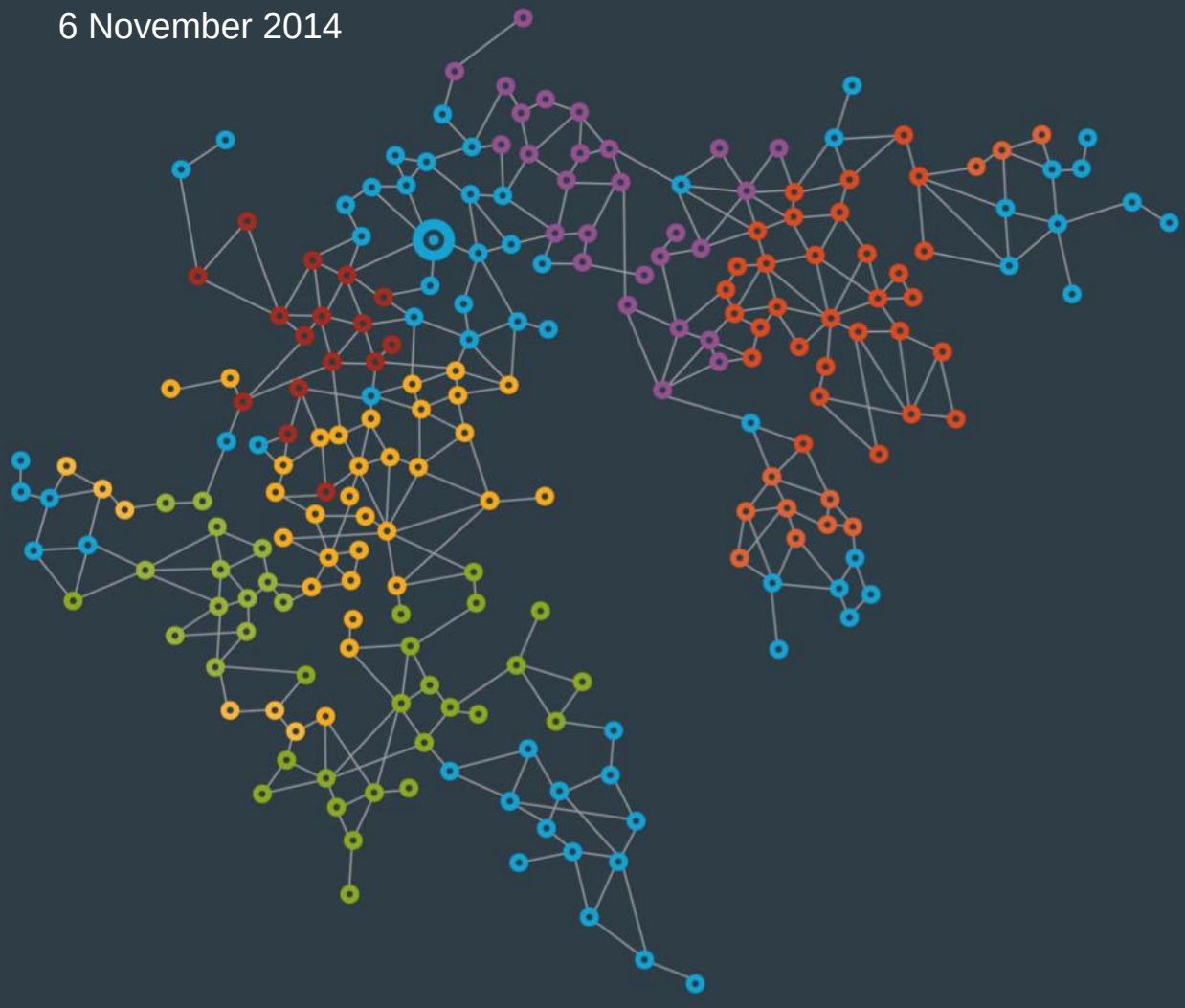
INDEPENDENT MARKET OPERATOR

Independent Market Operator

Final Report

2014 Ancillary Service Standards and Requirements Study

6 November 2014



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1. Background

In accordance with clause 3.15.1 of the Wholesale Electricity Market (WEM) Rules (Market Rules), at least once in every five year period starting from Energy Market Commencement the Independent Market Operator (IMO), with the assistance of System Management, must carry out a study on the Ancillary Service Standards and the basis for setting Ancillary Service Requirements for the South West interconnected system (SWIS) in Western Australia.

The study must include:

- technical analyses determining the relationship between the level of Ancillary Services provided and the SWIS Operating Standards set out in clause 3.1 of the Market Rules;
- identification of the expected costs that would result from an increase in the requirements for Ancillary Services due to additional Facilities connecting to the SWIS;
- a cost-benefit study on the effects on stakeholders of providing and using a variety of levels of each Ancillary Service; and
- a public consultation process.

Clause 3.15.2 of the Market Rules requires the IMO to publish a report (Final Report) at the conclusion of the study, containing:

- the inputs and results of the technical and cost-benefit studies;
- the submissions received by the IMO in the consultation process, a summary of those submissions, and any responses to issues raised in those submissions; and
- any recommended changes to Ancillary Service Standards and the basis for setting Ancillary Service Requirements.

If the IMO recommends any changes in the Final Report then it must, under clause 3.15.3, make a Rule Change Proposal to implement those changes.

The IMO published the Final Report for the first study on 6 November 2009[1].

The IMO engaged ROAM Consulting, an independent consultant, to assist the IMO in undertaking the second study (2014 Study). During October 2014 ROAM Consulting was acquired by the professional services firm Ernst & Young (EY) and the group now operates under the EY name.

