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TECHNICAL REVIEW OF MID-WEST ENERGY PROJECT REGULATORY TEST APPLICATION

Prepared for

ECONOMIC REGULATION AUTHORITY

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1. INTRODUCTION

Western Power is planning to construct a double circuit 330 kV transmission line between Pinjar and Eneabba in the Mid-West region of Western Australia, and also to construct a new 330 kV terminal station at Three Springs to provide an additional point of injection into the existing transmission grid serving the Mid-West region. This project is the first stage of a proposed two-stage project that, if fully implemented, would see Western Power's 330 kV high voltage network extended north from the Perth metropolitan area to Geraldton.

The existing transmission grid serving the Mid-West region operates at the lower voltage of 132 kV and is loaded to its design capacity. Western Power believes that a higher voltage augmentation is needed to:

- supply the increasing demand for electricity in the Geraldton area, driven largely by accelerating industrial development;
- allow wind- and natural gas-driven electricity generation located in the Mid-West region to connect to the grid and participate in Western Australia's wholesale electricity market; and
- supply new mining loads located in the Mid-West region. Two new iron ore mines, Karara and Extension Hill, are currently under development and both are seeking to connect to Western Power's grid.

The proposed project is a major augmentation as defined in the Electricity Networks Access Code 2004 (Access Code) and therefore, in accordance with clause 9.2 of the Access Code, cannot proceed until it has passed the Regulatory Test. The Regulatory test requires Western Power to satisfy the Economic Regulation Authority (Authority) that its proposed project maximises the net benefits to those who generate, transport and consume electricity, after considering alternative options[1].

To this end Western Power has therefore submitted a major augmentation proposal to the Authority. The Authority has engaged Geoff Brown & Associates Ltd to review this proposal and assess the extent to which it meets the Regulatory Test requirements from a technical and engineering perspective. This report presents the results of this review.

[1] Access Code, clause 9.3.

2. BACKGROUND

Western Power's Mid West transmission grid spans 400 km from the northern outskirts of Perth to north of Geraldton. The original grid comprised two single circuit 132 kV wood pole lines in the southern section between Perth and Three Springs and a further two single circuit wood pole lines in the northern section between Three Springs and Geraldton. The network was reinforced through the construction of a double circuit 132 kV line between Pinjar and Eneabba, completed in 2004.

Western Power advises that this double circuit line augmentation has ensured that the network now has sufficient capacity to supply forecast loads in the western corridor between Perth and Eneabba but the network capacity available to supply Moora, Three Springs and loads north of Three Springs is limited. This constrained part of the Mid West region is still reliant on the original grid for its electricity supply. Western Power's system studies indicate that the maximum load that can be supplied in the constrained area, assuming a firm supply[2], is approximately 135 MW. This load is supplied by the Mungarra Power Station, which is operated in a network support role, and the two 132 kV circuits injecting power into the area from Perth (Muchea and Eneabba), with some support from the Walkaway wind farm. Low cost strategic upgrades to the existing network have been identified that would increase the firm supply to about 155 MW. Beyond that level of demand, new transmission lines, at 132 kV or higher, are unavoidable[3].

The current peak demand in the constrained area is 115 MW. If it is assumed that this demand continues to grow at historic growth rates, with no new mining or other block loads, the existing network will be satisfactory until about 2021. If the electricity demand associated with the proposed Oakajee port facility (approximately 25 MW) is included then the significant network augmentation will need to be brought forward to about 2016. There is no way the existing network can supply new mining loads located in the Mid-West.

The existing network will also not support the connection of additional generation, either in the Eneabba or Geraldton regions. The potential for the connection of additional generation and its impact on the operation of the Wholesale Electricity Market (WEM) was mentioned only in passing in Western Power's regulatory test application. We consider this issue is significant and therefore merited significant in-depth discussion and analysis in Western Power's major augmentation proposal, which, in our view, should have provided a fuller picture of the benefits that all stakeholders would derive from the augmentation.

