GEOFF BROWN & ASSOCIATES LTD

NEW FACILITIES INVESTMENT TEST FOR WESTERN POWER'S MEDICAL CENTRE ZONE SUBSTATION

Technical Review

CONFIDENTIAL

Prepared for

ECONOMIC REGULATION AUTHORITY

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1. INTRODUCTION

On 25 March 2008, Western Power submitted an application to the Economic Regulation Authority (ERA) for a waiver of the Regulatory Test for a proposed major augmentation to its transmission network[1]. This augmentation involves the construction of a new 66/11 kV substation to replace the existing 66/6.6 kV substation supplying the Sir Charles Gairdner Hospital (SCGH) and surrounding area. The estimated capital cost of the project is $28.4 million, and Western Power proposes that the SCGH makes a capital contribution of $9.69 million towards this cost.

On 15 April 2008, the ERA issued a determination waiving the regulatory test[2] on the basis that the proposed augmentation met the requirements of sections 9.23(a) and 9.23(d) of the Electricity Networks Access Code 2004 (Access Code) in that there were no viable alternatives to the proposed new substation and the nature of the proposed funding would not cause a net cost to those who generate, transport and consume electricity in the covered network and any interconnected system.

Subsequently, on 7 August 2008, Western Power submitted an application for pre-approval of the New Facilities Investment Test (NFIT)[3]. The NFIT is a separate test from the Regulatory Test and determines that portion of a project that can be financed through the regulated network tariff. Any costs that did not meet the NFIT requirements would need to be financed through some other means, typically through a capital contribution. Hence the NFIT is important in determining the amount of any capital contribution.

On 26 September 2008, the ERA published an Issues Paper[4] on Western Power's pre-approval application and invited interested parties to make a submission on the Issues Paper and the pre-approval application. Submissions were received from Western Power[5] and from Alinta Sales Pty Ltd[6].

Alinta's submission raised a number of issues with respect to Western Power's submission and the ERA's Issues Paper. In summary, Alinta submitted that:

- any condition to impose a capital contribution should be made as part of the NFIT and should not be a condition imposed as part of a regulatory test waiver;
- Western Power has not demonstrated that the proposed new facilities investment has passed the efficiency test;
- for the new facilities investment to pass the efficiency test, Western Power should satisfy the ERA that it will minimise project costs and will be managing the project effectively and efficiently in accordance with best project management practices;
- Western Power has not justified the use of 132 kV cable, the installation of higher capacity transformers and the use of gas insulated switchgear and should do so to the ERA's satisfaction before the cost of that equipment is included as part of the new facilities investment costs;

1 *Request for Waiver of Regulatory Test – 66/11 kV Medical centre Zone Substation expansion and voltage conversion of distribution network.* Western Power submission to the Economic Regulation Authority, 24 March 2008.

2 *Determination on an Application from Western Power to Waive the Regulatory Test for a 66/11 kV Medical Centre Zone Substation Expansion and Voltage Conversion of the Distribution Network.* Economic Regulation Authority, 15 April 2008.

3 *Pre-approval of New Facilities Investment – 66/11 kV Medical centre Zone Substation expansion and voltage conversion of distribution network.* Western Power, 6 August 2008.

4 *Issues Paper on the New Facilities Investment Test for a 66/11 kV Medical Centre Zone Substation Expansion and Voltage Conversion of the Distribution Network. Economic Regluation Authority, 26 September 2008.*

5 *Pre-approval of New Facilities Investment – Response to the Issues Paper published by the ERA dated 26 September 2008, for the 66/11V Medical Centre Zone Substation expansion and voltage conversion of distribution network.* Western Power, 21 October 2008.

6 Letter from Alinta Sales Pty Ltd to the Economic Regulation Authority, 13 October 2008.

- the cost to replace the Medical Centre zone substation with a similarly rated substation should be deemed to pass the safety and reliability test on the grounds that the substation has reached the end of its useful life;

- the ERA should ensure that the NFIT is applied consistently to any new facilities investment triggered by load growth; the NFIT implications associated with the load growth of a large number of small customers each having incremental increases in demand should be the same as for the load growth of a single large customer that is increasing demand; and

- in making its determination the ERA should follow the precedent applied in the mid-west region of Western Australia where new facilities investment triggered by load growth is deemed to pass the safety and reliability test on the grounds that to do nothing would jeopardise the safety and reliability of existing loads.