The 2014 Study is now complete. The Final Report required under clause 3.15.2 comprises this report, EY's Final Report and the submissions received by the IMO during the public consultation period for EY's Draft Report.

Copies of EY's Draft Report[2] and Final Report, along with copies of all submissions received by the IMO during the public consultation period, are available on the Market Web Site at http://www.imowa.com.au/2014_AS_Study.

[1] Available at: 2009 Review of Ancillary Services Requirements, Processes & Standards
[2] Published under the original ROAM Consulting name.

2. EY's Draft Report

EY conducted an investigation and benchmark of the Ancillary Services provisions in the WEM compared to various international markets, focusing on:

- appropriate standards and requirements for Ancillary Services;
- operation and structure of different Ancillary Services markets;
- initiatives to minimise the need for and usage of Ancillary Services; and
- technical developments and improvements in Ancillary Services procurement.

EY also developed models to analyse current requirements and predict future requirements for Load Following Service (LFAS), Spinning Reserve Service (SR) and Load Rejection Reserve Service (LRR). In particular, EY examined the impact of increasing solar and wind generation on LFAS requirements, and the impact on system frequency of altering the amount of SR and LRR enabled. The System Restart Service was also analysed and benchmarked against arrangements in other comparable markets.

It should be noted that in some cases uncertainty about the outcomes of the State Government's Electricity Market Review (EMR) has limited the ability to develop detailed solutions to the issues raised in the 2014 Study. It is likely that further work on the definition of Ancillary Service Standards and Requirements will be needed once the EMR recommendations are known and the path for the ongoing evolution of the WEM is clearer.

A summary of the key conclusions and recommendations in the Draft Report is provided below.

- EY identified several instances where the Market Rules and/or the Power System Operation Procedures (PSOPs) are ambiguous or not strictly in agreement with normal practice in the WEM, as well some examples where the current Ancillary Services and related Market Rules may not be sufficient under all future conditions. To address these issues EY made a number of recommendations to clarify Ancillary Service definitions, remove redundant and conflicting standards from the Market Rules and refine the processes used to determine Ancillary Service Requirements for LFAS, SR and LRR.
- EY concluded that the frequency control standards in the Technical Rules were generally similar to those of the international markets reviewed and consistent with EY's assessment of best practice.
- EY noted that the standards applied by System Management according to its interpretation of the Technical Rules and Market Rules were not always consistent with the Technical Rules standards. For example, System Management seeks to retain the system frequency between 49.8 Hz and 50.2 Hz for 99.9 percent of the time, rather than 99 percent as prescribed in the Technical Rules. EY's international benchmarking exercise found this standard to be much more onerous than typical frequency standards elsewhere; in the markets reviewed the performance standard varied between 97 percent and 99 percent.
- EY concluded from its SR modelling that the current SR standard in the Market Rules (basically 70 percent of the output level of the highest output generator at the time) may be insufficient to satisfy the Technical Rules during times of low demand, i.e. to avoid load shedding on a single credible contingency. On the other hand, the 70 percent requirement appears to be unnecessarily high at times of peak demand. EY recommended that System Management investigate extending the calculation of the SR requirement to include the impact of load relief (the response of system loads to increases or decreases in frequency).

EY concluded that more explicit forecasting of load relief could allow for more efficient procurement of SR, and so minimise the impact of disallowing load shedding on a single credible contingency event. EY suggested a similar methodology could be used to determine the LRR requirement.

- EY's modelling indicated that a 50 percent increase in wind penetration in the WEM (about 280 MW) would result in increasing the overall LFAS requirement by about 10 MW. In contrast, a 162.5 MW increase in solar photovoltaic (PV) capacity would have a negligible impact on the LFAS requirement.
- EY noted the difficulties that exist with assessing actual LFAS usage in the WEM due to the manner in which the Balancing Portfolio is currently dispatched, which blurs the boundaries between the energy and Ancillary Services provided by Synergy Facilities. Given that in most markets Ancillary Service requirements are determined on the basis of historical experience, this presents a significant challenge in determining the required levels of this Ancillary Service in the WEM.
- The Draft Report noted that it is not always the case that a Facility providing Upwards LFAS will also be providing SR. However, the current Ancillary Service Standards and settlement arrangements for SR are based on this assumption.
- EY considered the issue of LFAS Facilities operating near their enablement limits and so having less capacity available to respond to an SR/LRR event. EY recommended that LFAS Facilities should continue to be allowed to provide SR or LRR if they are able, but that System Management should continue to monitor SR/LRR performance to ensure this arrangement does not have a significant impact on system security.
- EY made several recommendations for actions that would help minimise LFAS requirements based on international experience and review, including reduction of the dispatch interval time step and changes to allow System Management to vary generator ramp rates without triggering constrained on/off payments. EY's recommendations were consistent with the findings of the work team established by the IMO and System Management to investigate the causes of the LFAS requirement.
- EY discussed several new technologies with the potential to provide benefit to the WEM, including energy storage and the provision of synthetic inertia from wind turbines. EY also highlighted some of the technical advantages of storage and loads providing 'very fast response' frequency control and recommended that the requirements for SR-capable Facilities be made technologically neutral.
- EY found that the WEM's regulations for System Restart Service were broadly comparable to other international markets and consistent with industry best practice when geographical factors are taken into account. However, EY made a number of recommendations to address specific areas for improvement or opportunities to increase clarity.

