planning processes aim to identify universally required network developments and to commence investment to ensure that the network can respond to market needs in a timely fashion. This investment will be subject to, among other things, the regulatory regime, Access Code and capital contributions policy.

Western Power develops scenarios from the generation proposals of which it is aware, taking into consideration the current status of those projects. From these scenarios, planning analysis can be performed to assess the impact of various scenarios on the network enabling Western Power to identify elements of commonality between generation development scenarios and where particular network developments are beneficial to all generation scenarios. Where this occurs, the network development can be demonstrated to be sound from a regulatory perspective allowing the network developments to be progressed in a timely manner. A basic level of access to the network would then be available for whichever generation scenario develops. As particular generators commit to connecting to the network, additional network reinforcement is likely to be required to tailor the network to suit that particular connection. Therefore, some generator output constraints may still be required until all reinforcements can be completed.

In developing and considering these scenarios, Western Power is not recommending particular projects, however it does need to ensure that a minimum amount of network reinforcement has been undertaken to ensure that the network plans are robust enough for potential generation developments to meet forecast load growth. The following paragraphs outline the main scenarios and potential network constraints arising from potential new generation sources.

#### Southern Generation Development Scenario

There are a number of large generation proposals for this area and 555MW of new generation is committed to connect in the southern part of the SWIS by 2008/09. The new generation proposals are considered committed and, realistic given the ready access to a range of fuel sources and the recent historical levels of generation development in the area. The development of new generation sources in the southern areas exposes the network to the following limitations:

- Increased requirement for reactive power support within the metropolitan area; and
- Over loading of 330/132kV transformers interconnecting the 330kV bulk transmission and 132kV sub transmission networks

Additional reactive power support is required for two reasons.

- Firstly, the four 330 kV transmission lines between the south-west generation sources and the Perth metropolitan area are all around 200 km long. 330 kV lines of this length can transfer no more than 500 MW of power each before voltage stability limits begin to constrain their power transfer capacity. To maintain stable and secure network operation at loading levels above 500 MW, reactive power support is required. Even with this measure, the risks of system voltage collapse are significantly increased.
- Secondly, with increased baseload power generation, generation elsewhere in the network is displaced. Most usually this displaced generation is located near to the Perth metropolitan area and, due to its proximity to the load, it would normally have provided dynamic reactive power support to stabilise the network during faults. When this generation is displaced, the reactive power support normally provided by it needs to be sourced from elsewhere.

Therefore, significant network augmentations would be required to enable the SWIS to accommodate additional generation in the south-west region. All or some of the following network reinforcements would be required to accommodate the new generation proposed in the south-west region:

- Construction of 330 kV transmission lines from the south-west region into the Perth metropolitan area
- Installation of additional reactive power compensation, in the form of static VAr Compensators (SVC), shunt capacitor banks within the metropolitan area and/or series line capacitor banks on the major 330 kV infeeds to the metropolitan area
- Imposition of generation scheduling restrictions
- Installation of additional 330/132 kV transformer capacity in the metropolitan area
- Construction of additional transmission lines within the metropolitan area; and
- Establishing new terminal stations within the metropolitan area

Western Power are presently preparing a Regulatory Test submission relating to the provision of a new 330 kV transmission line between the south-west and Perth to facilitate the connection of new generating capacity in the south-west region.

**Northern generation development scenario**

The northern part of the SWIS extending from the Perth metropolitan area to Geraldton is supplied via a number of long parallel 132kV transmission lines. With a distance of approximately 400km between Northern Terminal and Geraldton, this is a long and weak interconnection and it provides very limited power transfer capability for this area of the state. This system operates close to its power transfer limits and the area is constrained by thermal, voltage and stability limitations.

Due to the limitations of this network there are currently no new committed generation proposals in the northern region, although there is considerable interest in the development of both renewable and fossil fuel energy resources in the area. Substantial reinforcements to the North Country transmission network will be required before additional generating capacity can be connected in this region. Western Power has proposed a major network augmentation to establish a 330kV transmission line interconnection from between Perth and Geraldton to increase the power transfer capability of the network to the north of Perth. This proposal is presently subject to the Regulatory Test process and should the augmentation proceed, it would assist new generator connections.

In addition to the network limitations within the northern area, the connection of additional generation sources in this area may expose the network within the Perth metropolitan region to the following limitations:

- Increased requirement for reactive power support;
- Over loading of 330/132kV transformers interconnecting the 330kV bulk transmission and 132kV sub-transmission networks; and
- Overloading of the 132kV transmission lines.