[2] It is not normal industry practice to load the grid up to its full available capacity, since this would mean that some connected customers would be disconnected following an unplanned fault on a transmission line or a connected generator. In this event the reliability of supply would be considered unacceptable. Firm supply implies that the network is loaded to a level consistent with good industry practice.

[3] Western Power advises that the constraint cannot be overcome by installing additional generation close to Geraldton because of the need to maintain power system stability under dynamic operating conditions. While we have not undertaken a detailed review of Western Power's network simulations, we consider this reasonable.

3. MINING LOADS

Western Power's Regulatory Test Application is based on an immediate need to provide a supply for the new Karara Mine Stage 1 development. However, given the submissions made to both Western Power and the Authority in the public consultation process associated with this regulatory test, Karara Stage 1 is only the first of a number of potential mining loads in the Mid-West area. Known potential loads are summarized in the Table 1 below.

Table 1: Potential Mining Loads

Project	Maximum Demand (MW)	Required	Comment
Karara			
Stage1	120	2013	This is the foundation customer. Contract negotiations with Western Power are well advanced. Karara is planning to construct a double circuit 330 kV line between Eneabba and Three Springs and Western Power will lease capacity on this line.
Stage 2	152	-	Timing uncertain.
Extension Hill			
Stage 1	150	2014	This project was put on hold as a result of the global financial crisis but has recently been reactivated. A final investment decision is expected in Q1, 2012, with the mine operating at full capacity by Q4, 2014. The load includes 125 MW at the mine site with the remaining load supporting a slurry pipeline between the mine site and the port of Geraldton. The project has secured a route for a 330 kV transmission line between Three Springs and the mine site. This will be double circuit to provide for future stages.
Stage 2	300	-	Timing uncertain.
Stage 3	300	-	Timing uncertain.
Jack Hills			
Stage 1	-	-	Currently in operation
Stage 2	163-246	-	Feasibility study in progress. Three options for a lower supply are being considered: (a) Combined cycle gas fired power station at Jack Hills (b) Combined cycle gas fired power station at Oakajee (c) Construction of a 330 kV line to proposed terminal station at Three Springs.

In the context of the existing grid capacity in the constrained Mid-West region, the prospective mining loads in the above table are large. For example, the Stage 1 load at the Karara mine alone is greater than the total present electricity demand in the constrained area. This means that future augmentations to the grid supplying the Mid-West area will be driven by the need to supply large spot loads at two or three mining sites rather than the more normal situation of supplying a forecast increase in the electricity demand of large numbers of indirectly connected small use customers dispersed over a wide area.

This unique situation has a number of implications. Firstly, it implies a high level of uncertainty that creates a significant planning risk. The optimal grid development program to provide for the Stage 1 Karara mine alone will be very different from the optimal program if all the projects identified in Table 1 were to proceed over a period of say 15 years. Hence, planning the network for a low growth scenario will not lead to the least cost development outcome should a high growth scenario eventuate. On the other hand, planning for a high growth scenario will prove very costly if the planned load does not materialize. In this event capacity would have been installed that will never be used.

These planning risks can be very real – in New Zealand there is a 250 MW thermal power station that was completed about 1982 and which, for a number of reasons, was never commissioned.

Secondly, it may be necessary to modify the standard planning criteria embodied in the Technical Rules in order to achieve economically sensible outcomes. As indicated in Footnote 1, it is normal practice to build a degree of redundancy into a transmission network in order to ensure an acceptable quality of supply and the Technical Rules, which form the basis for Western Power's grid development planning, require this. However, there is an economic cost to the provision of redundant capacity and, for very large point loads such as mining loads, this cost could potentially be very high. The Technical Rules were designed to support development of the grid to meet incremental load growth and we see a risk that, if they are blindly applied to the development of the Mid-West grid, outcomes that are inconsistent with the objectives of the Access Code could result. More specifically, the Technical Rules are designed around an implicit assumption that, while new users must pay the cost of connecting their loads to the grid, the cost of deep seated grid augmentations to support load growth would be shared by all grid users. However it could be argued that requiring grid users to pay for high cost grid augmentations required primarily to provide supply security to large mining loads would not be consistent with the economic objectives of the Access Code. In other words, if large mining companies require n-1 supply security then they should pay for it (to the extent that the redundant capacity is not required to provide security to other grid users) and not to be subsidized by other grid users.