The Draft Report contained a set of 21 recommendations for improvement, which EY divided into two categories: relatively straight-forward changes which EY considered could be implemented in the short term and longer term, more complex structural changes.

3. Public consultation process

On 24 September 2014 the IMO published EY's Draft Report and an invitation to all sectors of the Western Australian energy industry to provide submissions on the report (Invitation to Provide Submissions) on the Market Web Site. A copy of the Invitation to Provide Submissions was also

issued to all recipients of the IMO's weekly RulesWatch publication on this day. The consultation period was four weeks in length and closed on 23 October 2014.

3.1. Submissions received

The IMO received four submissions during the public consultation period, from Community Electricity, EnerNOC, Perth Energy and Synergy. All the submissions received were generally supportive of the Draft Report.

Community Electricity supported the Draft Report as being comprehensive, innovative, pragmatic and fit-for-purpose. Community Electricity noted the IMO's comments in the Invitation to Provide Submissions about the impact of the EMR on the 2014 Study and supported the Draft Report's interpretation of the relative feasibility and timeliness of the various recommendations.

In particular, Community Electricity:

- supported EY's recommendation that requirements for SR-capable Facilities should be technologically neutral (Recommendation 1) and further considered that SR Facilities should not be required to be available for nominally 100 percent of the year;
- supported the recommendation that technically capable LFAS Facilities should be permitted to simultaneously provide SR and LRR (Recommendation 4);
- considered that a more flexible and accurate determination of the SR requirement (Recommendations 7 and 13) would materially reduce energy costs and so should be prioritised; and
- considered that the Draft Report's finding regarding the standard for LFAS currently adopted by System Management (i.e. to maintain system frequency within the Normal Range for 99.9 percent of the time) provides evidence for the need to rejuvenate the previous MAC debate regarding the LFAS standard in the short term rather than the longer term, and to integrate System Management under the IMO.

EnerNOC's submission focused on the technical and economic benefits of using loads (including aggregated portfolios of loads) to provide SR and LFAS. EnerNOC strongly supported Recommendation 1, further suggesting that:

- the recommendation should also apply to the requirements for LFAS Facilities, to allow loads to provide this Ancillary Service; and
- the technical requirements for SR should be revised to avoid excessive and unnecessary costs (e.g. full real-time telemetry costs) for aggregated portfolios of small loads.

EnerNOC also supported the Draft Report's proposal to simplify the SR standard (Recommendation 7) and recommended the introduction of a competitive SR market, considering that an open, technologically neutral market for SR should reduce costs greatly, allowing a higher level of reliability to be achieved at lower cost.

Perth Energy supported the overall approach of the Draft Report, considering it to be forward looking and a comprehensive assessment of Ancillary Service requirements for the SWIS. Perth Energy considered storage technologies that are capable of providing some Ancillary Services

may become available for service in the SWIS in the not-too-distant future, and so agreed with the Draft Report recommendations supporting the use of such technologies.

Perth Energy also specifically supported the recommendations made around on-going monitoring of emerging ancillary services markets (Recommendation 3), the use of LFAS Facilities to provide SR and LRR (Recommendation 4), reduction of the dispatch interval time step to five minutes (Recommendation 10), simplification of Ancillary Service Standards (Recommendations 7, 8 and 9), elimination of overlaps in service provision (Recommendation 2) and most of the recommendations made about System Restart Service.

Perth Energy however questioned System Management's proposed requirement for Facilities providing System Restart Service to carry fuel stocks for 48 hours of operation. Perth Energy considered that if this requirement were to be applied to diesel fuelled operation then the Ancillary Service costs would have to rise substantially, to cover the cost of additional fuel storage facilities and fuel stocks.

Synergy congratulated the IMO and EY on the production of a generally well-balanced report that addresses areas where the treatment of Ancillary Services could be revised to meet the Wholesale Market Objectives. Synergy noted the ambiguities that exist currently between the Market Rules, Technical Rules and PSOPs and supported the proposed alignment and clarification of these documents.

Synergy strongly supported the procurement of additional black start providers in the South Country sub-network (Recommendation 19), but did not support the recommendations to increase the minimum capacity of black start units (Recommendation 15) or to require black start units, connected at 330 kV, to be capable of energising a 330 kV line section and a 330/132 kV 490 MVA transformer "by allowing generator excitation to commence while its generator circuit breaker is closed" (suggested in the discussion for Recommendation 16). Synergy also suggested that the recommendation to factor dynamically forecast load relief into the SR requirement (Recommendation 13) needs to be very carefully considered, to balance the risk of under frequency load shedding against the cost of avoiding it.

In respect of the provision of SR and LRR by LFAS providers, Synergy recommended that consideration be given to methodology changes to allow IPP Facilities to remain away from their set point to continue assisting in a contingency event, rather than requiring an IPP to immediately return to a set point, which can exacerbate a contingency event.

Perth Energy and Synergy also disagreed with a few of the statements made in the Draft Report. EY has reviewed these statements in consultation with the IMO, System Management and (where necessary) the submitter, and has updated the Final Report where appropriate.

As noted above, full copies of the submissions received are available on the Market Web Site: http://www.imowa.com.au/2014_AS_Study.

3.2. The IMO's response to submissions from stakeholders

Following the close of the consultation period the IMO and EY met with representatives from Synergy to discuss the comments made in Synergy's submission on the Draft Report. The IMO also contacted Community Electricity and EnerNOC to clarify various details of their submissions.

EY has considered the submissions received during the consultation period and made a number of

amendments to its Final Report to address issues raised by stakeholders. A summary of the changes is provided in section 4 below.

