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PROJECT BRIEF – revised to reflect REGWG discussion at 23/10 mtg

INTERMITTENT GENERATION IN THE CAPACITY MARKET

BACKGROUND

The Wholesale Electricity Market (WEM) for the South West Interconnected System

The Wholesale Electricity Market (WEM) for the South West Interconnected System (SWIS) is divided into energy and capacity markets. Electricity is traded through the bilateral energy market and the day-ahead Short Term Electricity Market (STEM). The capacity market, which operates on a four year cycle, provides an additional revenue stream that promotes investment in new capacity to meet anticipated growth in electricity consumption and peak load. Capacity credits currently provide a revenue stream of around \$15/MWh for firm capacity. For wind generators in Western Australia, this can be in the order of 15 or 20 per cent of project income.

One of the objectives of the WEM is to “avoid discrimination...against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions”¹. To this end, the market incorporates provisions which allow intermittent electricity generators to compete, on a cost basis, with dispatchable generators. In the capacity market, credits for intermittent generation are based on expected output and there are no penalties for not delivering power. These measures were considered world-leading at the time the market was designed.

Capacity credits for intermittent generation

Clause 4.5.9 of the Market Rules² outlines the planning criterion for setting the Reserve Capacity Target for the Wholesale Electricity Market in future years. Sufficient capacity to meet system peak loads events is one of the criteria for setting the total capacity. Extreme load peaks last for only relatively short periods of time, eg 2 or 3 hours a year, and are more likely to occur at certain times of the day and the year than at others. At other times of the year system margins may be depleted due to high levels of planned generator maintenance. At these times, higher than usual loads or unplanned outages may cause the system to approach the limits of its available capacity.

Capacity credits are allocated to intermittent generation facilities on the basis of average generation over the preceding three years (see Section 4.11 of the Market Rules). Consequently, allocations of credits to intermittent generators will vary over time and reflect the specifics of the facility and technology.

There are three medium to large-scale wind farms operating in the SWIS. Under current arrangements, these wind farms receive capacity credits equivalent to around a third of their rated capacity. Landfill gas generators receive credits for around 80 to 90% of the rated capacity of the facility. Average generation from a solar photovoltaic or thermal system would be around 20%, although there are none currently participating in the capacity credit cycle.

¹ Electricity Industry Act 2004, 122(2).

² http://www.imowa.com.au/Attachments/WEMSRulesUnOfficial/WEM_Rules_Unofficial.pdf.

Background on the operation of the market is available at http://www.imowa.com.au/market_structure.htm.

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Synergy, an electricity retailer, is proposing to allow intermittent generators to select an alternative capacity credit allocation method.³ The alternative method incorporates features of an allocation method considered at the time the market was developed and is likely to be beneficial to solar thermal technologies that are expected to generate at high levels during summer peak load events.

A number of potential variations to the allocation of capacity credits to intermittent generation facilities are outlined in Attachment A. The list includes alternatives canvassed at the time the market was under development, approaches taken in other jurisdictions and in other countries, and a proposal currently being considered through the market rule change process. Aspects of rules determining capacity credit allocations to intermittent generators could include:

- rules for identifying intervals for when the system is considered at risk;
- the statistical parameters (eg mean, median, percentiles) of output distributions;
- the number of years of data used for allocating credits;
- weightings to reflect varying levels of risk to the system; and
- accounting for combined output expectations of multiple facilities.

Intermittent generation and system security

Meteorological factors are a significant driver of electricity consumption in the SWIS and also influence output from weather-related energy sources such as wind, wave and solar. It is possible that the weather conditions leading to peak load events will also have a bearing on expected wind and photovoltaic generation. The extent and timing of peak load intervals are also influenced by other parameters, such as the timing of the weekly business cycle.

In the 2006-07 capacity year, the first year of the operation of the WEM, wind generation from the three major wind farms at peak load times was substantially below their combined capacity credit allocation. The following year wind generation was greater than their capacity credit allocation, although the peak loads were not as great. Solar energy electricity generation is likely to be highly correlated with summer peak loads driven by air-conditioning demand on hot and typically cloudless summer days.

It is unclear whether the current capacity credit allocation method adequately reflects wind generators' contribution to meeting the planning criterion. It is possible that existing arrangements could under-allocate credits to future solar thermal facilities.

Changing the capacity credit allocation method to focus more closely on expected output at times when the system is most at risk changes the incentives facing new intermittent renewable energy project developers.

Intermittent generation technologies and projects with a high correlation between output and system peaks would be expected to have a competitive advantage over those that do not. There may also be options for project developers to design projects to increase expected generation at times of peak load. For example, wind farm developers may be able to choose locations where the wind resource is better correlated with peak loads, and optimise their turbine selection and site layout for generation from better correlated parts of the wind profile. There may also be scope

³ Synergy's rule change proposal is included in the papers for the 10 Sep 2008 meeting of the MAC: http://www.imowa.com.au/market_advisory_committee.htm

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for incorporating short term electricity storage technologies into intermittent generation facilities, thereby improving output at peak times. Storage technologies could be a feature of future wave and solar thermal generation facilities.