Planning the development of the Mid-West grid requires assumptions to be made on the timing and development of mining load in the region. Western Power's Regulatory Test Application has presented two load growth scenarios[4]:

- A medium growth scenario that includes the Stage 1 Karara mine development and the Oakajee port. This assumption also includes slightly higher incremental growth rates than has been historically experienced, to allow for flow-on load resulting from the additional economic activity. Under this scenario peak demand in the constrained area is forecast to increase from the present 115 MW to about 275 MW in 2014 and then grow incrementally to about 340 MW in 2030.

- A high growth scenario that adds Extension Hill and Karara Stage 2 loads to the medium growth demand forecast. Under this scenario peak demand in the constrained area is forecast to rise to 650 MW by 2018 and then grow incrementally to about 700 MW by 2030. There is no provision in the high growth scenario for Extension Hill Stages 2 and 3 or for the proposed Jack Hills development.

Submitters to the public consultations generally considered Western Power's medium growth scenario to be an unduly conservative basis for design and Western Power itself has said that it considers that its high growth forecast has a high probability of being achieved. At the time the Western Power submission was prepared the Extension Hill development was on hold as a result of the global economic crisis and the project has only recently been reactivated. It is reasonable to conclude that the probability of Extension Hills proceeding is now much higher than it was when Western Power prepared its regulatory test application.

Beyond the Extension Hill project, the probability of additional mining load eventuating, and the timing of any such development, is much less certain. This makes grid planning very difficult. Primary grid assets have a high capital cost, an economic life of 40 years or more and no alternative use. The incremental cost of incorporating additional capacity to meet future needs is low compared to the cost of providing this capacity through the construction of a completely new asset. Thus if additional mining load is likely to materialize within a reasonable time frame relative to the economic life of the assets then it may well be more economic to make provision for this load now rather than have to construct a new asset in the future. Western Power has undertaken its cost benefit

[4] We have discounted the low growth scenario as irrelevant to the Regulatory Test. It assumes no mining load and Western Power has said that it will not proceed with the proposed augmentation in the absence of mining load.

analysis over a period of 20 years, which we think represents a reasonable balance between risk and cost since a load connected at the end of the 20 year planning period would still get 20 years use out of the asset.

The very limited information that has been made available to us means that we need to be very cautious about making predictions. However we cannot see Jack Hills connecting to the grid at Three Springs because of its distance from the mine, although a connection at Moonyoonooka, should the second stage of the Mid-West Energy Project proceed, is a possibility. However, in this event, it could be that the load would be supplied largely from new generation located in the Geraldton / Oakajee area, most likely combined cycle gas turbine plant as suggested by Crosslands in its submission.

However any Stage 2 load at either Karara or Extension Hill will likely connect at Three Springs and the planning question to be considered is whether these projects will proceed within the 20-year planning period. Given the extent of the resource available at each site we think it reasonable to assume for planning purposes that at least one of these expansions will proceed before the end of the planning period in 2030, even if timing is delayed compared to the assumed timings in West Power's high growth forecast. This would mean that, even if load growth falls short of Western Power's high load forecast of 650 MW by 2018, its forecast period end demand of 700 MW by 2030 is likely.

We therefore conclude that Western Power's high load forecast has a high probability of being realized and is therefore a prudent basis for grid planning. In this review we have therefore given a high weight to Western Power's high growth scenario.

