Submission to the Economic Regulation Authority

NEW FACILITIES INVESTMENT TEST PRE-APPROVAL APPLICATION

Mid West Energy Project (southern section)

Neerabup to Three Springs Terminal via Eneabba

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safe reliable efficient

Contents

Glossary

Abbreviation / Acronym	Definition
the Code	Electricity Networks Access Code 2004
DTF	Department of Treasury and Finance
ENB	Eneabba
ENT	Eneabba Terminal
ERA	Economic Regulatory Authority
ETAC	Electricity Transfer Access Contract
EUC	Early Undertakings Contract
GGV	Golden Grove
IDC	Interest During Construction
KML	Karara Mining Limited
MOR	Moora
MWEP	Mid West Energy Project
NBT	Neerabup
NFIT	New Facilities Investment Test
NPC	Net Present Cost
PNJ	Pinjar
SWIS	South West Interconnected System
SWIN	South West Interconnected Network
TST	Three Springs Terminal
WPN	Western Power Network

1 Executive Summary

1.1 Project Background

A number of new mining projects are being actively pursued in the Mid West region that will have significant impacts on total electricity demand. In particular, Karara Mining Limited (KML), a 50:50 Joint Venture between Gindalbie Metals Ltd and Chinese steel producer, AnSteel, is developing a mine around 100 km east of Three Springs with a view to producing around 10mtpa of iron ore and magnetite by mid 2012. The project will have an electricity peak demand of 120MW (taking an initial limited 132kV supply from Feb 2012, and then 95MW from June 2012 under an interim non firm arrangement), with the possibility of an additional 180MW staged over a 5 year period if proposed expansion takes place. KML is currently constructing a double circuit 330kV transmission line between Eneabba and its mine site at Karara (via Three Springs), in conjunction with the State Government funding commitment for the Mid West Energy Project (MWEP) (southern section). KML is well progressed with construction of its mine operations and the 330kV transmission line.

Western Power has also advanced discussions with Asia Iron's Extension Hill mine (peak load 140 MW) which has achieved most of its project approvals and is currently finalising debt financing for the project to proceed. Asia Iron is seeking connection at Three Springs when the MWEP (southern section) is completed.

The additional transmission capacity provided by MWEP (southern section) will overcome current network constraints, allowing the proposed connection of future mining and other loads at Three Springs, and facilitate the future connection of generation in the Mid West. The establishment a new 330/132 kV terminal located at Three Springs interconnecting the 132 kV and 330 kV voltage systems will provide support to the broader Geraldton region.

The MWEP (southern section) transmission augmentation underwritten by major off-takers presents a value proposition for the Mid West region providing broad economic benefit to the State and net market benefits to those who consume, produce or transport electricity in the South West Interconnected System (SWIS).

1.2 Regulatory Test Approval

Following Board endorsement in July 2010, Western Power commenced the regulatory approval processes for MWEP (southern section), including conducting an extensive public consultation process. On conclusion of the consultation process, Western Power lodged the formal Regulatory Test submission to the Economic Regulation Authority (ERA) in November 2010. In February 2011 the ERA determined that the MWEP (southern section) augmentation as proposed by Western Power satisfied the Regulatory Test. This pre-approval of NFIT submission has been based on the MWEP (southern section) Regulatory Test determination.

The MWEP (Southern section) project consists of:

- A new 201 km double circuit 330 kV transmission line between Pinjar and the future Eneabba terminal location[1] (utilising the corridor vacated by the dismantled line between Pinjar and Eneabba);

[1] Eneabba Terminal location is a proposed site for a future terminal substation and is not part of this project scope.

- Connecting to the new Eneabba – Karara 330 kV transmission line (a 58km line section between Eneabba Terminal to Three Springs transmission line constructed by Karara);
- Upgrading the existing Neerabup to Pinjar line from operating at 132 kV to 330 kV and building a new 330 kV circuit bay at Neerabup;
- A new 330/132 kV terminal located at Three Springs interconnecting the 132 kV and 330 kV voltage systems to provide support to the Geraldton region.

1.3 NFIT Assessment

The NFIT value of the MWEP (southern section) 330kV project has been assessed by considering the incremental revenue expected to result from the project proceeding (incremental revenue test) and the net market benefits to those who consume, produce or transport electricity in the SWIS delivered by the project (net benefits test). Table 1 provides a summary of the main source of benefits that contribute to the NFIT value. The safety and reliability element is not applied to this NFIT value assessment as the reduced costs of delivering a safe and reliable supply achieved by the project appear as deferral benefits in the net market benefit. These benefits are further described in section 6.

Table 1 NFIT present value benefits estimates (July 2010$)

NFIT element	Estimation Period	Benefit estimate 50th Percentile Case
Safety & Reliability Test	not applied	not applied
Incremental Revenue Test	40[2] years	$206M
Net Benefits Test	20[3] years	$271M
Total		**$477M**

Western Power's application of the Incremental Revenue Test and the Net Benefits Test is consistent with the ERA's interpretation of the NFIT and based on combining the separate and non-overlapping benefits estimated under the two tests.

The NFIT value exceeds the project cost by about $95M (in NPC terms) and as a result Western Power determines that no capital contribution is required from the project proponents, subject to the ERA final determination of NFIT.

1.4 Karara Project Update

Western Power and Karara Mining Limited (KML) are progressing agreements on the commercial arrangements that will apply to the Karara Power project.

A revised delivery model was agreed in principle with KML in early 2011 (subject to a number of key outstanding commercial matters being resolved with Government), the key points of which include:

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[2] See Appendix 2 (p. 64) for a discussion of the chosen timeframe for the Incremental Revenue Test
[3] See Appendix 2 (p. 64) for a discussion of the chosen timeframe for the Net Benefits Test

- KML will fund and build a double circuit 330kV transmission line from Eneabba to its mine site to provide a connection from the existing 132kV network for its immediate interim supply needs.
- KML will transfer ownership of the Eneabba to Three Springs line asset to Western Power under agreed purchase terms, for integration into the MWEP (southern section) and to form part of the SWIS. KML will enter a long term Electricity Transfer Access Contract (ETAC*) for supply from the 330kV MWEP (southern section) project;
- KML will also fund the advancement of the Western Power 132/330kV Three Springs Terminal and Western Power will refund an appropriate amount of this funding when this asset is later re-integrated into the *SWIN as part of the MWEP (southern section); and
- KML will retain ownership of the transmission line between Three Springs and the Karara mine site. Western Power will continue to supply the Golden Grove mine via a Wheeling Agreement with KML (as the existing line section from Three Springs to Koolanooka will be demolished).

KML will fully fund all these early works with a provision that certain capital costs will be rebated (either via refund provisions or purchase agreements) when these assets are subsequently included into Western Power's regulated asset base (subject to an NFIT determination of value by the ERA). It should be noted that the price being submitted for NFIT is Western Power's determination of the efficient price based on works being delivered in an efficient market-based supply arrangement and to standards applicable at the time of construction.

Western Power has progressed the design of the KML connection assets, under an Early Undertakings Contract (EUC*) executed in March 2011 with KML (including the Three Springs Terminal design). Western Power is also proceeding with site earthworks and civil foundations at Three Springs under a separate contract funded by KML.

Western Power is seeking to conclude a number of principal agreements with KML in order to further progress the connection of KML's project.

KML has a target completion date on the delivery of the 330kV Eneabba to Karara transmission line of January 2012. The agreed delivery date of the Three Springs Terminal (TST) is currently June 2012 (subject to commercial agreements being executed).