Geoff Brown and Associates has been asked by the ERA to consider the issues raised in Alinta's submission and provide advice as to whether the costs forecast by Western Power are efficient.

2. BACKGROUND

2.1 CURRENT SITUATION

The SCGH is currently supplied by a 66/6.6 kV zone substation located in a corner of a car park within the hospital complex. The substation is fed by a 66 kV overhead ring circuit from the Western Terminal Station. This ring circuit, which also serves zone substations at Nedlands and the University of Western Australia, provides n-1 incoming supply security in that supply can to be maintained in the event that one of the 66 kV lines that supply the hospital is out of service.

The existing Medical Centre zone substation contains three transformers. Transformers T1 and T3 are Mekano Electro 10/13 MVA transformers that were manufactured in 1958, and likely first commissioned in 1959 or 1960. Transformer T2 is a 10 MVA unit manufactured by English Electric, possibly in 1964. Fans were subsequently added in 1987 by Westralian Transformers to give a forced air rating of 15 MVA. These three transformers give the substation a theoretical firm power transfer capacity of 26 MVA[7], although it is unlikely that Western Power would want to risk loading the transformers to this level, given the age of the units and the fact that they supply a critical hospital load.

The substation has two double bus 6.6 kV switchboards. One is owned and operated by Western Power and includes the incoming supply circuit breakers from the three transformers and a supply to three outgoing 6.6 kV feeders serving customers in the area neighbouring the substation. The second switchboard is operated by SCGH and supplies seven outgoing feeders. Both switchboards were manufactured in 1971, although some components were manufactured more recently. Most outgoing circuit breakers on both switchboards have oil filled interrupters, which have now been superseded by other technologies.

Western Power undertakes a regular diagnostic testing program to monitor the condition of its primary transformers and switchboard. We have viewed the most recent test reports, which indicate that the equipment at the Medical Centre is in good condition for its age.

2.2 AUGMENTATION REQUIREMENT

The Western Australian State Government plans to rationalise Perth's health facilities over the next decade or so and, in particular, to expand SCGH into a major hospital serving the northern and central metropolitan area of Perth. An external consultant to SCGH has forecast the peak hospital demand to increase from a current 13.4 MVA to 20.7 MVA by 2016 with a subsequent maximum potential load of 25.3 MVA[8]. As part of this expansion and redevelopment, it is planned to upgrade the internal electricity distribution within the hospital complex from 6.6 kV to 11 kV. To meet these requirements Western Power is planning to replace the existing Medical Centre zone substation with a new 2 x 33 MVA, 66/11 kV substation, to be completed by October 2010. This substation will operate in parallel with the existing 66/6.6 kV substation until all loads on the existing substation have been upgraded to 11 kV. This is expected to be no earlier than December 2013.

[7] The firm power transfer capacity of a substation is determined by assessing the remaining power transfer capacity when the largest transformer is out of service.

[8] See Appendix 2 of Western Power's regulatory test waiver application (supra note 1).

3. ANALYSIS AND COMMENT

3.1 PROJECT NEED

In its application for a regulatory test waiver Western Power stated that there was a need to upgrade the Medical Centre zone substation to provide additional transformer capacity. This implies that the firm capacity of the existing substation (26 MVA), will be insufficient to meet the forecast load. To support this position Western Power has provided the ERA with the following load information:

- A system planning forecast, which shows that the current peak load at the zone substation to be about 18 MVA. Western Power is forecasting that this load will increase to about 35 MVA in 2014, and reduce to 30 MVA in 2015 after load is transferred to neighbouring substations. This forecast also shows that the peak load at the Medical Centre zone substation has historically increased from 15 MVA in 1995, a growth rate of about 1.5% per annum.

- A SCGH load forecast prepared by consultant KBR and included in the regulatory test waiver application. This shows the 2007 hospital peak load as being 13.3 MVA. The hospital load is forecast to increase to 20.7 MVA by 2016, with a total future load on the site of 25.3 MVA.