4. WESTERN POWER'S REGULATORY TEST ANALYSIS

4.1 INTRODUCTION

Western Power originally proposed a major network augmentation project to enhance capacity for the constrained Mid-West region through the construction of a 330 kV transmission line from Pinjar (northern outskirts of Perth) to Moonyoonooka (just outside Geraldton). This project received regulatory test approval in 2007 and NFIT pre-approval in 2008. However, more refined cost estimates indicated substantially increased costs. A review during 2009 led by the Department of Treasury and Finance and the Office of Energy recommended undertaking the proposed project in stages. Subsequent to this decision Western Power undertook to review the project, its costs and drivers, in order to submit a business case to government and, if appropriate, to prepare revised regulatory test and NFIT pre-approval submissions.

The project has been significantly restructured as a result of this review. Western Power has determined that, in the short term, load growth in the Geraldton area, which we understand to have been the primary driver for the original project, can be accommodated through a combination of low cost strategic grid upgrades, demand management and the controlled dispatch of available generation in a network support role.

However the need has now arisen for an electricity supply 120 MW if Stage 1 of the Karara mine is to proceed. Three options to provide this supply are available:

- A stand-alone generation plant located at the mine site. ACIL Tasman has compared the cost of energy from a grid connected supplier with the cost of energy from a site located supplier. It has estimated a savings in energy costs in real terms of $51.24 per MWh in 2014 to $55.71 per MWh in 2030. Assuming a typical annual energy consumption of 1000 GWh for a mine of this size, this represents savings of more than $50 million per annum if energy is purchased from a grid connected supplier. ACIL Tasman notes that the benefits of grid connection arise from having access to a large and more diverse generation plant mix, economies of scale through larger generation units, more diverse and secure fuel supply and greater opportunities to purchase low cost energy in off peak times. It must be noted that the ACIL Tasman analysis covered energy costs only and did not consider power delivery and connection costs. However, the savings in energy costs estimated by ACIL Tasman would be more than sufficient to fund these transmission related costs.

- A dedicated supply from a local generator through a bilateral contract. This would require a connection between the generator and the grid, which could be provided either by a dedicated transmission line or by using the Western Power grid. The only potential supplier that has been identified is Eneabba Gas, which has the required environmental consents for a 170 MW gas fired plant located at Dongara, about 90 km north of Eneabba. While this plant is located near the top of the access queue, there is insufficient grid capacity to accommodate the connection until the proposed new line between Eneabba and Moonyoonooka is completed. We have been unable to obtain much useful information on the costs of a direct connection to the mine to support a dedicated supply but, given the existence of a willing seller and willing buyer, we consider it safe to assume that this option has been considered by the parties involved and discarded for economic or technical reasons.

- A grid connection. This is clearly the preferred solution, even though a grid augmentation is required in order to make supply available. In essence, Western Power's Regulatory Test Application is about determining the optimal design and capacity of this grid augmentation given the likelihood that loads other than Karara Stage 1 may subsequently seek connection (and taking into account the potential benefits to other grid users from any grid augmentation).

4.2 DISCARDED SUPPLY ALTERNATIVES

Under the regulatory test, Western Power is required to consider a range of alternatives before arriving at the prefeered alternative. Normally the "do nothing" option is also considered, although in this case this option has been ruled out for the reasons discussed in Section 4.1 above.

Western Power has considered a number of alternatives, which it has ruled out for technical reasons. These include:

- Maintaining the existing maximum grid voltage of 132 kV in the Mid West and supporting this voltage with reactive compensation. Western Power has indicated that a new uncompensated 132 kV line would have insufficient capacity to meet Karara's Stage 1 requirement but its planning report indicates that the required capacity could be achieved either with a compensated new 132 kV line, or by reconductoring existing lines to increase their thermal capacity and also adding reactive compensation. However, while it does not appear to have undertaken any formal analysis, Western Power believes this option would be more expensive than alternative options. It notes that, typically, compensation is applied rather because a higher capacity line cannot be built (e.g. due to environmental restrictions), or to provide incremental increases in capacity to an existing system, or for longer lines. It is not normally economic in combination with new line construction especially for the line length required to the North Country region. We agree with this assessment.