Being subject to the same weather conditions can lead to correlations in output between wind farms, increasing the probability of extremely low (or high) levels of output from multiple wind farms at the same time. Diversifying the location of wind farms could reduce the variability of total output from all wind farms (ie the wind fleet).

Renewable Energy Growth in Western Australia

Western Australia has excellent intermittent renewable energy resources, particularly in the southwest of the state where the majority of the population is located. Just over 5% of electricity in the SWIS was generated from renewable energy in 2007/08, most from a small number of large-scale wind projects. There are currently over 1000 MW of wind projects under development in the SWIS. Wave and solar thermal projects are also being considered, although these technologies are some way from commercial deployment.

The Federal Government has committed to increasing the amount of Australia's electricity supply provided from renewable energy sources to 20% by 2020. The primary mechanism for achieving this is to increase the national Mandatory Renewable Energy Target (MRET) scheme to an additional 45,000 GWh of new renewable energy-based electricity. The Western Australian Government and other state and territory governments are currently working with the Federal Government on the design of the expanded scheme. The expanded MRET scheme will be a major driver of renewable energy investment in Western Australia over the coming years.

Market Advisory Committee Renewable Energy Generation Working Group

The Independent Market Operator is an independent statutory corporation established to operate and administer the WEM. The WEM Market Advisory Committee provides advice to the IMO on rule change proposals.

The Market Advisory Committee has established a Renewable Energy Generation Working Group⁴ to consider a range of issues for the market that may arise from increasing renewable energy generation. The Working Group is chaired by the Office of Energy and comprises committee members representing power producers, retailers, the power system operator and the IMO.

The Working Group has identified three major issues associated with the increasing penetration of intermittent generation in the SWIS that could require rule changes to maintain the integrity of the market. These include the:

- efficient allocation of capacity credits to intermittent generators;
- efficient recovery of load-following charges; and
- scheduling of intermittent and inflexible capacity at times of low load.

The work in this proposal seeks to address the first issue in a timeframe that enables a resolution on the issue for market participants prior to the closure of expressions of interest in the 2009 capacity credit cycle⁵. Expressions of interest for capacity credits

⁴ See http://www.imowa.com.au/mac_workinggroups.htm.

⁵ Information on the reserve capacity cycle: http://www.imowa.com.au/reserve_capacity_overview.htm.

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are sought in January 2009 and applications for certification of capacity for the 2011-12 capacity year in May. The IMO is also scoping a program of work to address all of these issues.

SCOPE AND OBJECTIVES

The objectives of the project are to review the capacity credit allocation rules for intermittent generators and undertake statistical analysis of historical intermittent generation and load data in order to inform the REG Working Group of:

- intermittent generators' expected contribution to system reliability according to the planning criterion for setting reserve capacity, and how this compares with allocations expected under existing and foreshadowed amendments to capacity credit allocation arrangements;
- the ramifications of changes to capacity credit allocation rules that may better reflect the contribution of intermittent generators to system security, as reflected in the objectives and operation of the Reserve Capacity Mechanism; and
- the potential value of diversifying wind farm generation locations.

Priority will be given to the assessment of intermittent generators' expected contribution to meeting the planning criterion.

Concurrent load and generation data is expected to form the basis of the analysis. Options to increase the power and scope of the analysis could include (but are not limited to):

- extending generation series with simulated output based on weather data from test masts or other sources;
- extrapolating likely generation at new sites from weather data; and
- simulating additional load profiles from weather series by varying load-determining parameters such as the timing of the weekly business cycle.

Rule change implications of interest for the Office of Energy will include:

- the likely impact on allocations for new and existing new generators;
- the ramifications for the Reserve Capacity Margin over time;
- the individual and combined contribution to system security;
- the implications for different wind sites across the SWIS, and different intermittent generation technologies.

The Office of Energy will also be interested in positioning the 2006-07 and 2007-08 hot seasons in the context of longer term expectations.

The consultant will draw upon immediately available data, tools and statistical techniques in order that the project be completed in the required timeframe. A list of weather and generation data that can be supplied by market participants, on a confidential basis, is available upon request to the Office of Energy.

This project is focused on the allocation of capacity credits to intermittent generators and is not expected to consider network constraints or broader load-following issues.

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POTENTIAL MILESTONES AND OUTPUTS

1. A detailed analysis proposal, agreed with the reference panel.
2. Comparison of intermittent generators' expected contribution to the Reserve Capacity planning criterion and capacity credit allocations under current and foreshadowed capacity credit allocation arrangements.
3. A draft report detailing:
 - analytical methods;
 - analysis and results;
 - the implications of the analysis in light of the project tasks and objectives; and
 - issues and areas for further research.
4. A final report, for the use of the Market Advisory Committee, incorporating feedback from the reference panel.
5. A summary report, with any confidential information removed, for public dissemination as required.
6. Supplementary reports, for any further analysis commissioned by the Office of Energy.
7. Presentations on the analysis and outputs.