The proposed interim and final arrangement is shown below in Figures 1 and 2;

Figure 1 Interim Supply Period layout

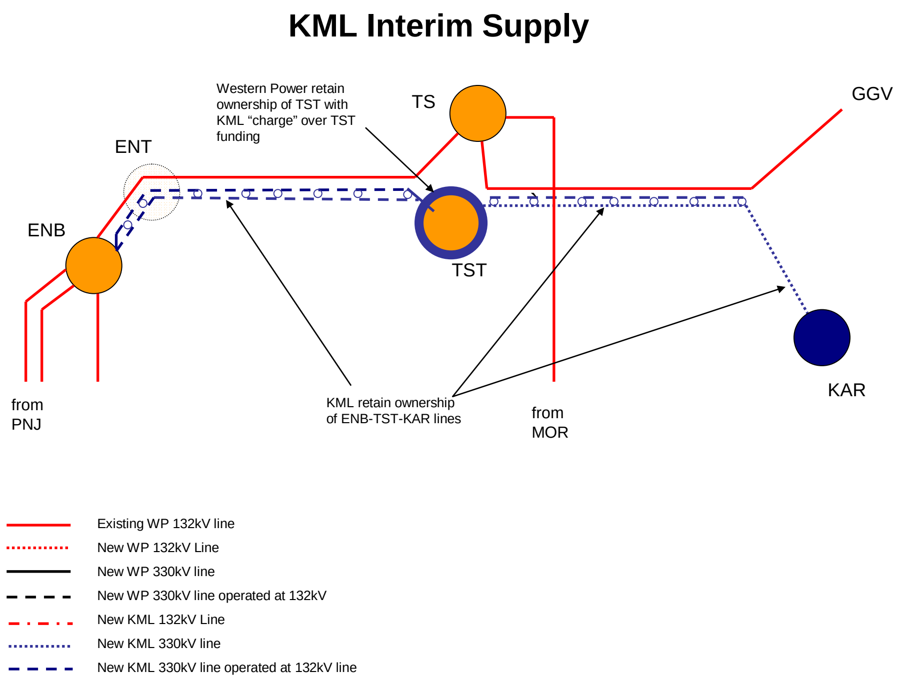
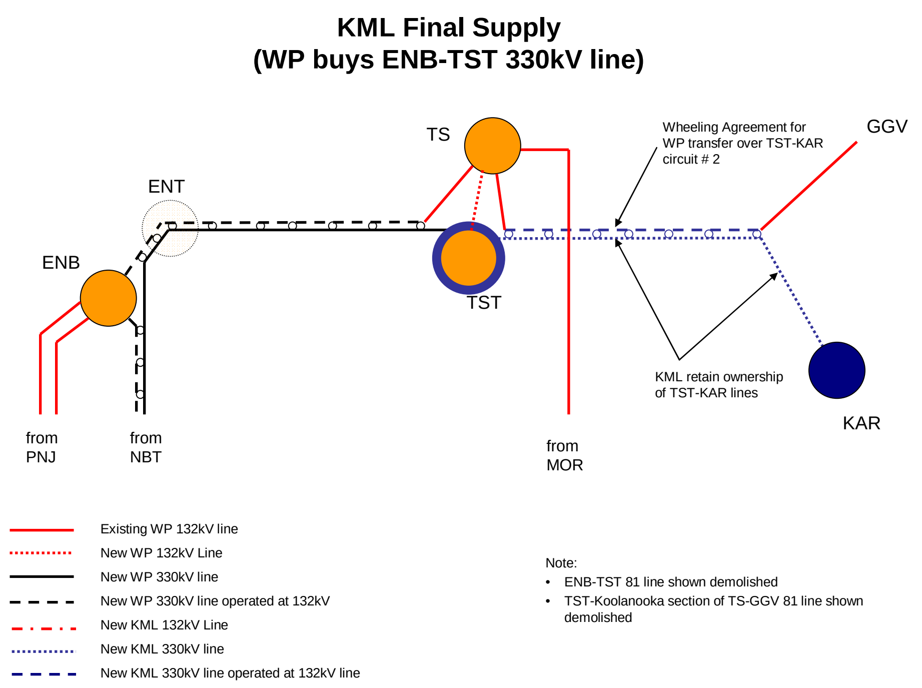


Figure 2 Final Supply Period layout



1.4.1 Project Delivery

To provide the Interim Supply (non-firm) from the 132kV network to the Karara minesite within KML's required timeframe (early - mid 2012), Western Power and KML are intending that construction of the MWEP (southern section)'s Three Springs terminal and the short section of the line between Eneabba and Eneabba terminal location will be accelerated. It is proposed that KML will construct the 12km Eneabba to Eneabba Terminal (ENB-ENT) 330kV line section and this will form part of the subsequent Eneabba to Three Springs line purchase.

Three Springs Terminal will be constructed by Western Power as the proponent, however it is proposed that the electrical construction component be undertaken by KML/Downer. The required in service date for the completion of the Western Power 330kV transmission line is March 2014, assuming all relevant approvals are secured by January 2012.

Western Power has conducted a detailed review of potential delivery methods for this project and determined that the appropriate delivery mechanism is to employ a mix of contract (through open competitive tendering) and internal resources. Some 82% of total project cost is proposed to be procured by open competitive tender.

1.4.2 Business Case

The assessment conducted by Western Power has been documented in a funding submission to the Economic and Expenditure Committee (EERC*). Western Power will submit this funding submission to government seeking funding approval.

Once funding is approved, relevant regulatory approvals have been achieved, and commercial agreements established, a further submission to the Board and then a section 68 to the Minister for Energy will be made seeking final approval to execute the preferred option.

1.5 Conclusion

In accordance with section 6.71(b) of the *Electricity Networks Access Code 2004* (**Access Code**) Western Power is seeking a determination from the Authority with respect to Western Power's proposed new facilities investment in Mid West Energy region.

The proposed new facilities investment is a subset of the proposed major augmentation defined in the Detailed Description of Recommended Option section of Western Power's Regulatory Test application.[4] That is, the new facility includes the establishment of a double circuit 330 kV transmission line between Neerabup and Three Springs[5], interconnecting the 132 kV and 330 kV transmission systems at Three Springs.

The total value of the works considered by this NFIT pre-approval application is $383.4M.

Table 2 presents an itemised summary of the proposed new facilities investment. For convenience, this will be referred throughout the remainder of this document as the Mid West Energy Project (**MWEP**) (Southern section).

[4] Western Power (November 2010), Major Augmentation Proposal, Regulatory Test Submission: Mid West Energy Project – Southern section Neerabup To Karara Mine Site via Eneabba p. 41; http://www.erawa.com.au/cproot/9092/2/20101201%20D57220%20Western%20Power%20-%20MAP%20-%20RTS%20-%20MWEP%20-%20SS.pdf [accessed 24 June 2011].

[5] This NFIT pre-approval application excludes the new facilities between the Three Springs and Karara Mining Limited's (KML) mine site.

Table 2 Summary of works

Element of Works	Cost that meets NFIT	Comment
Three Springs Terminal 330kV dedicated assets.	$0M	Fully funded by customer [redacted]
Neerabup Terminal to Three Springs Terminal 330kV line including the Three Springs Terminal works	$383.4M	The NFIT assessment is based on the MWEP (southern section) and Eneabba to Three Springs Terminal 330kV line acquisition from KML, (includes Interest During Construction (IDC) for Eneabba to Three Springs Terminal 330kV line and Three Springs Terminal)
Total cost of works that meets NFIT	$383.4M	

2 Mid West Energy Project (Southern Section) – Summary

2.1 Introduction

In order to meet KML's timeframes, this project is being delivered by parallel work-streams conducted by Western Power and KML. Western power will acquire from KML, at efficient cost, those assets constructed by KML that will be integrated into the SWIN on commissioning.

The MWEP (Southern section) project consists of:

- A new 201 km double circuit 330 kV transmission line between Pinjar and the future Eneabba terminal location[6] (utilising the corridor vacated by the dismantled line between Pinjar and Eneabba);

- The new 58km transmission line between Eneabba Terminal and Three Springs being constructed by KML;

- Upgrading the existing Neerabup to Pinjar line from operating at 132 kV to 330 kV and building a new 330 kV circuit bay at Neerabup;

- A new 330/132 kV terminal located at Three Springs interconnecting the 132 kV and 330 kV voltage systems to provide support to the Geraldton region.

For convenience, Appendix 1 provides a map of the proposed works, Configuration of MWEP (Southern Section).

This New Facilities Investment Test (**NFIT**) application is aligned to the Regulatory Test approval of the MWEP (southern section).

The proposed new facilities investment is as follows,

- Western Power is delivering the 201km 330kV double circuit transmission line from Pinjar to Eneabba, noting that 12km section between Eneabba Substation and Eneabba Terminal is being advanced and constructed by KML.

- Western Power is delivering the 330/132kV terminal substation at Three Springs, noting that the construction is being advanced, and the electrical construction is proposed to be contracted to KML. The terminal build is initially being funded by KML.

- KML is delivering the 12km double circuit 330kV line between Eneabba Substation and Eneabba Terminal, and the 58km double circuit 330kV line section between Eneabba Terminal and Three Springs Terminal. (KML is also delivering the 330kV line from Three Springs to its mine site and this section does not form part of the NFIT submission); and

- Western Power will acquire from KML, at the costs that pass NFIT;
  - the 12km line between Eneabba Substation and Eneabba Terminal
  - the 58km line between Eneabba Terminal and Three Springs Terminal

[6] Eneabba Terminal location is a proposed site for a future terminal substation and is not part of this project scope.

- Western Power will refund to KML at the costs that pass NFIT of Three Springs Terminal

The following sub-sections briefly describe each portion in further detail and assess the value that meets NFIT.