Our analysis indicates a material discrepancy between these two load forecasts in respect of the total forecast load at SCGH. If it is accepted that the actual 2007 load at SCGH was 13.3 MW, then the other load supplied by the Medical Centre zone substation was 4.7 MVA. This load primarily supplies a mature and fully developed residential area with little potential for growth. If however a growth rate of 1% per annum is assumed for this existing residential load, it will increase to 5.1 MVA in 2016 and 5.4 MVA in 2020. If the KBR hospital forecast is added the maximum demand at the Medical Centre zone substation in 2016 would be 25.8 MVA, and this would increase to a possible 30.4 MVA by 2020, assuming the hospital is developed to its full potential by that time.

This analysis indicates that the Western Power planning forecast of 35 MVA by 2014 is most unlikely to materialise, unless there is another new major load to be supplied from the substation. There is no indication of this. We further conclude that, while the situation is marginal, there is sufficient spare capacity in the existing substation to accommodate the first stage of the SCGH redevelopment, running through to 2016. We acknowledge that this conclusion is based on transformer capacity considerations only and does not take account other factors, such as the age of the existing transformers and the importance of the hospital load, which indicate that earlier replacement would probably be prudent.

It seems to us that the most compelling reason for the substation replacement proceeding at this time is SCGH's requirement for its supply voltage to be upgraded from 6.6 kV to 11 kV. Given that it is about to embark on a major upgrade, which could see its load increase more than 50% by 2016 and eventually almost double, we think this requirement is reasonable. 6.6 kV is an obsolete distribution voltage and 6.6 kV distribution equipment is no longer routinely manufactured by the major equipment suppliers. Hence an upgraded 6.6 kV solution would probably use 11 kV rated equipment, but could not take advantage of the economic benefits of the higher voltage, such as increased power transfer capacity and reduced losses. Hence we are satisfied of the need for the project.

We note however that, while Western Power and SCGH have informally agreed that the hospital requires an 11 kV supply, there is no documented formal request from SCGH to Western Power for the upgraded supply voltage.

Western Power has stated that the other major load in the area, the University of Western Australia, which is supplied from a different substation, has indicated a similar requirement to increase its load and upgrade the distribution network within its campus to 11 kV around 2016. It has further stated that the replacement of the Medical Centre zone substation would be the first stage of a longer term development plan that would eventually see all its distribution in the area upgraded to 11 kV. Given the age of much of the distribution equipment, there is likely to be a sound economic and technical case for such a plan. A distribution system operating at 11 kV would have a 66% greater power transfer capacity than a similar system with the same conductor sizes operating at 6.6 kV. Furthermore thermal losses would be reduced by 64%.

However if the benefits of a network upgrade to 11 kV are to be fully captured, we think Western Power should take an area-wide approach to its network development planning, rather than consider the replacement or upgrading of each individual zone substation in isolation. The additional power transfer capacity of 11 kV distribution increases the ability to transfer load between substations, and this capacity could be used when planning for n-1 network contingencies. Such an area-wide planning approach should allow transformers in the area to be more fully loaded under normal operating conditions and this in turn could reduce the total required power transformer capacity.

3.2 TIMING OF THE PROJECT

The timing of the project is dictated by SCGH's requirement for its supply voltage to be upgraded from 6.6 kV to 11 kV, since the voltage transfer cannot commence until an 11 kV supply is in place. On this basis Western Power's proposed completion date of October 2010 is reasonable.

3.3 SCOPE OF WORKS

At a high level, Western Power's proposal to construct a new 66/11 kV substation and initially operate it in parallel with the existing Medical Centre zone substation is reasonable. It is going to take both Western Power and SCGH some time to upgrade their existing supply networks to the higher voltage and both supply voltages will need to be available over this transition period. Hence the premise that there are no viable alternative options to the proposed new substation is essentially sound.