The IMO's response to each of the issues raised in stakeholder submissions is presented in Appendix 1 of this report.

4. Summary of changes in EY's Final Report

EY has prepared its Final Report after considering the issues raised in submissions during the public consultation period and in subsequent discussions with the IMO, System Management and Synergy. Changes made from the Draft Report include:

- additional discussion of technological neutrality in section 4.2.1 and an extension of the recommendation to make SR requirements technologically neutral (Recommendation 1) to all Ancillary Services;
- addition of a new recommendation to confirm that all generators are meeting their connection requirements with respect to governor settings (Recommendation 1A);
- removal of an incorrect statement in section 4.3.1 that all fast start generators in the WEM are owned by Synergy;
- incorporation of stakeholder views on LRR costs in section 11.3;
- changes to section 12.2 to clarify the potential Trip to House Load (TTHL) capabilities of some coal and cogeneration power stations in the WEM;
- withdrawal of support for setting a minimum fuel reserve requirement of 48 hours runtime for black start Facilities in section 12.4.2;
- withdrawal of Recommendation 15, which proposed increasing the minimum size of black start Facilities;
- changes to the suggested requirements regarding the transmission energisation methods for 330 kV connected black start Facilities in section 12.4.3;
- clarification of the recommendation to add an explicit requirement for an annual test for black start units (Recommendation 17);
- correction of the capacity provided under Perth Energy's System Restart Service Ancillary Service Contract (ASC) in Table 12.3; and
- broadening the recommendation to consider establishing a Muja-specific black start sub-network (Recommendation 20), to recommend that relative geographic and network advantages be included in the evaluation criteria for all System Restart Service tenders.

5. The IMO's recommendations

As mentioned in section 2 of this report, uncertainty about the outcomes of the EMR has limited the ability to develop detailed solutions for some of the issues raised in the 2014 Study. This is

mainly because the EMR is considering several options for the future evolution of the WEM that directly impact on frequency control Ancillary Services, including:

- facility-based bidding for all Market Participants, including Synergy;
- the structural separation of Synergy (which may affect its role as the default Ancillary Service provider in the WEM);
- reduction of gate closure and dispatch interval times for Balancing and LFAS;
- the co-optimisation of energy and Ancillary Services;
- the introduction of competitive markets for SR and LRR;
- the introduction of a constrained network access model; and
- adoption of the National Electricity Market (NEM) market rules.

The ability to prepare meaningful cost/benefit analyses for longer-term changes or assess the payback period for shorter-term changes is also affected by this uncertainty.

For this reason the IMO, while generally supportive of EY's recommendations (subject to an assessment of the benefits and costs once the appropriate baseline can be determined), does not propose to recommend any specific changes to the Ancillary Service Standards and the basis for setting Ancillary Service Requirements at this time.

Instead, the IMO has classified EY's recommendations into the following groups for further consideration and, where appropriate, action over the coming months.

5.1. System Restart Service recommendations

Work on the 2014 Study and preparation of the 2014 Ancillary Services Plan has highlighted some uncertainties about the current Ancillary Service Requirements for System Restart Service and the extent to which the current arrangements (including the ASCs for System Restart Service) meet those requirements. Additionally, System Management has flagged the procurement of replacements for the current ASCs, which are due to expire by July 2016, as a matter of high priority. The IMO therefore recommends that System Management:

- review its current operational plans for restarting the SWIS and the requirements for Facilities providing System Restart Service, taking into consideration the specific recommendations (Recommendations 16-21) in EY's Final Report as well as the areas where EY suggested further investigation was warranted;
- identify any deficiencies in the current black start arrangements that need to be addressed in the short term and prepare an action plan to address any such issues; and
- develop the proposed requirements for System Restart Service for the next tender period (including the rationale for any changes to the current requirements) for consideration by relevant stakeholders, with a view to commencing the tender process for the next tender period as soon as possible.

5.2. Provision of Spinning Reserve Service by LFAS Facilities

The IMO proposes to further investigate the impacts of LFAS Facilities that do not, when they provide Upwards LFAS, also provide SR, and present its findings to the MAC for discussion in early 2015. The purpose of the investigation is to identify what, if any, short to medium term changes to the Market Rules and Market Procedures are needed to address problems caused by the existence of these Facilities.

5.3. Confirmation of compliance with governor response obligations

Consistent with EY's Recommendation 1A, the IMO recommends that System Management, in consultation with Western Power, confirm that all Market Participants in the WEM are meeting their connection requirements under the Technical Rules with respect to governor settings.

5.4. Potential enhancements to the Technical Rules

EY's Recommendation 12 ("Begin to secure synthetic inertia capability") proposes the introduction of new, specific technical requirements for wind turbines, which the IMO considers fall within the scope of the Technical Rules rather than the Market Rules. The IMO proposes to pass on EY's recommendation to the Economic Regulation Authority's (ERA's) Technical Rules Committee for further consideration.

5.5. Monitoring of emerging Ancillary Services markets

EY's international review found that several jurisdictions were investigating the creation of explicit markets for short timescale primary response, to address concerns about decreasing system inertia caused by the growth of renewable generation. EY recommended that the IMO continue to monitor the proposed changes in these markets, with a view to the longer-term implementation of a shorter timescale primary response service (Recommendation 3).

The IMO intends to continue its observation of developments in other markets around the management of Ancillary Services, including those relating to the implementation of 'fast response' reserves. However, like EY the IMO does not consider that increases in renewable generation will have a critical impact on inertia levels in the WEM over the next five years.