Therefore, some additional network augmentation may be required to enable the connection of additional generation sources in the area north of Perth.
This may include:

- Installation of additional reactive power compensation, in the form of static VAr Compensators (SVC), shunt capacitor banks within the metropolitan area and/or series line capacitor banks on the major 132kV infeeds to the metropolitan area
- Installation of additional 330/132kV transformer capacity in the metropolitan area; and
- Establishing new 132kV transmission lines within the metropolitan area.

**Metropolitan generation development scenario**

320MW of generation is committed to connect within the metropolitan area by 2008/09. Beyond this, Western Power is aware of a few proposals for the connection of additional generators within the metropolitan area.

The electricity transmission network within the Perth metropolitan area is characterised by high loads and high fault levels. The fault levels on the 132kV network within the metropolitan region are nearing design levels and the 132kV network between the metropolitan power stations and terminal stations is loaded to capacity. New generating sources within the metropolitan area will need to be connected to the 330kV network to manage fault levels. To facilitate this requirement, it may be necessary to establish new 330kV transmission interconnectors within the Perth metropolitan area to connect new power stations with the bulk transmission network.

The development of additional generation within the Perth metropolitan area will expose the following network limitations:

- Higher fault levels
- Increased loading of the 330kV transmission network within the metropolitan area (for some connection locations)
- Increased loading of 330/132kV transformers interconnecting the 330kV bulk transmission and 132kV sub-transmission networks; and
- Increased loading of parts of the 132kV transmission network.

The retirement of some generators within the Perth metropolitan area also exposes some network limitations.
These are as follows:

- Reduced reactive power support for the network during faults; and
- Increased demand for reactive power support if metropolitan generation is replaced with remote generation.

Therefore the connection of additional generation sources within the Perth metropolitan area would require some network augmentation, but may also have some beneficial effect on the network by providing reactive power support. The exact siting of generation within the metropolitan areas would significantly affect the network development required. The concentration of new generation in the southern part of Perth, alongside existing generation, would increase network loading and fault levels, requiring some reinforcement. The siting of new generation in the northern part of Perth would initially require the establishment of a new 330kV connector but should minimise any other fault uprate, network reinforcements or reactive power support requirements.

#### Eastern generation development scenario

There are no current generation project proposals for connection to the eastern part of the SWIS, although there has been some interest in generation connections in the Kalgoorlie region. The following discussion seeks to provide a general overview of the existing network and the constraints that are likely to be encountered with the connection of generation in this part of the network.

Generation in the Northam/Merredin Area

This scenario has been included (even though there are few convenient fuel sources) to illustrate the impact of significant generation developments in the area.

This part of the SWIS is connected to the metropolitan area long and weak 132kV and 66kV transmission lines. The transmission system was originally designed to supply relatively small loads. There would be significant thermal, voltage and stability constraints associated with power transfer from Northam/Merredin into the metropolitan area should any generation to connect in this area. Further, significant line losses may result from power transfer across such a weak network. Network reinforcement costs to cater for the connection of significant amounts of generation in this area are likely to be high due to the absence of existing 330kV transmission infrastructure or strong points of connection at lower voltages.

Generation at Kalgoorlie

Kalgoorlie is located approximately 550km east of the Perth metropolitan area and is connected to the SWIS via a radial 220kV transmission line. The 220kV interconnection from Muja in the south-west to Kalgoorlie is 650km long and was originally designed and constructed in 1984 to supply loads in the Kalgoorlie area. Due to its length, the transmission line incorporates a complex reactive compensation scheme to adequately control voltages. The line and reactive support system were originally designed to enable generators to be connected for emergency stand-by purposes only, to supply some load when the radial 220kV line was out-of-service.

In the last 10 years or so, generators have connected in the Kalgoorlie area to supply local load. Due to synchronous instability problems associated with the operation of this generation, a remedial action scheme ("RAS") was installed at Kalgoorlie to island this generation for local and remote faults in the SWIS when power transfer exceeds certain thresholds.

The system was not designed to cater for large abrupt changes in power transfer that result from operation of the RAS (there are limitations in the dynamic range of the reactive power compensation equipment) and therefore while the RAS enhances the transfer capability of the existing system, it also imposes limits on the amount of power that can be exported from generators in the Kalgoorlie area without undertaking additional reinforcements.

Detailed studies would need to be completed to determine whether additional generation plant could be connected in the Kalgoorlie region. The design of power plant would need to be managed very carefully to ensure that the system operates in a synchronously stable state.

If the amount of generation connected in the Kalgoorlie area exceeds the local load, then power would be transferred from the across the 220kV transmission line into the SWIS via Muja. This has similar effects as the southern generation development scenario with similar network reinforcement requirements

If you have any questions or queries, please do not hesitate to contact either Bill Bignell on 9326 4569 or Hai Bui on 9326 6446.

Yours sincerely,

**Laurie Curro**
**Manager, Network Planning and Development**

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