2.2 MWEP portion being delivered by Western Power

The portion of the MWEP (southern section) project being delivered by Western Power consists of:

- Item 1: A new 201 km double circuit 330 kV transmission line between Pinjar and the future Eneabba Terminal location (utilising the corridor vacated by the dismantled line), noting that the 12 km section between Eneabba Substation and Eneabba Terminal will be constructed early by KML. Upgrading the existing Neerabup to Pinjar line from operating at 132 kV to 330 kV and building a new 330 kV circuit bay at Neerabup; and;

- Item 2: A new 330/132 kV terminal located at Three Springs interconnecting the 132 kV and 330 kV voltage systems to provide support to the Geraldton region, noting that this will be constructed early to provide a 132/330kV supply to service KML's interim power needs.

The estimated in-service date for the completion of the project is now March 2014, assuming all regulatory (NFIT) and funding approvals are received by January 2012.

Table 3 Itemisation of work being delivered by Western Power

Item number	Element of Works	Asset Classification	Cost	Value that meets NFIT
1	Pinjar-Eneabba 330 kV transmission line and line upgrade works on the existing Neerabup to Pinjar line	Shared asset	[redacted]	100%
2	330/132kV Three Springs Terminal*	Shared asset	[redacted]	100%

Note: costs are 1 July 2010 present value estimates. *Costs that meet NFIT have been reduced by the KML dedicated connection asset component XXXXX and include IDC.

2.3 MWEP portion being delivered by KML (Karara Transmission) and acquired by Western Power.

The portion of the MWEP (Southern section) being delivered by KML and acquired by Western Power consists of:

- Item 3: the 12 km 330 kV transmission line between Eneabba Substation and Eneabba Terminal; and

- Item 4: the 58 km 330 kV transmission line between Eneabba Terminal and Three Springs.

KML has a target completion date on the delivery of the Eneabba – Karara transmission line of January 2012. Delivery of the Three Springs Terminal is currently targeted for June 2012 (subject to commercial agreements being executed).

The transmission line between Three Springs and the Karara mine site is deemed a connection asset. Accordingly, KML is funding this component of the cost. This line does not form part of the NFIT submission. Western Power will continue to supply Golden Grove through a Wheeling Agreement with KML.

Dedicated assets installed at the Three Springs Terminal to facilitate the supply to KML do not form part of the NFIT submission.

Table 4 Itemisation of work being delivered by KML

Item number	Element of Works	Asset Classification	Cost[7]	Value that meets NFIT
3	12 km 330 kV transmission line Eneabba Substation to Eneabba Terminal	Shared asset	[redacted]	100%
4	58 km 330 kV transmission line Eneabba Terminal to Three Springs	Shared asset	[redacted]	100%

Note: costs are 1 July 2010 present value estimates and include IDC.

[7] These costs reflect acquisition costs to Western Power and is not the KML delivery cost.

3 Access Code Considerations

3.1 New Facilities Investment Test Requirements

Prior to new facility investments being added to the capital base, several requirements under section 6.52 of the Access Code must first be met. Section 6.52 is reproduced below.

6.52 *New facilities investment* satisfies the *new facilities investment test* if:

(a) the *new facilities investment* does not exceed the amount that would be invested by a *service provider efficiently minimising costs*, having regard, without limitation, to:

(i) whether the *new facility* exhibits economies of scale or scope and the increments in which capacity can be added; and

(ii) whether the lowest sustainable cost of providing the *covered services* forecast to be sold over a reasonable period may require the installation of a *new facility* with capacity sufficient to meet the forecast sales;

and

(b) one or more of the following conditions is satisfied:

(i) either:

A. the *anticipated incremental revenue* for the *new facility* is expected to at least recover the *new facilities investment*; or

B. if a *modified test* has been approved under section 6.53 and the *new facilities investment* is below the *test application threshold* – the *modified test* is satisfied;

or

(ii) the *new facility* provides a *net benefit* in the *covered network* over a reasonable period of time that justifies the approval of higher *reference tariffs*; or

(iii) the *new facility* is necessary to maintain the safety or reliability of the *covered network* or its ability to provide contracted *covered services*.

The new facilities investment test elements are referred to as the ‘Efficiency Test’ (section 6.52(a)), ‘Incremental Revenue Test’ (section 6.52(b)(i)), ‘Net Benefits Test’ (section 6.52(b)(ii)) and ‘Safety and Reliability Test’ (section 6.52(b)(iii)).

In order for the new facility investment to satisfy the requirements of the Access Code, the efficiency test and at least one of the other remaining tests must be satisfied.

3.2 Assessment With Respect to Section 6.52 (a) of the Access Code

Section 6.52(a) of the Access Code requires that the value of any new facilities investment to be added to the capital base does not exceed the amount that would be invested by a service provider efficiently minimising costs. In determining this, consideration should be given to economies of scale and economies of scope in conjunction with system natural load growth and incremental load forecasts.

To demonstrate compliance with this section of the Access Code, Western Power submits that it must:

- ensure the most appropriate option has been selected to meet the requirements associated with reasonable forecasts of growth of covered services,
- demonstrate that the design and design standards are appropriate, and
- demonstrate that the delivery (including acquisition) cost of the new facility will be efficient.

Choice of network option

The choice of network option is linked to the requirements of the Regulatory Test defined in the Access Code. Among other things, the Regulatory Test requires demonstration that the recommended option maximises net benefit to those who generate, transport and consume electricity.

In its decision dated 3 February 2010 the Authority stated on page 2:

> "…The *Authority has* determined, pursuant to section 9.18 of the Access Code, that the regulatory test as defined in sections 9.3 and 9.4 and applied in accordance with section 9.20 of the Access Code is satisfied…"

Given that the proposed new facilities investment described in this NFIT application is materially the same as that described in Western Power's approved Regulatory Test application, Western Power submits that the new facilities investment proposed in this application represents that option that best satisfies the requirements of section 6.52 (a) of the Access Code.

Design efficiency standards

The second requirement with respect to section 6.52 (a) of the Access Code is to demonstrate that the selected network option's design and design standards are efficient.

- Line design is an optimised 330kV double circuit line
- Terminal design has been based on a breaker and a half arrangement

There are several key documents that relate to the design and design standards for this project (copies of the substation and line design reports are attached in Attachment 1 – Design Reports for reference):

- MWEP (southern section) Substation Design Report (DM# 7355185),
- MWEP (southern section), Line Design Report (DM# 7075162)

In addition the works at Three Springs Terminal have been designed in accordance with Western Power's standard for 330/132 kV terminal stations. It is worth noting that these standards have been peer-reviewed by Hydro Tasmania Consulting, who determined that Western Power's breaker and a half design standard aligns with current industry practice.

With respect to design standards, further assessment has been completed to review the appropriate design requirements for Three Springs Terminal. This has been included in Attachment 2 (Mid West Energy Project (southern section) Planning Considerations).

Three Springs Terminal (Substation design report DM# 7355185)

The Three Springs 330 kV switchyard layout selected is a breaker and a half configuration, which is Western Power's standard design. Although set up for the ultimate breaker and a half configuration, at this stage only three circuit breakers are planned to be installed in the mesh as part of this project, which is one circuit breaker per circuit which jointly operate as a three switch mesh.

The three 330 kV circuit breakers are used to connect three circuits being the Neerabup line, the Three Springs Terminal 330/132kV transformer and the KML line connection. An additional circuit breaker is being used to operate the 330 kV shunt line reactor which is effectively shunt connected on the incoming 330kV overhead line from Neerabup. This breaker and a half configuration will allow for ease of future expansion, some of which is currently being considered in relation to other projects.

Designing the initial layout of the 330 kV switchyard to operate in a mesh configuration, with future capability for breaker and a half layout, defers the upfront capital of additional primary plant while maintaining future options.

Transformer 330/132kV 490MVA unit.

The 490 MVA transformer rating was selected for Three Springs due to the following reasons:

- It provides the ability to supply the Geraldton region load forecast under all of the low, central and high scenario's[8]; and
- It allows lower cost augmentation options for supplying the Geraldton region by deferring the need for 330kV operation of new transmission line to Geraldton. A 490MVA transformer allows proposed new lines constructed for 330kV to be initially operated at 132kV deferring the establishment of a 330kV terminal at Moonooyooka.

Estimated savings associated with this choice over a 250MVA transformer is $8.6M[9] based on the high load forecast.

Attachment 2 provides additional information on the planning considerations for the MWEP (southern section). Section 4, Three Springs Terminal – Transformer Sizing of the MWEP (southern section); provides additional details regarding the review of the transformer size for Three Springs Terminal.

Transmission Line Optimisation

Western Power has undertaken a transmission line optimisation as part of the process to produce an efficient and prudent design. The line optimisation focused on the span length and structural design. The nominal span length was increased from 500m to 600m which resulted in a reduction in the number of towers used. A lost angle analysis was also performed as part of the optimisation process to determine the optimal angle structures as part of the structure suite.