- Installing a high voltage direct current (HVDC) system. HVDC can be an efficient method of transferring large quantities of power over long distances, between two unsynchronized grids or through submarine cables. The high cost of alternating-direct current converter stations make this technology uneconomic over distances of less than about 600 km, between connection points. If HVDC technology were economic for this application there would already be a significant number of high capacity HVDC systems within the east coast grid[5].

- The use of a higher voltage than 330 kV. Western Power did not consider this option for three reasons. The first was that the environmental approvals that have been received are for construction of a double circuit 330 kV line and conversion of the project to 500 kV (which is a standard voltage on the east coat grid) would incur significant delays to the extent that KML's nominated deadlines could not be met. The second issue was that the amount of load that could be carried on a single 500 kV circuit would be limited by issues of frequency rise if the line tripped. While there are possible technical solutions to this issue (including provision of fast generator runback or trip, initiated by the line breakers opening), there are commercial issues around the implementation of such schemes in a market system. Resolution of these and implementation of a scheme could well delay the project. Finally, to supply Extension Hill with firm supply (up to its connection point at Three Springs) would require the line to be double circuit, which would increase the cost of the project to provide capacity that may not be required. The quality of supply required by Extension Hill is discussed in Section 4.4.1.

  Given the discussion in Section 3, where we concluded that Western Power's high forecast was indeed a prudent basis for design, and given that this high forecast does not provide for the potential expansion of the Extension Hill mine or the connection of any unidentified new mining loads within the 20-year planning period, we believe a more detailed consideration of the potential higher voltage would have been useful. However, given the history of this project, and the budgetary constraints imposed on Western Power by the Western Australian

[5] The only high capacity HVDC scheme in Australia is between Victoria and Tasmania. An HVDC system was necessary for this link because of technical problems associated with the transmission of power over long distances though a submarine cable. There are also two low capacity HVDC schemes (Direct Link between Queensland and New South Wales) and Murraylink between New South Wales and South Australia). These use a different, proprietary technology, known as HVDC Light, and do not have the power transfer capacity required for the Mid-West application.

Treasury, we suspect that a voltage higher than 330 kV was never a realistic option.

4.3 REGULATORY TEST ALTERNATIVES

Having determined that a grid augmentation will be required to meet the Stage 1 Karara mine load, Western Power has undertaken a series of systematic network studies to identify feasible grid alternatives. A key assumption in these studies was that a reduced reliability (n-0) supply was acceptable at mine sites, but other grid users would be entitled to a supply fully consistent with the Technical Rules. The studies looked at the following options for a range of voltages between 132 kV and 330 kV.

- A single radial circuit, which would be completely independent of the existing Mid-West grid, between Perth and the mining area. The study found that a 245 kV radial circuit was needed to supply sufficient load to support Karara Stage 1 only and that a 330 kV radial circuit would provide about 280 MW of load (sufficient for Karara Stage 1 and either Extension Hill Stage 1 or Karara Stage 2).

- Some additional capacity could be made available at a relatively small incremental cost by providing an interconnection between the above circuits and the existing 132 kV network at Three Springs. Under this arrangement the initial mine site load that could be supported by a 330 kV circuit would increase to about 330 MW. This would give a little additional capacity but insufficient to support both Extension Hill and Karara Stage 2 in addition to Karara Stage 1. A second 330 kV circuit would be required before the last of these three potential mine developments could proceed.

- In order to provide significant additional mine site capacity the new development would need to be double circuit, irrespective of voltage. Western Power proposes that one of these circuits is initially operated at 132 kV in place of the old wood pole single circuit line, and not operated at full voltage until the mining load requires it. The mine site loads that could be supplied by double circuits at the voltages studied by Western Power (with the second circuit operating at full voltage) are shown in Table 2 below.