The scope of the works to be undertaken by Western Power includes:

- Construction of two new 66 kV line transition structures to enable two underground high voltage cables rated at 132 kV to be terminated and connected to the existing 66 kV incoming circuits;
- Procurement and installation of two incoming underground cable circuits and the proposed new 132 kV gas insulated switchgear. This is to be installed indoors in a specially constructed switchgear building;
- Procurement and installation of 132 kV gas insulated incoming switchgear;
- Procurement and installation of two 33 MVA 66/11 kV transformers and associated equipment;
- Construction of a new 11 kV indoor distribution switchboard. A second separate 11 kV switchboard will be constructed to serve the SCGH, but this will not be owned or operated by Western Power; and
- Upgrading of the portion of the Western Power distribution system served from the Medical Centre zone substation from 6.6 kV to 11 kV operation.

However, on the basis of the information available to us, we think it should be possible for Western Power to provide the required level of service at a lower cost. Western Power has not submitted a preliminary design report, and we think further justification is required on the following aspects of the design:

- The need for gas insulated switchgear. Western Power argues that gas insulated switchgear does not require as much land as traditional outdoor construction and has a visual appearance more in keeping with an urban environment. We agree. However the existing substation is located in a car park area and space is available to extend the existing 66 kV buswork to serve the new substation. This would be a much less costly option – the procurement cost alone of the gas insulated switchgear is almost 20% of the total project cost. While the total land area required for this option is greater, it should be possible with careful design to minimise the visual impact. Under this option, the existing 66 kV switchyard would be demolished and the site reinstated once the 6.6 kV supply was no longer required. Western Power has stated that SCGH requires the land for other uses, but the SCGH has not confirmed this.

- The need for 132 kV switchgear and cables. Even though the substation will be operated at 66 kV, Western Power is proposing to install 132 kV underground cable and switchgear, in case a decision is made in the future to upgrade the incoming supply to 132 kV. However, it has provided no evidence that such a decision is likely.

  Western Power has submitted that it is phasing out its 66 kV network and will eventually upgrade the Medical Centre and other substations to 132 kV. The installation of 132 kV equipment at the site makes provision for this. However as there appears to be no firm plan or technical need to upgrade the Medical Centre zone substation to 132 kV, we think the installation of 132 kV equipment can only be justified if the additional costs are not material. Western Power has not established this, although it has indicated that the procurement cost of 132 kV cable is 10-15% greater than 66 kV cable.

  Western Power has also stated that it needs to install gas insulated switchgear rated at 132 kV since it has been unable to locate 66 kV switchgear with the required 40 kA fault rating. It has submitted a product catalogue from Siemens to confirm this. However our research indicates that both ABB and Toshiba manufacture 66 kV gas insulated equipment rated at 40 kA. Furthermore techniques are available to reduce potential fault ratings and Western Power has provided no analysis as to why 40 kA rated equipment is required.

- The configuration of the gas insulated switchgear. Western Power is proposing to provide for three incoming lines and three transformers. However on the basis of our analysis of the likely load at the site, and allowing for the additional power transfer capacity if the distribution voltage is increased to 11 kV, we think a two transformer – two line construction will meet all reasonably foreseeable long term load requirements. Adding equipment to provide for a third incoming line and transformer significantly increases the cost of the project and we do not think that existing customers should pay for this, given that the need appears to be speculative. It is also likely that, if only two line infeeds are provided for, the required fault rating of the switchgear will reduce to 32 kA.

  We doubt if Western Power would be proposing that all extra high voltage switchgear required for a three line – three transformer arrangement be installed at this time if a standard outdoor switchyard was proposed, since the traditional design can be readily expanded in an incremental fashion, provided land is available. However, the integrated nature of gas insulated switchgear design makes it difficult to subsequently add additional equipment. Western Power may therefore consider it prudent to include the additional two circuit breakers at this

stage, just in case they are eventually required, as the cost of retroactive installation at a later date would be much greater.

The problem with this argument is that it ignores the holding cost of the installed equipment before it is actually used. This cost must be carried by existing customers, who receive no corresponding benefit. Our view is that, while it is prudent to make provision for future requirements when planning new electricity distribution assets, there must be a reasonable probability that the assets will actually be required within the forecast period. We do not believe that the additional equipment meets this threshold – on the basis of the information we have analysed we think that, on the balance of probabilities, the additional equipment will not be required within the lifetime of the gas insulated switchgear.