Full details of the optimisation approach used by Western Power has been described in Section 5 of MWEP (southern section), Line Design Report (DM# 7075162).

Estimated cost savings associated with the optimised line design is $14M.

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[8] An additional 330/132kV transformer will be required in 2015/16 to supply N-1 capability at Three Springs 132kV substation under the high load forecast scenario.

[9] DM8452685 Investment Evaluation Model for Three Springs Terminal

An independent review on the line optimisation process (Midwest Energy Project – South Section, Report on 330kV Transmission Line Design Optimisation) was also completed and included in Attachment 1

Transmission Line Conductor Selection

In order to determine the most cost efficient conductor for the Pinjar to Eneabba 330kV line, Western Power considered the capital and operational costs for the life of the transmission line. The operational cost includes the cost of the line losses, i.e. joule and corona losses.

Further details of this investigation is provided in section 4.3.2.4, and the line design report, contained in attachment 1

A net present cost analysis of the capital cost and the operational cost between Lacrosse and Hurdles indicated that Lacrosse will be the most cost efficient for the central-high forecast and high load.

An overall saving of from $1.7M to $23.92M could be expected for the 40 years life of the transmission line.

MWEP Delivery

The third requirement with respect to section 6.5.2(a) of the Access Code is for Western Power to demonstrate that the project has been delivered efficiently. Western Power uses a suite of approaches in its project delivery portfolio to ensure, on an ongoing basis, an efficient cost is achieved. Attachment 3 – Delivery Strategy Reports contains a detailed break down of the components of the work and the delivery mechanism employed.

This approach is summarised in Table 5.

Table 5 Western Power Delivery portfolio

Delivery mechanism	Percent of Total Works
Competitive tender	[redacted]
Preferred supplier	[redacted]
WP internal resource	[redacted]

Note : remainder of works contained in Table 6

Acquisition of assets from KML

During late 2010 and early 2011, Western Power and KML, facilitated by the Department of State Development, reached an in-principal agreement on a revised delivery model for the KML project and the MWEP (southern section), subject to (amongst other things) obtaining government approvals and support in resolving a number of key outstanding matters. This revised delivery model incorporates Western Power acquiring the KML constructed Eneabba to Three Springs transmission line, prior to integration into the completed MWEP (southern section), to become part of the Western Power covered network. This approach delivers an optimal development of the Mid West network leveraged from initial private sector investment.

Project Timing:

KML had initially planned to construct the ENT-TST line section to provide an initial supply to its mine (95MW) and Western Power was to have completed the MWEP line from NBT to ENT, and hence allow connection to KML's line at ENT. Access to this line was to be negotiated between parties. Delays in finalising the KML agreement, and ongoing regulatory approvals, have lead KML proposing to advance the completion of the ENB-ENT line section under the same contract as the remainder of their line. This line allows a 132kV project connection for KML with a step-up to 330kV at Three Springs to allow a contingent start-up supply.

Similarly, project timing by KML has lead to the proposal for KML to contract the electrical build of the Three Springs terminal.

Determine efficient price for KML acquisition.

To determine an efficient price for each item of works being undertaken by KML, the following is being submitted for NFIT approval.

1. TST Electrical works will be contracted to KML, with the price being the lower of actual documented costs KML incur, and the value that Western Power has estimated the costs to be under an efficient contracting methodology.
2. ENT to TST line works will be acquired at the cost that Western Power estimate the line can be constructed efficiently, based on the actual line route and actual tower suite, both of which are the efficient decisions at the time of construction.
3. ENB to ENT line works will be acquired from KML at the cost that Western Power proposed to build the line in an efficient manner. This cost is the actual cost quoted to KML, prior to their decision to build the line, and is based on the MWEP (southern section) efficient cost estimate.

It should be noted that the price being submitted for NFIT is Western Power's determination of the efficient price based on works being delivered in an efficient market-based supply arrangement, and not KML's actual delivery strategy.

This approach is summarised in Table 6 below.

Table 6 KML acquisition portfolio

Delivery mechanism	Percent of Total Works
Acquired from or contracted to KML	[redacted]

Note : remainder of works contained in Table 5

3.3 Assessment With Respect to Section 6.52 (b)(i) of the Access Code (Incremental Revenue Test)

Section 6.52(b)(i) requires the new facility investment to be recovered via the anticipated incremental revenue described in section 6.52(b)(i)A. A new facility investment will meet the Incremental Revenue Test if the incremental revenue (measured in present value terms) is greater than the capital cost (also measured in present value terms) of the new facility. This analysis is undertaken by comparing the net present value of the anticipated additional revenue to Western Power from anticipated demand (in this case, both new load and new generation) less the net present value of the non-capital costs associated with servicing the new facility.

The primary rationale for the MWEP (southern section) is to safely connect additional block mining loads and the connection of 230MW of generation capacity[10], in the next few years with further growth in the future as the base load of the network increases. Incremental revenue associated with this step increase in demand implies that application of the Incremental Revenue Test is appropriate.

In applying the Incremental Revenue Test, Western Power has considered both deterministic and probabilistic approaches to calculating the anticipated incremental demand. Details of this assessment are included in Section 6 (which begins on page 41 of this document) with a summary given below;

Table 7 Incremental Revenue Test present value benefits (2010 $M) – 40 years

Source of revenue	Benefit estimate 50th Percentile Case
Iron ore mining	$187 M
Wind turbine generation	$19 M
Total	**$206 M**

Note 1: estimate includes XXXXX of interim incremental revenue from Karara Mining Ltd.
Source: DM 8094186

3.4 Assessment With Respect to Section 6.52 (b)(ii) of the Access Code (Net Benefits Test)

Section 6.52(b)(ii) requires the new facility to provide a net benefit[11] that justifies the approval of higher reference tariffs within a reasonable period of time. The reference to higher tariffs recognises that electricity network tariffs will increase if incremental revenue is insufficient to offset the approved capital cost. This is only justifiable under the Access Code if the proposed new facility offers a benefit that can be captured by the electricity market. Typically, this would be realised as an offsetting cost reduction somewhere else in the system.

When applying the Net Benefits Test, the Access Code requires that any identified net benefits be quantified. In doing so, it is necessary to present persuasive evidence that both the form and magnitude of the identified net benefits are likely to be realised.

[10] The assumed 230MW of additional generation capacity matches the additional renewable generation modelled by ACIL Tasman in the estimate of net benefits (see p. 34 of the ACIL Tasman's report, DM# 7254479v2)
[11] The term “net benefit”, which is a defined term in the Access Code, limits assessment of net benefits to those who generate, transport and consume electricity. This suggests that externalities are excluded from consideration when applying the NFIT.

To assist with this requirement, Western Power commissioned ACIL Tasman to identify and estimate the net benefits of the MWEP (southern section). The resulting report is presented as Attachment 4 – Net Benefits

In addition to ACIL Tasman's study, Western Power conducted studies to estimate benefits associated with reduction in network electrical losses and deferral of other network augmentations that can be derived from the MWEP (southern section). The resulting analysis is presented as Attachment 4 – Net Benefits.

A concise summary of the net benefit assessment can be found in Section 6 of this document with a summary given below;

Table 8 Net benefit break down

Source of net benefit	**Net benefit estimate**
Market-based benefit (ACIL Tasman) (20 years)	$236 M
Deferral of other network expenditure (20 years)	$26 M
Reduction in system losses (40 years)	$9 M
Total	**$271 M**

Source: DM 8094186

3.5 Assessment With Respect to Section 6.52 (b)(iii) of the Access Code (Safety and Reliability Test)

Section 6.52(b)(iii) is satisfied when it can be demonstrated that the covered network requires the new facility in order to maintain the safety and reliability of the covered network, or its ability to provide a contracted covered service. The Regulatory Test has already demonstrated that the MWEP (southern section) is the best option for meeting the future supply requirements for all customers and thereby provide them with a safe and reliable supply. The primary driver for the MWEP (southern section) is to connect the new mining loads and generation in the mid-west, without this driver Western Power would not require the MWEP (southern section) to maintain network safety and reliability.

The MWEP (southern section) does allow Western Power to defer other augmentations that would be required for safety and reliability of supply to the Geraldton region. However, the benefit of this is captured under the Net Benefits Test evaluation.

Consequently, Western Power has not applied the Safety and Reliability Test to the Mid West Energy Project (Southern Section) NFIT application.

4 Proposed Western Power Augmentation Project (Neerabup to Eneabba Terminal 330kV Line Works and Three Springs Terminal)

4.1 Introduction

To demonstrate compliance with 6.52(a) of the Access Code, Western Power submits the following documentation to:

- demonstrate the most appropriate option has been selected to meet the requirements associated with reasonable forecasts of growth of covered services (Section 4.2 below),
- demonstrate that the design and design standards are appropriate (Section 4.3 below) and
- demonstrate that the delivery cost of the new facility be efficient (Section 4.4 below) and the method of delivery is efficient (Section 4.5 below).