5.6. Post EMR energy/frequency control market evolution

The IMO proposes to give detailed consideration to EY's other recommendations and, subject to the outcomes of the EMR, determine how and whether they should be incorporated into the evolution of the Balancing Market and frequency control Ancillary Services in the WEM. The IMO considers it likely that most of these recommendations might, subject to further assessment, be incorporated into a package of work that includes:

- resolution of ambiguities and anomalies in the Ancillary Service Standards;
- definition of the frequency control Ancillary Services/Classes that will be required in the WEM going forward, including regulation, primary and secondary reserves;
- definition, for each service/class, of the triggers for the provision of the service, the required

time to begin responding to a trigger, the nature of the required response, the required time to fully respond and the required duration of the response;

- clarification of the technical requirements for Facilities providing each service/class, i.e. what a Facility needs to be able to do and in what timeframes, how performance is to be measured and what, if any, restrictions should apply to the concurrent provision of different services by a Facility;

- determination of how, and according to what timeframes, the MW enablement requirement should be determined for each service/class and Trading Interval;

- review of the Ready Reserve Standard, to take into account the revised Ancillary Service definitions and requirements; and

- development of the required changes to the Market Rules and Market Procedures.

Depending on the outcomes of the EMR this work could form part of a wider program of enhancements, which might also include:

- enhancements to the Balancing Market, e.g. the reduction of gate closure and dispatch interval times and changes to the management of ramp rates;

- facility-based bidding and dispatch for Synergy Facilities;

- co-optimisation of energy and Ancillary Services and the implementation of competitive markets for SR and LRR; and

- implementation of a constrained network access model.

Appendix 1: Responses to submissions received from stakeholders

	Submitter	Issue	Comment/Change requested	IMO Response
1.	Community Electricity	LFAS Standard	We note the report's finding that: "Owing to the ambiguity and difficulty in interpreting and implementing the LFAS standard, System Management instead uses the practice of procuring at least 72 MW each of upwards and downwards LFAS. By observation this has been found to be sufficient to contain the system frequency to the Normal Range 99.9 percent of the time. However, the SWIS Operating Standards state that the Normal Range need only be met for 99 percent of the time. ROAM's international benchmarking exercise found that containing frequency to its normal range for 99.9 percent is much more onerous than typical frequency standards elsewhere; in the markets ROAM reviewed, the performance standards varied between 97 percent and 99 percent." We observe that this issue has been debated extensively at the Market Advisory Committee, where despite System Management obfuscating the process to a standstill, it has been intuitively obvious that the cost of the LFAS service is higher than it reasonably needs to be. We consider that the report's finding provides evidence for the need to rejuvenate the debate in the short term over the longer term and integrate System Management under the IMO.	Noted. The IMO notes that in practice the performance level for LFAS is even higher than 99.9 percent. For example, over the period from May 2013 to April 2014 the system frequency remained between 49.8 Hz and 50.2 Hz for at least 99.97 percent of each month. EY's findings indicate that the current performance levels are unnecessarily high, and given the very high cost of LFAS in the WEM (around $54 million for the period mentioned above) the IMO considers the size of the current LFAS requirement cannot be justified. The IMO has raised its concerns with System Management and intends to pursue the matter further in the New Year.
2.	Perth Energy	Requirement for System Restart Facilities to carry 48	ROAM has indicated its support for System Management's proposed requirement that black start facilities should carry fuel stocks for 48 hours	EY has acknowledged Perth Energy's concerns and considers that further work is required to confirm the appropriateness of this requirement. EY has amended

	Submitter	Issue	Comment/Change requested	IMO Response
		hours of fuel	during a system black-out. Currently all three black start plants are capable of operation on natural gas and diesel. If the 48 hour requirement were to be applied to diesel fuelled operation then the Ancillary Service costs would have to rise substantially to cover the cost of additional fuel storage facilities and fuel stocks.	its Final Report accordingly.
3.	Synergy	Security/reliability/ cost balance	Synergy notes that when assessing appropriate standards and requirements for Ancillary Services, care needs to be taken to strike the appropriate balance between secure and reliable supply of electricity and minimising the long term cost of electricity supplied.	Noted.
4.	Community Electricity	Recommendation 1	We welcome correction of the current inefficiency. We would add that we understand the current requirement to exclude 'capacity' that is not available for nominally 100 percent of the year and that this is a stark inefficiency that should be remedied.	The IMO discussed Community Electricity's concern with System Management, who confirmed that it currently only enters into ASCs for SR with providers that can guarantee a very high availability level. For example, the maintenance cycle of a normal Scheduled Generator would reduce its availability to a level that was considered unacceptable. System Management noted that this approach avoids the logistical and administrative overheads of managing ASCs that only operate some of the time, and considered that an SR market would provide the appropriate framework to support non-full time offers for SR. While the IMO agrees an SR market would provide the most flexible and efficient solution, it recommends that System Management give further consideration to whether reducing its availability threshold for SR ASCs could reduce overall SR costs in the WEM under the current market arrangements.
5.	EnerNOC	Recommendation 1	Provision of contingency frequency-raising	Noted.