We think it would be sufficient for Western Power to ensure that space is available to accommodate the additional connections should they be eventually required. In this event new gas insulated switchgear should be installed at that time. This would be either bolted directly to the end of the existing equipment, or installed as a separate unit and connected to the existing arrangement by cable. Provision for this may need to be made when placing the initial switchgear order.

We also note that Western Power is planning to construct a building to house the gas insulated switchgear indoors and that it has made provision for a fourth 11 kV feeder. These are both areas where potential savings may be possible, although in both cases any savings would be small when compared to the total cost of the substation. Western Power has noted that the fourth feeder could potentially increase the transfer capacity between adjoining substations, although it has not studied this in detail.

3.4 PROJECT COSTS

Western Power has estimated the cost of the project at $28.4 million. This cost has been broken down as shown in Table 1 below.

Table 1: Forecast Cost of Medical Centre Zone Substation Project.

Item	Cost ($ million)
66 kV Substation	
Procurement of GIS switchgear	5.38
Procurement of transformers and associated equipment	2.86
Procurement of secondary equipment (protection, SCADA, communications)	0.63
Civil works	3.68
Electrical installation works	1.05
Preliminary site works and construction administration	0.98
Design and commissioning	1.82
Subtotal 66 kV substation	**16.40**
Other Costs	
11 kV switchgear	2.39
Decommission old substation	0.93
Incoming cable and line termination	4.47
Environment and land management	1.29
Project management	0.29
Distribution network conversion	2.60
Total project cost	**28.37**

Western Power has stated that the estimate has been developed in accordance with its standard estimating procedures, which in turn are based on its standard capital expenditure governance and project delivery processes. These are discussed in some detail in Appendix 4 and 5 of its recent access arrangement submission, which will presumably be considered by the Authority as a part of its review. We note also that Sinclair Knight Merz has confirmed in the access arrangement submission that Western Power's project costs are closely aligned with similar project costs in other Australian states[9].

We attempted to independently verify the procurement cost of the gas insulated switchgear, but the manufacturer approached did not provide budget prices in the timeframe required. We know that GIS switchgear is expensive and note that Western Power has based its cost estimate on the installation of similar equipment at its Cook St substation[10].

We therefore accept Western Power's cost estimate as generally reasonable, *given its assumed design*. Our one reservation is the line item *Environment and Land Management* with an estimated cost of $1.29 million. While this cost may be reasonable for a green field site, we consider it excessive in a situation where the substation is to be located on a flat site immediately adjacent to an existing substation, within a complex that has already been developed. We assume that this development will not require the environmental impact studies and land use consents that would normally be required before a green field development could proceed.

We also note that the project cost does not include land, which is to be leased to Western Power by SCGH at a peppercorn rental.

3.5 CAPITAL CONTRIBUTION

In order to calculate the capital contribution payable by SCGH, Western Power has assumed that, without the proposed redevelopment of the hospital, the new substation will not be required until 2021. The cost of this project is used as the baseline for the analysis.

However, because of the hospital redevelopment, the substation will be required by 2010 and so the project needs to be accelerated. Western Power has calculated the difference in the net present value (NPV) of the cost of the two projects (accelerated and baseline) and assumed this to be the base calculation for the required capital contribution. It has then reduced this by the NPV of the additional revenue that it expects to get from the additional load from the redevelopment over the period 2010-2021. Using this methodology the required capital contribution, as calculated for the regulatory test waiver application, was calculated to be $9.69 million. After we noted that the costs for the two projects (accelerated and baseline) assumed in the original regulatory test waiver analysis were different, Western Power recalculated the required capital contribution using the same model to be $11.87 million (assuming the same incremental revenue from the additional load). There is no indication that SCGH has agreed to pay a capital contribution or even that the issue has been seriously discussed.

While Western Power has provided us with a spreadsheet showing its revised analysis, it did not show the formulae and we have been unable to replicate its calculations. Our analysis, using the updated Western Power model, indicates a required capital contribution of $8.75 million. This figure has been derived by calculating the net present value of the various real cost streams assuming a discount rate of 6.76%, the real re-tax weighted average cost of capital assumed by Western Power. We have not explicitly taken inflation into account in the analysis.