Table 2: Impact of Voltage on Mine Site Load Capacity

Voltage (kV)	Initial mine site load (MW)	Comment
220	270	Insufficient for both Karara Stage 1 and Extension Hill
275	410	Possibly sufficient for Karara Stage 1, Extension Hill and one further development after allowing for some diversity. However the situation appears marginal and some additional low cost strategic grid augmentations may be needed if all three developments were to be supplied.
330	530	Adequate capacity for three mining developments.

While Western Power has, for completeness, analysed a range of voltages between 220 kV and 330 kV we would be very reluctant to suggest that it should build the new line at a voltage other than its current standard voltage of 330 kV. In order to standardize designs, minimize spares inventory and ensure interchangeability of equipment it is considered good industry practice to standardize the voltage levels within a power network. The minimum ratio between two adjacent voltage levels on the same network is typically 1.8. Western Power has standardized on 132 kV and 330 kV and we believe there would need to be a very compelling economic argument for the line to be constructed at a non-standard intermediate voltage[6]. In any case the analysis presented in the above table indicates that neither 220 kV nor 275 kV would be optimal.

[6] We acknowledge that the Goldfields line is constructed at 220 kV. We suspect this is a historical anomaly, where 220 kV was used in preference to 132 kV because of the length involved. We do not consider 220 kV to be a standard Western Power voltage.

If it is decided to standardize on a 330 kV solution the choice reduces to a single circuit alternative, with sufficient capacity to provide a non-firm supply to both Karara and Extension Hill and a double circuit option, which would also provide non-firm capacity either for a Stage 2 expansion at one of these sites or a third mine. This is consistent with the results of Western Power's regulatory test analysis, which shows that, while the single circuit option has the least net present cost in its medium load forecast scenario, the double circuit option is more cost effective if the high load forecast is assumed. These relative costs are shown in Table 3 below.

Table 3: Net Present Costs

	Net Present Cost ($ million)	
	Medium Load Forecast	High Load Forecast
Single Circuit 330 kV	401	592
Double Circuit 330 kV	430	444

4.4 ADDITIONAL COMMENTS

4.4.1 Security of Supply

As noted above, Western Power's regulatory test analysis assumes that mine loads would be non-firm. However Western Power has recently advised that Extension Hill wants firm capacity to be available at Three Springs. This would require the network to be operated less fully loaded in order to leave redundant capacity available to provide supply in the event of a fault. Our assessment is that this may mean that the double circuit 330 kV option would only be able to supply Karara and Extension Hill, with no further capacity available to supply additional mining load.

It is not known why Extension Hill wants firm capacity at Three Springs as Karara does not have a similar requirement. It may be that a firm supply is required to ensure the integrity of the slurry pipeline that it proposes to build to transport the iron ore between the mine site and the port at Geraldton. However the slurry pipeline will only use a relatively small portion of Extension Hill's electricity demand and it may be possible for the firm supply requirement to be limited accordingly. This could allow the double circuit option to support additional mine development while at the same time ensuring that Extension Hill got the security of supply it needed.

We would expect the level of supply security required by Extension Hill to be reflected in its transmission rate.

4.4.2 Impact of Generation

Western Power's regulatory test analysis assumes that all load in the constrained Mid-West area would be supplied by generation located to the south, outside the area. Hence all load, is assumed to be transferred from south to north over the proposed new 330 kV line and the existing 132 kV circuits between Perth and Eneabba/Three Springs.

While this assumption is likely to be valid for the early part of the planning period, we consider it unrealistic as the mining load increases. Gas from the Dampier to Bunbury natural gas pipeline is available in the Mid-West, which could make the area attractive for new gas fired base load generation. While the only firm gas fired generation identified at present is the Eneabba Gas plant at Dongara, we think other projects may emerge, particularly if the northern section of the Mid-West Energy Project proceeds. If local load is available, price signals from the WEM should encourage such development. Injection of base load power at locations north of Eneabba and Three Springs may reduce the need for power transfer capacity from Perth. This could mean that the proposed 330 kV double circuit line may be able to support additional mining loads over and above that estimated in the above high level analysis.