The following sections describe the proposed project implementation for the project section being delivered by Western Power. It includes the double circuit 330kV line section from Neerabup Terminal to the future Eneabba Terminal site, including all associated 132kV works, distribution works, and other substations works to enable the line to be constructed and put into service; and construction of the Three Springs Terminal.

This section includes the following items:

- Engineering design reports, describing the design decisions ensuring efficient designs for the lines and substation designs
- Project cost estimates, providing details of the estimated costs of the proposed augmentation project
- Delivery and Sourcing Strategies, providing details on how the augmentation project is proposed to be delivered in an efficient manner.

4.2 Project Planning

A scope for estimate report was produced to scope out the requirements of the MWEP (southern section). This document is included in Attachment 5 – Scope for Estimate.

This project planning definition report includes detail of the project scope for all transmission lines, substations and distribution works required for the Neerabup Terminal to Eneabba Terminal 330kV line section, and the Three Springs Terminal. It is the scope basis used for all design reports, project delivery strategy report and estimates forming the NFIT submission for these augmentation works.

This base document aligns with the MWEP (Southern Stage) 330kV double circuit line option approved in the Regulatory Test.

4.3 Project Design Standards

To ensure an efficient and cost-effective project, the designs used for the proposed augmentation project are based on Western Power's standard designs for substations and an optimised line design for the double circuit 330kV line design. The application of these design standards to meet the code has been previously discussed in section 3.2

For the substations, the use of Western Power's standard designs also minimises design effort, and decreases uncertainty of construction costs within the estimating process. Significant design optimisation has been undertaken on the line design, with the refined design providing a more efficient and cost effective design, as described in the line design report.

4.3.1 Substation Design Report

The detailed substations design report for this project is included in Attachment 1 – Design Reports. In addition, further documentation on the switchyard layouts, provision of reactors for voltage control and 330/132kV transformer sizing can be found in planning reports included in Attachment 2 – Planning Reports.

The design report outlines the design characteristics for the transmission substations component of the MWEP (southern section), namely the new Three Springs 330/132kV Terminal, new line bay at the existing Neerabup 330kV Terminal, and works at a number of substations along the Neerabup to Three Springs Terminal 330kV line route.

4.3.1.1 Substation Design Summary

A brief outline of the substation scope for the Mid West Energy Project follows:

- Environmental and Community Requirements
- Construct a new Three Springs Terminal 330/132 kV
- Add a new 330 kV line circuit at the existing Neerabup Terminal 330 kV switchyard
- Add a new 132 kV line circuit at the existing Three Springs Substation 132/33kV
- Upgrade 132kV line Protection systems at a number of 132kV substations affected by the construction of the augmentation, and protection upgrades to improve fault tripping times and North Country voltage stability
- Communication works at Three Springs Terminal and a number of 132kV substations on the line route

4.3.1.2 Three Springs Terminal Design Summary

A summary of the proposed Three Springs Terminal 330 kV designs to meet the project scope are as follows:

- The yard will be constructed as a 330 kV breaker and a half layout with two busbars and two bays. The initial construction allows for the addition of one more line circuit with minimal works, and the ability for expansion of up to a total of 8 full bays.
- Initially Three Springs Terminal will be configured as a three switch mesh comprising of two line circuits (NBT91 and KRA91) and one transformer
- One iron cored three phase shunt reactor will be connected to the Neerabup 330 kV line (NBT91) for voltage regulation during line energisation and low load conditions
- Two air cored shunt reactors will be connected to the transformer 22 kV tertiary for energisation of the 330kV line to Karara and steady state voltage control
- Future network requirements include additional possible 330 kV connections from Three Springs Terminal to Karara mine site, Moonyoonooka MWEP (northern section) and Extension Hill mine site. Also possible 330kV augmentation from the MUC – MOR to TST 91/92 circuits. Allowance has been made for a future 132 kV yard to be located at Three Springs Terminal

4.3.2 Line Design Report

4.3.2.1 Introduction

The design report outlines the design characteristics for the transmission lines component of the MWEP (southern section), namely the 330kV double circuit Pinjar to Eneabba Terminal overhead line and the 132kV transmission line connection design.

4.3.2.2 Background

The Pinjar to Eneabba double circuit line is required to provide sufficient capacity for the network in the Mid West region of WA. The new line is being constructed in the line route created by removing the existing 3-pole wood pole line from Pinjar to Eneabba.

The transmission line will be built as double circuit with both sides strung as 330kV but only the west side of the circuit energised at this voltage. The east side of the circuit will be energised at 132kV and will be connected into 132kV substations along the line route. These substations are Pinjar, Regans, Cataby and Eneabba.

The Pinjar to Eneabba 330kV line will be connected to the existing Neerabup to Pinjar line and will connect to the proposed 330kV line to Three Springs Terminal at the future Eneabba Terminal site location. The complete line will then form the Neerabup to Three Springs 330kV line.

4.3.2.3 Environmental Conditions

The Regulatory Test for the MWEP (southern section) has confirmed that replacing the existing wood pole 132kV line between Pinjar and Eneabba with a new steel tower 330kV double circuit line following the same route, represents the least cost, and most environmentally and socially acceptable line route option for the southern section of the MWEP. All environmental approvals have been secured for this route. The line will traverse a number of diverse terrain conditions, some of which have an impact on the line design as follows:

- Height Restriction - The Department of Defence's height restriction is in place for structures within the vicinity of RAAF bases. Low profile towers were designed to cater for this constraint.
- Wheat belt clearance - Additional ground clearance of 2.3m is required to cater for the unusual height of farming machinery.
- Visual Impact - Steel poles are required for crossings of Brand Highway, Jurien Bay Road and Bibby Road to meet the aesthetic and visual requirements of the local council.

4.3.2.4 Conductor

The new Pinjar to Eneabba 330kV line will be in close proximity to the coast and to prevailing winds from the ocean. An ACSR conductor with an aluminium-clad steel core (ACSR/AC) was selected based on the risk of steel corrosion.

A whole of life cost analysis was carried out to determine the most economic size of conductor. This included Joule and Corona losses in addition to the capital cost. Joule losses are attributed to the length of the line and the resistive losses from the conductor, while the corona losses are attributed to the size of the bundled conductors and the environment that the conductors are operating in. Western Power engaged University of

Western Australia to undertake a study of the corona performance of the proposed line. The report indicated that out of the conductors considered (Gymnastics, Hurdles and Lacrosse), Lacrosse will have the least corona losses.

A 40 year central and high load forecast was used in the net present cost calculation. A cost of $36/MW-hr (weighted average STEM price of energy 1 June 2008 to 15 April 2011) was used. Further details on the analysis can be found in the Planning Considerations for the MWEP report in Attachment 2 – Planning Reports.

Table 9 below shows the variance in whole of life cost for Lacrosse over Hurdles.

Table 9 – Net Present Cost Difference of Lacrosse over Hurdles

Conductor Surface State Coefficient[12]	Load Forecast	Net Present Cost Average cost difference ($M)
0.6	Central Mid Central High High	-1.41 0.85 4.51
0.58	Central Mid Central High High	-0.56 1.70 5.36
0.56*	Central Mid Central High High	11.40 13.66 17.32
0.54	Central Mid Central High High	18.00 20.26 23.92

*0.56 is the likely conductor surface state coefficient

Lacrosse was selected over hurdles as the phase conductor based on:

- Lower net present cost for conductor surface state coefficient lower than 0.6 – which is likely due to the higher salt pollution area being transversed
- Lower overall cost for load higher than the central forecast
- Lower radio interference and audible noise
- Additional capacity benefit

4.3.2.5 Maximum operating temperature

The maximum conductor operating temperature will determine the ultimate rating which can be achieved. The Pinjar to Eneabba 330kV double circuit line was profiled at 85°C, due to the following considerations:

a. The operation at Karara mine and future connections are expected to be 24/7 operation for 365 days a year. Once the circuit is energised, there will be no opportunity to uprate the circuit physically while still maintaining supply.

[12] Conductor surface state coefficient is a factor used to determine the corona onset gradient. This factor is affected by the condition of the surface area of the conductor (stranding and environment). Higher values correspond to smoother surface.

b. Extension Hill is considering a firm supply (n-1) and will require higher line capacity. The spare capacity resulting from 85°C operating temperature will be available for usage with reactive support (SVC or STATCOM).

c. The design life of a transmission line is 60 years. Future load projections have to be considered over an extended period beyond that of the 20 year load forecast. Future generation connections have also been identified and there are currently over 1450MW of enquiries for connection in the Mid West region. The spare capacity provided by 85°C operating temperature will allow the circuit to accept further network expansion.