[9] See Section 3.1 of Western Powers response to ERA's Issues Paper (supra note 5).
[10] Ibid

Notwithstanding this, there are a number of other issues with Western Power's capital contribution model as applied to this case that, in our view, need further consideration. These are discussed below:

- In Section 3.2 of the regulatory test waiver application, Western Power indicated that only 60% of the capital cost of the shared assets was allocated to SCGH for determining its capital contribution. However the cost used in the model was $25.8 million which is the total cost of the project, excluding only the cost upgrading Western Power's network from 6.6 kV to 11 kV. We have no indication of how the reported 60-40 split was applied in the model.

- The assumption that, without the redevelopment of the hospital, the new substation will not be required until 2021 implies that the existing transformers will remain in service until 2024, assuming that a period of three years is required to upgrade all 6.6 kV loads to 11 kV. The two 10/13 MVA Electro Mekano transformers were manufactured in 1958. Assuming that they were first commissioned in 1960, this means they would have been in service for 64 years by the time they were decommissioned. Notwithstanding the fact that tests have shown these units to be in good condition for their age, this is a long time for such assets to remain in service. In New Zealand the Commerce Commission assumes a standard asset life of 55 years for Transpower owned 66/11 kV power transformers. Even Western Power's own regulatory test waiver application notes that, without the projected load growth, the asset replacement plan is to replace these transformers by 2015/16. This is consistent with the 55 year standard life assumed by the New Zealand Commerce Commission.

  It should be noted that the economic life of a particular asset cannot be predicted with certainty. The standard economic life assumed for asset valuation is only an estimated average for a particular asset class. Some individual assets can be expected to last longer than the standard life while others will not last as long. We think that when an asset life is used for economic analysis, as done by Western Power to calculate the required capital contribution, it is reasonable to use the standard asset life. The risk associated with the actual life of an individual asset being longer or shorter than the standard life should be symmetrical (assuming the standard life is correct) and should thus be carried by the asset owner.

- We note that the capital contribution calculated using Western Power's model is very sensitive to the assumed economic life of the existing assets. Our analysis indicates that, if the commissioning date of the new substation is brought forward five years from 2021 to 2016, the required capital contribution calculated using Western Power's own model would reduce from $8.75 million to $2.73 million.

- In calculating the required capital contribution Western Power has only calculated the incremental revenue for the period between the accelerated and base project installation dates. The rationale for only using the incremental revenue over this limited time frame is not clear. Arguably, it would be just as rational to assume an incremental revenue stream over the full life of the project and, if this approach was taken, it is unlikely that any capital contribution would be required.

- In its regulatory test waiver application Western Power has alluded to other benefits of the project, which have generally not been quantified and have not been included in the analysis to determine the required capital contribution. One example is a deferral for three years of the major substation development at the University of Western Australia, at a cost savings of $3 million in net present value terms[11]. We have noted above further potential benefits, including a

[11] We note that if this $3 million benefit was offset against the $2.73 capital contribution determined using the revised base case assumptions, no capital contribution would be required.

reduction in network losses and a higher power transfer capacity, which in turn allows a reduction in the required power transformer capacity in the area.

Given the sensitivity of the calculated capital contribution to the analysis assumptions, we think it is important that the analysis to determine the required capital contribution is robust and accepted by all parties. If it can be shown that an upgrade of the area to 11 kV distribution is to the overall benefit of all Western Power consumers, it may be appropriate for no contribution to be required of either SCGH or the University of Western Australia, but that both large consumers be required to modify their electrical installations to take supply at 11 kV. However, further analysis by Western Power would be required before any firm conclusions could be reached or recommendations made. This could include a technical and economic analysis, on an area wide basis of the potential benefits from upgrading all Western Power's existing 6.6 kV distribution in the area to 11 kV.

4. CONCLUSIONS AND RECOMMENDATIONS

On the basis of the information provided by Western Power, and our analysis above, we have the following conclusions and recommendations. We note however that the information provided is very limited and that more detailed preliminary design and robust analysis by Western Power could persuade us that the conclusions and recommendations below are not well founded.