	Submitter	Issue	Comment/Change requested	IMO Response
			Ancillary Services by loads rather than by generation can bring significant economic and environmental benefits. This is because a load can be available to provide a decrease in demand while operating normally, whereas for a generator to be available to provide an increase in supply it must be operating below its maximum output capability. A generator must withhold capacity from the energy market all the time that it is offering the Ancillary Service, even if contingency events only occur a few times a year. This often means that the generator must operate away from its most fuel-efficient level.	
6.	EnerNOC	Recommendation 1	In addition, many loads can curtail their demand much faster than generators can ramp up their output, allowing them to provide the "very fast reserve" services mentioned in the Draft Report.	Noted.
7.	EnerNOC	Recommendation 1	Loads are allowed to provide SR (primary response), but this is done through tenders for fixed quantities rather than through an organised market, and the technical requirements imposed by System Management are inappropriate for provision by aggregations of small loads. The technical requirements for SR should be revised, so as to avoid excessive costs for aggregated portfolios of small loads. Specifically, once a proper market is introduced, there should be no need for participating loads to provide real-time telemetry. Neither the New Zealand market nor the NEM requires this. The quantity of reserves available can be taken from bids, with performance verified using high-resolution post-event data.	The IMO notes EnerNOC's comments and agrees that aggregated portfolios of loads (including small loads) may provide a valuable source of SR in a future market. The IMO notes however that while the participation of small loads in an SR market without full real-time telemetry may be feasible, it would involve non-trivial implementation and ongoing verification costs and so, like any such change, should be subject to an assessment of the benefits and costs to the market. The IMO notes that EnerNOC's suggestion is consistent with EY's Recommendation 1.

	Submitter	Issue	Comment/Change requested	IMO Response
8.	EnerNOC	Recommendation 1	When providing regulation services, loads typically have a faster response and better ramp rate than generators, so they can track the regulation signal more accurately. Loads had been an active part of the regulation markets for some time in PJM and Ontario. PJM has recognised the better performance of demand-side regulation providers by introducing "Performance-based regulation", and allowing traditional regulation providers, with more limited ramp rates, to follow a less dynamic regulation control signal. At present in the SWIS, loads are not allowed to provide LFAS because the Market Rules are defined only in terms of generators. The rules and procedures around LFAS should be rewritten so as to be technology neutral.	The IMO and EY have considered EnerNOC's comments and agree that loads have the potential to be a valuable future source of LFAS in the WEM. To reflect this, EY has updated Recommendation 1 in its Final Report to extend the recommendation (which originally related to SR-capable Facilities) to cover all Ancillary Services. However, the incorporation of loads into the LFAS Market would require some significant changes to the Market Rules and the associated systems and processes, and so the costs and benefits would need to be assessed before its progression.
9.	Perth Energy	Recommendation 1	Perth Energy notes that storage is gaining considerably more attention and that suitable technologies may become available for service in the SWIS in the not-too-distant future. For this reason, Perth Energy agrees with ROAM's recommendations which support the use of such technologies.	Noted.
10.	Synergy	Recommendation 2 and section 4.2.3	Synergy notes that in a small system such as the WEM it is important that all running generators contribute to the correction of a disturbance – it could not be assigned to a single machine or two. Essentially you are deciding that you will provide this service by either thermal machines or GTs. Synergy notes that the 'emerging technologies' (batteries) will not reach any form of material	The IMO agrees that the provision of governor response by generators provides a significant contribution to ensuring Power System Security in the SWIS. There appears to have been some confusion in the past about how the dead band requirement in the Technical Rules should be interpreted, i.e. whether the dead band requirement is +/-0.05 Hz or +/-0.025 Hz. System Management has confirmed that the latter interpretation

	Submitter	Issue	Comment/Change requested	IMO Response
			penetration within this review period. Given the rapidly emerging disparity between coal and gas prices, Synergy considers that least cost provision of SR/LRR will need to come preferentially from thermal machines rather than artificially dispatching GTs for this purpose. However, the only way this can happen is if governors are enabled on all units.	is the correct one. There has also been some discussion within the market over the last 12-18 months about whether in fact all generators are providing governor response in accordance with the Technical Rules. EY has included a new recommendation in its Final Report to confirm the compliance of all generators with these obligations (Recommendation 1A). The IMO understands that Western Power is currently undertaking a review of generators in the SWIS to ensure their compliance with the Technical Rules relating to governor response.
11.	EnerNOC	Recommendation 3	The idea of a separate market for 'very fast' response is also being developed in the New Zealand market, due to concerns about declining system inertia, such that 6-second response is too slow to be useful for some contingencies. The Electricity Authority and System Operator are also considering the idea of procuring reserves on the basis of effectiveness, rather than simple MW quantities, through an 'area-under-the-curve' approach.	Noted.
12.	Community Electricity	Recommendation 4	We support the suggestion that within the technical capabilities of the Facility, LFAS Facilities should be permitted to simultaneously contribute to SR and LRR. We perceive the provision of LRR by Downwards LFAS to contribute to the resolution of the prospective increase in the required LRR quantity due to the commissioning of the mid west network extension.	Noted.
13.	Community	Recommendations	Given that a Facility that is providing SR is not available to provide energy, which by its nature	The IMO agrees that a more flexible and accurate methodology for determining the SR requirement is