A review of similar utility practices which use long transmission circuits to supply remote loads was undertaken. Powerlink, Queensland operates long transmission lines and all their transmission lines are typically profiled at 85°C or higher dependant on conductor type and size. Powerlink, Queensland effectively uses reactive support to ultimately drive the capacity at the transmission line remote ends to fully utilise the conductor capacity and this enables deferment of augmentations and replacement of transmission circuits.

4.3.2.6 Structure Suite Optimisation

In order to obtain the most cost effective line design, an optimisation process was applied to the cost critical design items. In order to optimise the suit of structures utilised for the Pinjar to Eneabba 330kV line, the following steps were undertaken:

a. Initial structure type selection and refinement

The initial analysis of electrical, environment and civil requirements identified 18 types of structures, based on wind region A and B, wheat belt areas, higher land subjected to higher wind load in region A, and height restrictions. By considering the total design cost (including prototyping and testing) and utilising tower designs for multiple applications the optimal suite was refined to 10 types.

b. Lost angle analysis

The 10 tower types comprise of suspension and strain/angle towers. In order to maximise the effective usage of the strain/angle towers, lost angle analysis was carried out based on the deviations on the line route.

The analysis showed that the most economical option was to design 4 angle towers, which were 0-0.4 degrees, 0.4-5 degrees, 5-15 degrees and 15-45 degrees.

The final suite of structures resulted in the tower types contained in Table 10 below:

Table 10 – Tower Suite

Tower Type	Region A	Region B
Suspension	9DS0A	9DS0B
Heavy Suspension	9DS5A 9DS15A	
In-line Strain	9DA0A	
Strain Tower	9DA45A	9DA15B
Terminal Tower	9DT25A	9DT25B
Low Profile Tower	Low Profile	

Note :

9DS0A means **9**(330kV) **D**ouble Circuit **S**uspension tower **0** degree Region **A**

9DA15B means **9**(330kV) **D**ouble Circuit **A**ngle tower **15** degree Region **B**

4.3.2.7 Optimal Span Length

Span length is a key parameter that has a large effect on the ultimate line cost. As part of the design optimisation process, desktop studies using PLSCADD were performed to establish the most cost effective span length for the line route.

The results from the studies showed that a 600m span provides the most cost efficient design.

4.4 Project Cost Estimate

4.4.1 Introduction

The planning level estimate was based on the project scope defined in the Scope of Estimate in Attachment 5 – Scope for Estimate

The development of the project cost estimate for the MWEP (southern section) was in two stages – development of an initial Scoping Phase (formerly A1) accuracy level estimate – followed by a more accurate Planning Phase (formerly A2) level estimate. This approach followed the current internal process for project development where initially a project is estimated at a scoping phase accuracy level (± 30% typically) for use in comparison amongst other options and for approval in principle. This level of estimate was used for Regulatory Test submission for the project.

Following approval to proceed with the line optimisation and associated detailed design, a planning phase accuracy cost estimate was generated. This has resulted in an estimate with ±10% accuracy level which is being used for both this Pre-NIFT submission and project approval to proceed.

The Planning Phase estimate associated with the MWEP (southern section) 330kV transmission line has been developed in a greater degree of accuracy due to the size of the project and the increased amount of estimating effort expended on this project during the development phase to date. The project cost estimate in this report provides an approximate ±10% level of estimation accuracy.

The estimation process described in this section and applied to the MWEP (southern section) project was based on a detailed breakdown of activities within the project derived from early project delivery development work carried out with the EDI Downer/Western Power Power Alliance, and the use of expert estimation resources within Western Power, to compile a robust, defensible, bottom-up cost estimate for the project. The estimation database for this project is extensive and provides for an auditable estimation trail. The estimating compilation has made use of supplier quotations for all major materials purchase items.

This cost estimate will also be used as a basis of evaluation of tenders for the line construction contract which involves some design, procurement and construction for the 330kV line.

4.4.2 Cost Estimation Summary

The total estimated project cost for the scope of works included in the Scope for Estimate is $ XXX M[13] (constant dollars). All dollar figures are presented in base July 2010 Australian dollars.

This cost includes all direct & indirect costs, overheads, contingencies and risk provisions but specifically excludes allowances for currency (EUR, USD, JPY & RMB) and commodity (Aluminium, Copper & Steel) price fluctuations. Sensitivity analysis has been performed on the commodity exposure which indicates that over the past year, the commodity costs and exchange variations work to provide a natural hedge to these variations (see section 4.4.4 below).

Note that MWEP works in the tables below include the delivery cost of the KML funded 12km ENB-ENT transmission line section for consistency (previously this line section was part of the Western Power MWEP works scope). The following table shows the high level composition of the overall estimated project cost in constant dollars:

Constant $M	Risk Free (base) A$ M	Risk Allowance (P80) A$ M	Total Cost A$ M
MWEP works	[redacted]	[redacted]	[redacted]

A description of the components of the breakdown line items as well as comments on costing estimates is provided in the project estimate report. (Commercial in Confidence)

4.4.3 Estimation Methodology

The cost estimate was developed by a multidisciplinary internal team comprising of cost estimators, project managers, procurement specialists, technical specialists and finance personnel. The cost estimators compiled the overall cost estimate using in-house

[13] Includes [redacted] for KML dedicated connection assets.

estimating software employing data from a number of sources, including data and inputs from Western Power construction personnel, suppliers and contractors, and Western Power's estimation database.

Major inputs into the estimating methodology included the delivery strategy for the southern section of the project (discussed in section 4.5 below).

The cost estimate was formed using a bottom up estimation method characterised by the use of a Work Breakdown Structure (WBS) to break the project progressively down into component phases and activities (such as planning, design and so on), and further decomposition of these into lower activities involving materials, labour and plant for each. This follows standardised approaches to estimating recommended by organisations such as the Project Management Institute.

- The lower level activities are estimated using quantity and time estimation and based on Western Power estimating database information as well as data from sources such as contractors and suppliers. These are combined into higher level components leading to high level cost estimates for individual lines, substations and terminals.
- The execution methodology which placed constraints on how the project could be executed on site had been determined from earlier estimating and analysis of the project. During these earlier phases, workshopping of several different approaches to construction activities based on delivery timing, constraints and risk was conducted.
- Risk cost estimation was then done using multidisciplinary teams to assist in the risk assessment process which is based upon Australian Standard AS.NZS4360. Risks are identified both from risk database information and input from the project team. These risks are then quantified and rated using risk impact and likelihood evaluation.
- Mitigation was applied where possible and in the case of this project, earlier estimating cycle information and field experience were used to reduce the risk ratings. Worst and best case estimates were developed for significant risks and used as inputs to Monte Carlo simulations generating a consolidated risk curve for the project.
- The confidence level used to select the appropriate risk contingency was established at 80%[14].

4.4.4 Foreign Exchange and Commodity Market Movements.

Within the Planning level estimate, there has been no allowance for either foreign exchange fluctuations, or changes in the base commodity costs.

The amount of the project that is subject to Foreign exchange (Forex) or commodity prices is noted in table 4.4 of the estimate report. The exposure is XXXXX, with the greatest exposure being in the supply of tower steel XXXXX and aluminium conductor (XXXXX for Lacrosse conductor).

Western Power has carried out a sensitivity analysis to ascertain the sensitivity of the total estimate to the change in both Forex and Commodities prices, given the significant change in the USD/AUD Forex rates that have occurred since the project estimate was created.

[14] This means a 20% probability that the risk contingency provision will be exceeded on average.