- The planning forecast being used by Western Power as the basis for planning the development of its network is inconsistent with the SCGH load forecast provided by the hospital consultant. We conclude that the existing Medical Centre zone substation has sufficient transformer capacity to supply the first stage of the hospital redevelopment, but that a new substation is nevertheless required to provide an 11 kV supply.

- We believe that it should be possible to reduce the cost of the proposed new substation without materially affecting the level of service provided. In particular:

    - There is insufficient justification for the installation of 132 kV equipment, when the plant will be operated at 66 kV. We think it unlikely that an upgrade to 132 kV operation will be able to be justified on the basis of load growth alone.

    - Notwithstanding the limitations on future development resulting from the use of gas insulated switchgear, we think a two line – two transformer installation will provide sufficient capacity to meet all reasonably foreseeable future load requirements.

    - The provision for environment and land management costs should be reduced substantially.

- The inclusion of gas insulated switchgear, while reducing the required land area and improving the design from an aesthetic standpoint, adds significantly to the substation cost. The use of this equipment also reduces flexibility, as it is not easily extended to accommodate future load growth. However, on balance we consider that the use of gas insulated switchgear may be justified. There is no doubt that the use of this equipment will reduce the land requirement and we appreciate that Western Power must take heed of the SCGH desire for land use to be minimized, particularly as the land is being provided to it at a peppercorn rental. We further note that the site is in a developed area used only for residential and hospital purposes and is close to a major recreational reserve.

  Notwithstanding this, we do not think that any acceptance by the Authority of the use of gas insulated switchgear in this particular situation should be treated as a precedent for future developments. Given the high cost of this equipment, we think each case should be treated on its merits and that the Authority should in future require a more robust justification than has been provided in this instance.

- The output of the economic model used by Western Power to determine the required capital contribution from the SCGH is very sensitive to the input assumptions. Our analysis shows that if the base case assumed replacement of the existing Medical Centre zone substation in 2016 rather than 2021, the required capital contribution would reduce from $8.75 million to $2.73 million. The revised base case assumption is consistent with Section 3.3 of Western Power's own regulatory test waiver application and is, in our view, more reasonable.

- We have concerns about the validity of the economic model used by Western Power and doubt that it has captured all the benefits of advancing the project. While we are reluctant to draw firm conclusions on the limited information provided, we consider that it would not be difficult to construct an equally valid model that shows that the SCGH should not make any capital contribution.

- One reason why all the potential benefits have not been identified is that the project has been analysed in isolation rather than as the first stage of a more comprehensive redevelopment programme that would see all distribution in the area upgraded to 11 kV. Such an upgrade would reduce distribution system losses and increase the available power transfer capacity within the distribution network. This in turn could allow the power transformer capacity in the area to be better utilised and loaded more heavily under normal operating conditions, without adversely affecting the overall reliability of supply. It may also permit some rationalisation of overall transformer capacity.

For the purposes of applying the NFIT, we think the following cost reductions should apply.

- All installed equipment should be rated for 66 kV operation. We were unable to get relevant costs from switchgear manufactures but have assumed a reduction of 10% in the gas insulated switchgear procurement cost provided by Western Power. We also looked at the cost impact of reducing the rating of the incoming cable to 66 kV. However this was not material due to the relatively short cable length, the fact that installation costs were not significantly affected and that the cable price can vary with the relatively volatile cost of the conductor material.

- The gas insulated switchgear should be reduced to a two line – two transformer configuration. This will eliminate two of the seven circuit breakers and we have assumed that this will reduce the switchgear costs by a further 20%.

- The costs for environment and land management should be reduced by $1 million.

On this basis, we think the estimated NFIT cost of the substation should be $25.86 million, which we have calculated in accordance with Table 2 below.

Table 2: Adjusted Cost of Medical Centre Zone Substation Project.

Item	Cost ($ million)
Total project cost estimated by Western Power	**28.37**
Recommended reductions	
Reduction of switchgear rating	0.54
Reduction of switchgear configuration	0.97
Reduction in environment and land management costs	1.00
Revised total project cost	**25.86**

Overall we think the information provided by Western Power in support of this NFIT application to be superficial and not commensurate with the detail implied by the NFIT requirements as set out in the Access Code.