The amount of generation that can be connected north of Eneabba/Three Springs is likely to be limited by grid stability considerations and will be influenced by the capacity of the

new line to be installed between Eneabba/Three Springs and Perth. If the Authority decides, as a result of this review, that a new double circuit 330 kV line should be constructed, Western Power still has a range of options in respect of the capacity of the new line. This will be determined by the size of the conductor used and the number of conductors in each phase bundle. As line capacity will impact the cost of the project, we assume that the basis on which the capacity of the 330 kV line was determined will be included in Western Power's NFIT pre-approval application. We think this analysis should consider not only the ability of the grid to support mining and other loads but also its ability to support the connection of new generation without becoming unstable. This will allow a fuller understanding of the benefits of the proposed augmentation than is possible from the information available at this time.

4.4.3 Project Costs

Accurate estimation of project costs is a difficult exercise because of the wide range of variables that can affect the delivered cost of a new project. Cost estimation is also an area that Western Power has historically not done well, as evidenced by the fact that the costs submitted to the Authority with the original regulatory test and NFIT applications for the Mid West grid augmentation were underestimates by a substantial margin.

As a result of this experience, Western Power has revised the cost for this project using much more detailed and up-to-date information and has had the revised cost estimate peer reviewed. We understand this revised cost estimate forms the basis for the cost of the preferred double circuit 330 kV project. Costs of other alternative options used in the regulatory test cost benefit analysis were obtained by adjusting the double circuit base estimate for the cost impact of design differences. Data for these adjustments has come from a number of sources, including the delivered cost of recently completed projects and current equipment procurement prices.

Western Power has said that its costs are accurate to +/-30%. We have not conducted a detailed review of Western Power cost estimates but are satisfied that the differences in the costs of the different options considered in Western Power's cost benefit analysis are reasonable. We are also satisfied that the accuracy of Western Power's estimated project costs has not impacted the outcome of this review.

A much more accurate estimate of the cost of Western Power's preferred option will be required for NFIT pre-approval.

5. OTHER ISSUES

5.1 INTRODUCTION

We have identified a number of other issues relevant to the Mid-West Energy Project which have either not been identified in Western Power's Regulatory Test Application or have been dealt with in a very superficial manner. This section of the report discusses these issues in more detail and in particular their potential to impact the selection of project alternative. We think much of the material discussed in this section should have been included in Western Power's original Regulatory Test Application in order to ensure that the Authority had access to all relevant information before making its decision[7].

5.2 MARKET BENEFITS

Limitations on the power transfer capacity of the existing 132 kV network serving the Mid-West mean that is not possible for generation located in the Mid-West to participate in the WEM. This is because the existing network has insufficient power transfer capacity to move the electricity from the point of generation to the major load centre in the Perth metropolitan area. A consequence of this may be that electricity consumers are paying more for energy than would otherwise be the case. This is because if low cost generation cannot be connected, then more expensive generation, paid for by consumers, must be operated in its place. Market benefits will arise from the savings that will accrue from low cost generation being able to connect.

We understand that Western Power has current applications from in excess of 1400 MW of new generation in the Mid West region that it is unable to connect because of a lack of transmission capacity. Apart from the 170 MW Eneabba Gas plant, the generation is all wind, driven by the fact that the wind resource available in the Mid-West is higher than other regions of the SWIS and amongst the highest in Australia.

Western Power has provided the Authority with a copy of a study that it commissioned on the market benefits of new wind generation being able to connect to the network as a result of the completion of both sections of the Mid-West Energy Project. The study notes that the economics of wind generation will be driven by the Government's REC scheme and also by the carbon pollution reduction scheme, which it is assumed will come into operation in 2013. As a result of these schemes the provision of wind generation is a national market. However the availability of REC certificates is limited and modelling undertaken for the study indicates that it is therefore unlikely to be economic for all the wind generation projects in the access queue to connect to the Mid-West grid over the 20-year study period.