Western Power has considered the forecast movements in commodities prices over the MWEP construction period. In doing so, Western Power has analysed futures markets for the main commodities including steel and aluminium. Taking into consideration the exposure of the project to commodity and foreign exchange markets, Western Power considers the risk of significant changes in the cost of the project to be low

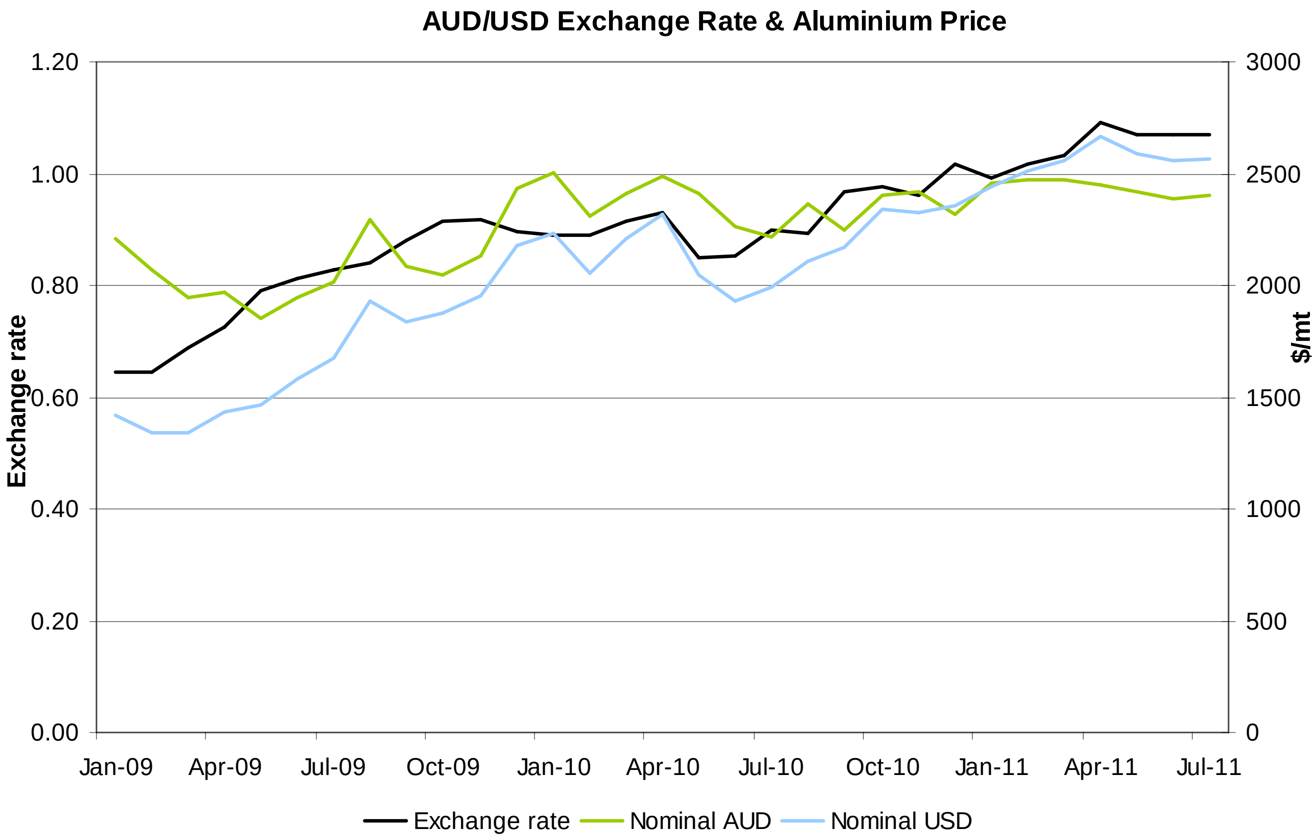
Western Power notes that as the Australian dollar has risen significantly in value and that there has also been a similar rise in commodity prices of both steel and aluminium. There is a natural hedge that exists between the commodities prices and the Forex rates, that reduces the affect of the change in Forex since the estimate was created.

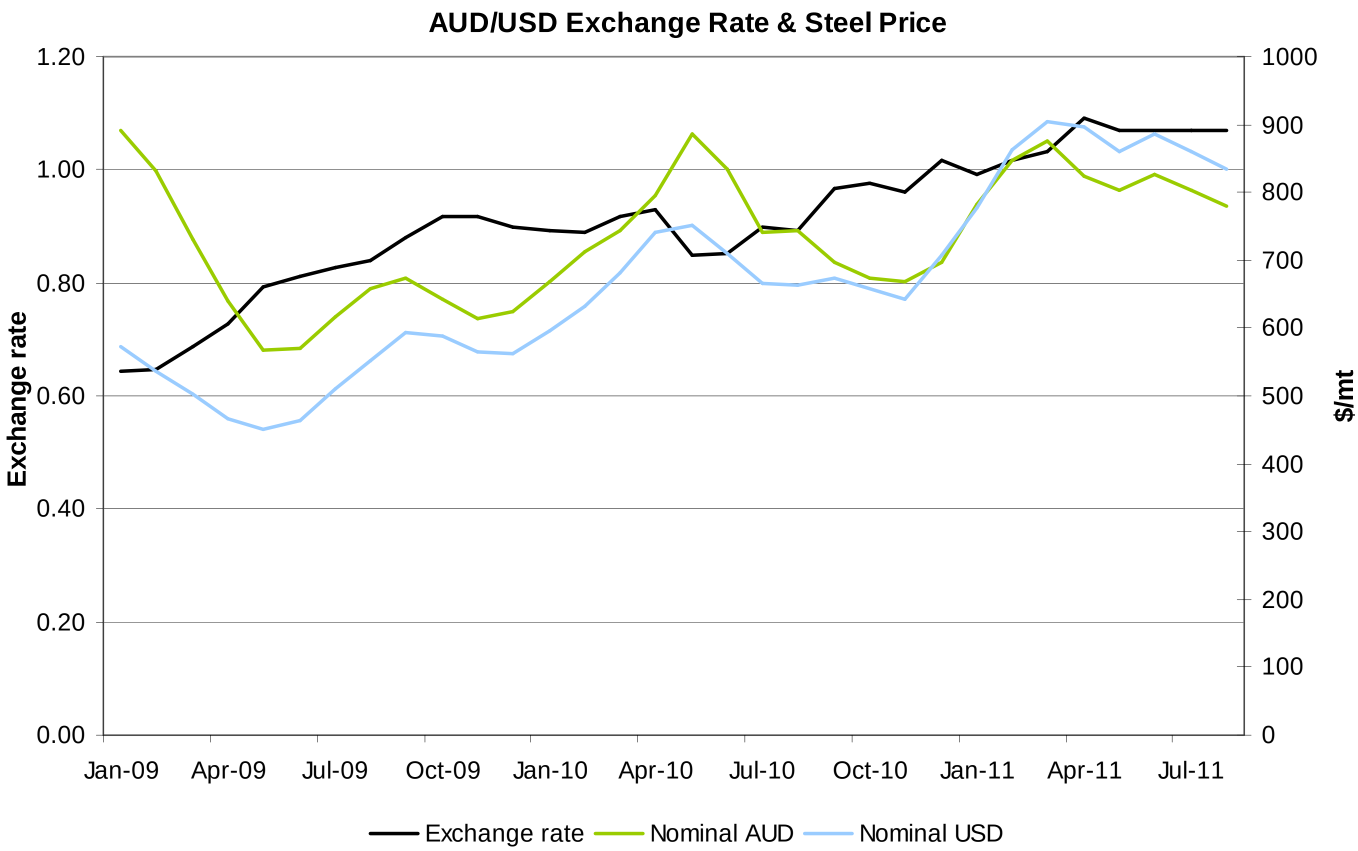
Western power has tracked the prices of steel and aluminium prices costs in US Dollars, the AUD/USD rates since January 2009; these are shown in the graphs on the following page.

The sensitivity analysis indicates that while the Forex rates have gone up by nearly 30% in the past year, the actual cost of both Billet Steel and Aluminium has gone up rather than down in AUD terms. Indeed at some particular dates over this period, the cost in AUD has been both above and below the cost of both commodities at July 2010.

Given that it is expected that it will be between 6 to 9 months before Western Power actually places a line contract with a tenderer, the risk of significant changes in the actual price to the estimated price is low, and the likely impact of such a change would also be low.

Commodity Graphs – Steel, Aluminium and AUD/USD exchange rate base lined from January 2009, and the commodity spot prices converted to AUD using the AUD/USD rate.





4.4.5 Cost Benchmarking

As the construction of the double circuit 330kV line is by far the most significant portion of the project costs, benchmarking has been undertaken to confirm that the estimate and the construction methodology behind it provides a result which confirms efficiency and costs effectiveness.

Benchmarking has been performed against a previous Western Power 330kV construction, Powerlink Queensland, Downers KML construction and Worley Parsons. The Worley Parsons report provides an independent estimate of the line costs, based on the actual line route and tower base designs. This report was completed during 2010. The results of these benchmarking exercises and the Worley Parsons estimate suggest that the MWEP (southern section) estimate is within and on the lower side of the ranges provided.

4.5 Delivery Strategy

4.5.1 Introduction

The southern section of the Mid-West 330 kV reinforcement project will be delivered through a combination of works being carried out by Western Power (WP) resources, contract resources procured by open tender, equipment from competitively selected preferred vendors, and acquisition of assets from KML. The detailed delivery strategy is provided in Attachment 3 – Delivery Strategy Reports.

The delivery strategy of the MWEP (southern section) requires a range of competencies across diverse activities including:

- Easement access provision, environmental management planning and acquisition of environmental permits;
- System design;
- Detailed facility design (transmission and distribution);
- Procurement;
- Construction and Demolition (transmission and distribution); and
- Commissioning.