PROJECT GOVERNANCE

The Office of Energy is funding and contracting the analysis and will convene a reference panel comprising the Office of Energy, the IMO and Western Power (System Management). The proponent is expected to work closely with the reference panel.

The Office of Energy will facilitate the collation of data from market participants on the REG Working Group and other sources.

TIMING

November 2008	Project commissioned
December 2008	Data collection and refined analysis proposal
February 2009	Analysis & draft report
March 2009	Final and summary report Data and derived time-series.

COST STRUCTURE

Office of Energy funds of \$50 000 to \$100 000 (GST exclusive) are available for the work.

The proposal should be costed and presented in such a way that the total cost of the project can be clearly identified and justified. Any options or variations to the proposal

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that would lead to changes in the total cost should be clearly identified to facilitate comparison between proposals.

A cost for quantitative analysis of additional rule change proposals at the request of the Office of Energy is requested.

CONFIDENTIALITY

The proponent will have access to commercially sensitive information from the REG Working Group members and will accordingly need to be willing to sign a confidentiality agreement.

PROPONENT SELECTION

The Office of Energy

Proponents are asked to submit a costed work proposal to the Office of Energy and demonstrate how it will meet the objectives of the analysis.

The proposal evaluation panel will be convened by the Office of Procurement and include the Office of Energy and the Independent Market Operator.

The evaluation panel will select a proposal on the basis of the merits of the proposal, cost, relevant skills and experience of personnel involved, and a demonstrated capacity to deliver the project outcomes in a timely manner.

The panel may consider no proposal meets the project objectives and timing and cost parameters.

Potential parameters of intermittent capacity certification methods

	Current Method¹	Original Method²	Proposed rule change³	PJM⁴	IRCR⁶	Reserve Capacity Refund Mechanism⁸
Summary	Average generation.	Fleet generation over the top 250 hot and intermediate season load intervals with 90% confidence, shared according to facility generation.	Generation over the top 250 hot and intermediate season load intervals with 90% confidence.	Average generation ⁵ during summer daily peak-use hours.	Median load during the 12 Peak Trading Intervals ⁷ used to allocate reserve capacity liabilities.	Weight generation to reflect penalties for dispatchable generation. ⁹
Intervals	All	Top 250 loads of hot & intermediate season	Top 250 loads of hot & intermediate season	3pm-6pm in June, July and August	12 peak trading intervals	All
Statistic	Mean	10 th percentile	10 th percentile	Mean	Median	Weighted average.
Time	Preceding 3 years	Preceding year	Preceding year	Preceding 3 years		
Interval weighting	Equal	Equal	Equal	Equal		Weights proportionate to reserve capacity refund multipliers.
Diversity benefits	None	Fleet generation apportioned between generators on the basis of their contribution to the total.	None	None	Total capacity liability apportioned across liable parties.	

¹ Clause 4.11.3A, http://www.imowa.com.au/Attachments/WEMSRulesUnOfficial/WEM_Rules_Unofficial.pdf

² The Market Rules were amended in 2005, prior to the commencement of the market, to add clause 4.11.3A and then remove the original clause, 4.11.3.

³ Synergy proposes reinstating Clause 4.11.3, sans the fleet component, to improve certification for solar thermal power. The rule change proposal is included in the papers for the 10 Sep 2008 meeting of the MAC: http://www.imowa.com.au/market_advisory_committee.htm

⁴ PJM operates the world's largest competitive electricity market and North America's largest centrally dispatched control area, covering seven states and Columbia.

⁵ For units with less than three years' operating experience, a "class average" credit applies. The class average, currently 20%, is based on the operating experience of wind turbines in use in the region and will be updated periodically.

⁶ Market Customers (i.e. retailers) are given an Individual Reserve Capacity Requirement (IRCR) obligation, (expressed in MW) which are used to determine the customer's share in system load during peak times. The share determines the customer's liability for purchasing capacity credits.

⁷ The three highest demand half hour intervals of the four highest demand days for the South West Interconnected System (SWIS).

⁸ All facilities that have been assigned Capacity Credits are required to make refunds to the market in the event that they are unable to offer their full capacity through bilateral contracts or into the STEM, unless they are undergoing an approved outage. The Refund Mechanism is designed to provide an incentive to encourage capacity providers to be fully available at peak times but there must also be incentives for good performance at other times of the year when scheduled outages reduce the available system capacity.

⁹ From 1 November 2007, the calculation of the refund includes different factors for business or non-business day (peak and non-peak trading intervals) and between the first and second half of the Hot Season (as there is a significant difference in peak demands which occur in December and January and those occurring in February and March).