	Submitter	Issue	Comment/Change requested	IMO Response
	Electricity	7 and 13	would generally be low cost energy, we consider that these recommendations will materially reduce energy costs and should be prioritised. We acknowledge that System Management has over the years performed very well on the basis of the '70 percent' rule.	likely to achieve a higher level of system security while reducing both energy and SR costs, particularly if this change is accompanied by the introduction of a competitive SR market. The IMO however notes that the changes are non-trivial and their progression is likely to be dependent on the outcomes of the EMR. For this reason the IMO has recommended that the proposed improvements to the determination of SR and LRR requirements be considered as part of a larger, coordinated work package once the outcomes of the EMR are known.
14.	EnerNOC	Recommendation 7/ SR market	We also support Recommendation 7: it is rather shocking that the current approach allows for involuntary load shedding to result from a single credible contingency. We suspect that the reason for this departure from international norms is concern about the cost of procuring sufficient spinning reserves to avoid involuntary load shedding. Establishing an open, technology-neutral market for spinning reserves should reduce costs greatly, allowing a higher level of reliability to be achieved at lower cost.	Please refer to the IMO's response to issue 13. The IMO notes that the introduction of a market for SR is the fourth ranked issue in the current Market Rules Evolution Plan (MREP), and is also being considered by the EMR.
15.	Perth Energy	Recommendation 10	Perth Energy strongly supports moving towards a five minute dispatch interval and sees the reduction in Ancillary Service Requirements as another strong point in favour of this development.	Noted.
16.	Synergy	Recommendation 13	Synergy considers that this recommendation (factor dynamically forecast load relief into the SR requirement) needs to be very carefully considered. Synergy notes that it is important to balance the risk of Under Frequency Load Shedding (UFLS) events versus the cost of avoiding UFLS in order to achieve the most	Following the consultation period the IMO met with EY and Synergy to discuss Synergy's submission. During this meeting Synergy noted its concerns about the potentially high cost of moving from the current '70 percent' methodology for determining the SR requirement.

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			appropriate outcome. Synergy is happy to discuss this recommendation further with the IMO and its consultant in the development of the Final Report.	Based on the analysis presented by EY in its Draft Report, the IMO considers it likely that increases in the cost of SR in Off-Peak periods (when the requirement is likely to exceed 70 percent) could be offset by the savings of a reduced requirement in Peak periods (when the cost of providing SR is likely to be higher). The IMO also considers that overall costs are likely to be reduced through the introduction of an SR market. However, the IMO agrees that further analysis is needed to confirm that the higher SR standard can be achieved without imposing any unacceptable cost increases on the market.
17.	Perth Energy	Recommendation 15	ROAM has made recommendations in respect to the minimum size of black start facilities. Perth Energy sees this as a purely technical issue and defers to the assessment of System Management.	Noted.
18.	Synergy	Recommendation 15	Synergy considers that at the very least the required minimum capacity of black start units should be so that a Frame 6 gas turbine (GT) could provide those services. Further, Synergy disagrees with the report that states “since 20 MW is likely not sufficient to start a large gas turbine, such as one of the Pinjar, Kwinana High Efficiency Gas Turbines (HEGT) or Kemerton units”. Synergy notes that a Frame 9 GT has a 1.2 MW starter motor plus approximately 400 kW of ‘other’ auxiliaries. As such, Synergy considers that a 20 MW machine is more than adequate to start a Frame 9 GT. The HEGTs need even less than this due to them being lighter aero-derivative machines. Synergy notes that increasing the minimum capacity of black start units would potentially lead	EY has advised the IMO that, after discussing the issue further with Synergy and System Management, it is not convinced there is a need to increase the minimum capacity requirement for black start units from 20 MW to around 40 MW. EY has updated its Final Report accordingly.

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			to an increase in the contract costs for this service. Given smaller units can provide the service, Synergy questions whether these is a clear need for change.	
19.	Synergy	Recommendation 16	Synergy notes that "allowing generator excitation to commence whilst its generator circuit breaker is closed" is a highly non-standard requirement for any GT. Synergy notes that the IMO needs to be cognisant that such a requirement would come at additional cost to the market. Further, Synergy considers that there is a real risk here that the level of customisation required could discourage participation by any existing generators.	Following further discussion with Synergy and System Management, EY advised the IMO that it now considers requiring a 330 kV connected black start unit to energise a 330/132 kV 490 MVA transformer by "allowing generator excitation to commence whilst its generator circuit breaker is closed" may be unnecessarily onerous. EY considers that the issue requires further investigation and had amended its Final Report accordingly.
20.	Synergy	Page 4 – LRR cost	Synergy disagrees with the statement "The ERA determined the current cost of LRR to be zero 'because it did not have information demonstrating that the Load Rejection Reserve Ancillary service is provided at a particular (unremunerated) cost to any Market Participant'". Synergy considers that LRR requirements lead to increased cycling of thermal plant (and the associated de-commitment and cycling costs) as well as increasing prevalence of negative pricing in the market.	The IMO notes that the statement in question is a direct quote from the document published by the ERA on 18 March 2013 titled "Determination of the Ancillary Service Cost_LR Parameter"[3], and is not intended to represent EY's views on the costs of providing LRR in the WEM.
21.	Synergy	Page 9, section 2.1.3 – Governor response	Regarding ROAM's comment "In the WEM, a generator will not normally have to contribute governor response for long unless they are providing SR or LRR" – Synergy notes that not all machines are on AGC in Western Australia and, at	The IMO agrees that there may be a greater call on governor response in times of higher frequency volatility (e.g. when severe wind events are occurring). The IMO further notes that the burden on each generator of providing governor response should be minimised if all

[3] See page 3 of: http://www.erawa.com.au/cproot/11212/2/20130318%20-%20Determination%20of%20the%20Ancillary%20Service%20Cost_LR%20Parameter.pdf. The full paragraph is as follows: "System Management's submission stated that it had not previously sought an allocation for the 'L' component of the Cost_LR parameter because it did not have information demonstrating that the Load Rejection Reserve Ancillary Service is provided at a particular (unremunerated) cost to any Market Participant. System Management has retained this position and made no change to the allocation of zero value for the 'L' component of the Cost_LR parameter for the period from 1 July 2013 to 30 June 2016".