Net benefits considered in the study included additional revenue to the generators that do connect and lower costs to consumers. Hence, the study looked at energy costs only and did not take into account the capital cost of the grid augmentations necessary to allow this generation to connect. The study shows that there are real market benefits from the connection of new wind generation in the Mid West region but that these benefits alone may not be sufficient to cover the costs of the grid augmentations that would allow the generators to connect. However, the augmentations are also required for other reasons and the benefits would not be captured if they did not proceed.

5.3 LINE ROUTES

Western Power has provided a copy of its line route assessment for the southern section of the Mid West Energy Project. This assessment notes that the last transmission easement in the area was obtained in the area about ten years ago for the construction of the double circuit 132 kV line between Pinjar and Eneabba. A proposal to construct the new line adjacent to the route of the existing single circuit wood pole line was rejected at

[7] Sections 9.3 and 9.4 of the Access Code require that the Regulatory Test assess whether the proposed augmentation maximises the net benefits to those who "generate, transport and consume" electricity, having regard to all reasonable alternative options. There is a risk that, if a major augmentation proposal does not properly take into account all identifiable benefits to grid users, the preferred option may not be optimal.

the time in favour of a western alignment that entails a significant deviation from the straight line route between Pinjar and Cataby.

The report indicates some difficulty in obtaining transmission line easements, particularly in the area immediately north of Pinjar. This leads us to conclude that it would be prudent to maximize the use of available easements. This outcome would not be achieved by a single circuit option – indeed single circuit transmission lines are rarely built these days, largely because of the need to optimize the use of transmission line easements.

The required environmental approvals to replace the existing single circuit 132 kV wood pole line with a double circuit 330 kV line over the same route have already been obtained. These approvals do not extend to the construction of a new 330 kV single circuit line alongside the existing circuit, which would require a wider easement. Western Power does not consider this an insurmountable impediment to the single circuit option but notes there could be some delays.

In its submission, Extension Hill comments that, with the benefit of hindsight, the decision to construct the double circuit line between Pinjar and Eneabba at 132 kV was short sighted. We find it difficult to disagree with this, given that a further augmentation is required within ten years of its construction and that a 330 kV easement was available at the time. Given the present forecasts for electricity demand in the Mid West, we consider it important that this mistake is not repeated.

5.4 OTHER BENEFITS

The double circuit option provides other unquantified benefits over the single circuit alternative. While these benefits may be relatively small, we believe they are of sufficient magnitude to be worthy of note. These are:

- The double circuit option will replace the original single circuit wood pole line between Pinjar and Eneabba. This line is now 34 years old and is estimated by Western Power to have 15 years remaining life. If the double circuit line is constructed there is likely to be some savings in maintenance costs in the short term and the replacement cost at the end of the line's remaining economic life will be avoided.

- The replacement circuit is likely to use a larger conductor than the existing single circuit lines. This is likely to provide some increase in power transfer capacity, even when the circuit is operated at 132 kV. This should also result in a reduction in the cost of losses, compared with the costs that would be incurred if the existing line was not replaced.

6. RECOMMENDATIONS

- We recommend that the Authority **approve** Western Power's proposal to construct a double circuit 330 kV line between Pinjar and Three Springs.

- In its NFIT pre-approval application Western Power should include:

    - an analysis showing the basis for determining the line capacity and conductor size for the new line;

    - an indicative analysis showing the quantity of new generation in the constrained Mid-West region that could be supported by the proposed new line; and

    - a detailed report showing a full breakdown of the cost estimate and identifying all assumptions made in the preparation of this estimate. Where practical, the source of the component costs used in the estimate should be identified.

- As the section of line between Eneabba and Three Springs is to be constructed and owned by Karara, with provision for capacity to be leased to Western Power, the Authority should ensure that it is designed and built to meet the requirements of the grid rather than just the requirements of the Karara mine. This may mean ensuring that capacity is made available to supply Extension Hill Stage 2 or an alternative mining load, should such a project proceed ahead of any Karara mine expansion.