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			times when severe wind events are occurring, it is not unusual for governor action to be controlling the frequency in response to movements in wind farm output, not regulation service.	generators have their governors enabled as required under the Technical Rules.
22.	EnerNOC	Section 3.2.2	Section 3.2.2[4] misquotes the PSOP: Ancillary Services. What is written in the report makes sense; the current PSOP text does not. While clause 2.2.6(b) of the PSOP allows for Load Facilities to provide Class A SR, clauses 2.2.7(c) and 2.2.8(c) do not refer to Load Facilities. A literal reading of the PSOP suggests that Load Facilities are only allowed to provide Class A SR, not Classes B or C. This is probably not intended, but is contradicted by System Management's 'Short Term Spinning Reserve Opportunity' letter, which specifies a 500 millisecond response and 15 minute duration – i.e. faster than Class A and as long as Class C.	The IMO agrees that the steps 2.2.7 and 2.2.8 of the PSOP: Ancillary Services should be updated, to remove any doubt about the eligibility of Load Facilities to provide Class B and Class C SR (as some already do under ASCs). This is consistent with EY's Recommendation 1 (to ensure requirements for SR-capable Facilities are technologically neutral).
23.	Synergy	Section 4.2.5	Regarding ROAM's comment "Furthermore, non-Synergy providers of LFAS are currently expected to act like other IPP units and quickly act to restore their output to their set points after a governor response, if such response is actually provided. These units may not therefore be providing the required SR/LRR, even if they are technically capable": Synergy considers that the Market Rules requirement results in perverse outcomes and that consideration should be given to a methodology to allow IPPs to remain away from a set point to	The IMO notes that if, for example, an LFAS Facility increases output through governor action in response to a sudden frequency drop, then there is nothing in the Market Rules or PSOPs to prevent that Facility from maintaining (or further increasing) its output level if instructed to do so via its AGC signal. It appears however that some LFAS Facilities are unable to maintain their initial governor response levels in these circumstances, because of either physical limitations or environmental concerns. The Market Rules also already contain the necessary mechanisms to allow for non-LFAS IPP Facilities to be

[4] The IMO confirmed with EnerNOC that its comments related to section 3.2.2 of the Draft Report, not section 3.3.2 which discusses LRR.

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			continue to assist in a contingency event, rather than requiring an IPP to immediately return to a set point, which can in fact exacerbate a contingency event.	appropriately compensated (through constrained on/off compensation) if they maintain their initial governor response output levels to assist with the recovery of the system frequency after a major frequency disturbance.
24.	Synergy	Section 4.3 – fast start units	Synergy does not agree that all fast start generators are currently owned by Synergy. Synergy considers that there are many other IPP Facilities that are capable of fast starts, including ERM Neerabup, Alinta Wagerup, Perth Energy Kwinana and the Tesla diesels.	EY has confirmed with System Management that at least one IPP Facility is capable of starting up and synchronising within 15 minutes. EY has updated its Final Report accordingly.
25.	Synergy	Section 9.1 – causes of LFAS	Synergy agrees that it is a likely scenario that if the Balancing Portfolio was to be dispatched on an individual facility basis (i.e. the same as for IPP Facilities), then the amount of LFAS usage in the WEM would increase – as noted by the IMO's consultant.	Noted. However, the IMO also notes EY's finding that "containing frequency to its normal range (between 49.8 Hz and 50.2 Hz) for 99.9 percent of the time is much more onerous than typical standards elsewhere; in the markets EY reviewed, the performance standards varied between 97 percent and 99 percent". Further, the performance level of (at least) 99.9 percent adopted by System Management is significantly above the 99 percent level required in the Technical Rules. As discussed in the response to issue 1 above, the IMO considers it likely that the LFAS requirement is currently higher than it needs to be. The IMO also considers that the potential LFAS impacts of a move to facility-based bidding would likely be greatly reduced if the change formed part of a larger suite of changes, some of which would act to either reduce LFAS sources (e.g. shortening the dispatch interval) or promote competition for the provision of the service.
26.	Synergy	Section 12.2 –	Regarding System Management's assessment of	In discussions with the IMO and EY, Synergy advised

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		TTHL capability	the ability of coal and cogeneration power stations in the WEM to use TTHL schemes to provide black start support: Synergy does not agree with System Management's assessment that the coal and cogeneration power stations in the WEM are not suitable to act in this manner for system restart purposes. Synergy considers that whilst newer plants like Collie and Bluewaters could not sustain, plants like Muja A, B, C and D do have the ability to TTHL, with some control system work. Synergy notes that the new governors at Muja CD in particular have demonstrated the ability to withstand a 100 percent load rejection without overspeed.	that while its coal Facilities do not currently have TTHL capacity, it should be possible to upgrade at least the Muja Facilities so that they could use TTHL to provide a System Restart Service. EY has updated its Final Report to clarify that the relevant Facilities are *currently* unsuitable to provide this service.
27.	Perth Energy	Table 12.3 - Perth Energy Kwinana Swift	There is one error in Table 12.3 which describes Facilities that currently provide black start services to the system. The Perth Energy Kwinana GT1 is shown as 30 MW with a footnote commenting that there are four 30 MW units at Kwinana Swift, however System Management only use a single unit in the system restart scenario. This is incorrect. The black start contract for this station is for the full 120 MW capacity and Perth Energy is required to ensure that this full capacity is available to System Management at all times.	EY has updated the Final Report to correct the error in Table 12.3.