4.5.2 Sourcing and Procurement Strategies

The key elements of the sourcing and procurement strategies are summarised for the respective portions of the MWEP (southern section) listed below:

- Construction of double line circuit transmission line Pinjar – Eneabba
- Neerabup Terminal 330kV expansion; and
- Establishment of Three Springs 330kV terminal substation

A one page summary of the above mentioned sourcing strategies for public viewing is provided in Attachment 6 – Sourcing Strategy.

4.5.2.1 Construction of Double Circuit Transmission Line Pinjar – Eneabba

Western Power will invite up to 14 Potential Vendors[15] to participate in a competitive tender process to establish the successful Contractor.

This will be established via a competitive process whereby participating Potential Contractors, in addition to providing value for money, will need to satisfy a number of pre-defined assessment criteria in order to be recommended as the successful Contractor.

Key features of the assessment criteria will include:

1. Qualitative criteria surrounding capacity, capability, experience, safety and environment; and
2. Pricing

4.5.2.2 Neerabup Terminal 330kV Expansion and the Establishment of Three Springs 330kV Terminal

Separate competitive processes will be undertaken to engage Potential Contractors for the above two scope of works. Timing, market availability and total expected cost of the individual project will influence which of the following sourcing strategies will be employed:

1. Issue a Request for Quotation (RFQ) to utilise existing panel arrangements for Preferred Contractors for the following:
   i. Civil Works
   ii. Electrical Works (currently in development)
   iii. Steel Fabrication
2. Go-to-market via a Request for Tender (RFT).

Both strategies will ensure that competitive pricing and programmes are obtained to satisfy the Value for Money objective.

4.5.3 Delivery Approach

As part of review of the MWEP (southern section) and implementation of the project over a number of stages, Western Power has determined that the most appropriate delivery mechanism for this project is to employ a mix of contracting (through open tendering), internal resources and construction undertaken by KML.

The major component of the project is the design and construction of the 330 kV dual circuit transmission line both from a cost and effort basis.

A specific methodology was adopted to determine how this project component should be delivered. This methodology was based around the State Government Infrastructure Procurement Options Guide and involved a two - stage assessment of delivery options against the specifics and nature of the works to be delivered.

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[15] Western Power conducted a Registration of Interest process in October 2010. 14 companies formally registered their interest for the Request for Proposal to establish Preferred Vendors for High Voltage (220kV and above) Transmission Lines Construction Works and will therefore be eligible to participate.

This assessment process included consideration of the elements required for the delivery of the transmission line works, internal Western Power capacities and competencies and also the commercial priorities relevant to the procurement model selection.

Detailed assessment of the viable options resulted in the recommended option of open tendering procurement method for delivery of the design and construction of the transmission line works being identified as a superior procurement approach. Key factors driving the decision included:

- The requirement to extract and demonstrate Value for Money;
- Requirement for cost certainty and cost control;
- The low level of uncertainty surrounding design and construction issues given that significant portions of design had already been completed as well as site issues such as environment, line route, access and ground conditions were known because of the amount of work already done. This limited the scope for delivering project gains under partnering style procurement methods;
- Market conditions and presence of a number of experienced contractors in this market segment;
- Requirement for a low risk approach given regard to cost, timing and stakeholder requirements; and
- Availability of support mechanisms and "fit" with Western Power current processes and systems.
- Opportunity to leverage construction services available from KML.

The remainder of the project works including the new terminal works and augmentation works at existing Western Power facilities is proposed to be implemented via:

- Use of Western Power engineering design and drafting resources;
- Contracting out of earthworks, civil works and structural fabrication for all works, and electrical construction for the major substations;
- Use of Western Power electrical construction resources for minor substation works;
- Use of Western Power specialist secondary systems resources for Protection, Communications and SCADA systems for installation and commissioning.

This delivery strategy leverages off Western Power's experience in project delivery of large terminal stations, smaller substation enhancements, and varying sized transmission lines.

The breakdown of the work packages and associated delivery mechanism is shown in Table 11 and Table 12 below.

Table 11 Delivery Strategy Breakdown by Work Type

Work Package Items	Delivery Mechanism
Planning & Project Management	[redacted] of total cost. Planning and project management are done using internal resources due to the need for specific knowledge of network requirements, planning criteria and efficient execution management of works.
Design	[redacted] of total cost. Optimisation is done using engineering staff using WP specific systems and methodology.
Three Springs Related	[redacted] of total cost. Primarily contract works by competitive tender as well as materials sourced via preferred supplier contracts.
Augmentation to existing Substations	[redacted] of total cost. Mix of specialist skills available internally plus contract works and materials sourced via competitive tender.
Environmental / Access Related	[redacted] of total. Predominantly contract works from competitive tender and payments for land based on independent valuation.
330kV and 132kV Lines	[redacted] of total. Almost all is contract works sourced via competitive tendering.
KML acquired or contracted works	[redacted] of total. These works are to be acquired at the estimated costs of works delivered under a competitive tender.

Table 12 Delivery Strategy Breakdown by Delivery Method

Delivery Mechanism	Delivery Mechanism
Project Specific competitive market tenders	[redacted] of total cost. Direct placement of project specific design, procurement and construction works provided through competitive tender.
Western power Preferred Suppliers	[redacted] of total cost. Materials sourced via Western Power preferred suppliers selected via competitive market process. Primarily specialist primary plant standardised across the network.
Western Power Internal Specialists, or ELMS Costs	[redacted] of total cost. Western Power internal labour and plant - mix of specialist skills available internally including design and contract supervision. Includes internally funded easement purchases and works for environmental offsets.
KML acquired or contracted works	[redacted] of total. These works are to be acquired at the estimated costs of works if under a competitive tender.

4.5.4 KML Delivery Involvement

In the revised agreed project delivery model, Western Power and KML are intending that construction of the Three Springs Terminal and the 12km of line between Eneabba substation and the future Eneabba Terminal location will be accelerated to meet KML's schedule. This is required to provide an Interim Supply (non-firm) from the 132kV network to the Karara minesite within KML's required timeframe (early - mid 2012)

The proposal for KML to undertake the early construction of the 12km Eneabba Substation to Eneabba Terminal line construction, and the electrical construction activities at Three Springs Terminal, using its contractor EDI Downer, impacts on the percentages of works being placed under competitive tender.

KML has requested this approach to ensure control over maintaining its schedule of construction. The agreement with KML requires that it indemnifies Western Power against any additional costs incurred over those estimated by WP assuming a competitive tendering process.

4.5.4.1 ENB-ENT Line Estimate

It is proposed that KML will construct the ENB-ENT line section which will form part of the line acquisition by Western Power.

The value that is proposed for acquisition of this line section is based on the value that was provided to KML by Western Power to construct this section of line as part of the MWEP construction. This proposed acquisition cost is the NFIT value, being the efficient cost of building the line by Western Power as part of the complete MWEP works.

4.5.4.2 TST Electrical Works

The Three Springs Terminal will be constructed by Western Power, however it is proposed that the electrical construction component be undertaken by KML/Downer.

The value that is proposed for the electrical, structural steel and site surfacing works to be contracted to KML will be the lower of actual documented costs KML incur, and the value that Western Power has estimated the costs to be under an efficient contracting methodology. Details are contained within the Delivery Strategy Attachment, contained in Attachment 3 – Delivery Strategy Reports. Appropriate measures are in place to ensure that Western Power pays an efficient cost for the delivered works.

To provide further confirmation that the estimate is a reasonable determination of the actual costs to construct these works, the estimated construction costs for the Three Springs Terminal has been benchmarked against previous similar terminals at Western Power. This benchmarking indicates that the estimated costs for all construction works for Three Springs are of the same magnitude as the estimate costs for Three Springs. This provides a level of assurance that the strategy of lowest of actual or estimated will provide an efficient delivery and value for money.

4.5.5 Project Delivery Timetable

The timetable for the delivery of the project is based around the primary driver which is the provision of a 330kV supply for KML's mine operations at its Karara mine site.

The initial phase of the project delivery plan is to obtain the necessary financial and regulatory approvals. Following the approvals phase, project execution proper then proceeds which is expected to commence early 2012. A number of activities then need to be initiated:

- Issue of tender to market, receipt of tender responses, analysis and tender award. As per legislation, the Minister will need to approve a section 68 submission regarding the recommended tenderer and approving the resultant contract. This process is being fast-tracked by the creation of a line construction panel, which will allow the tender design process to be streamlined.
- Early work to reconfigure the connections to Emu Downs Windfarm to allow for demolition of the existing 132kV line;
- Undertaking of distribution work to underground low voltage power lines which cross the route of the new 330kV transmission line;
- Early work to prepare the line route for construction, including finalising approvals, providing access tracks, and clearing vegetation.

The main 330 kV line construction phase is expected to commence from Quarter 1 2012 with the contractor commencing detailed tower fabrication design and early foundation construction. Once these designs are complete, materials procurement can proceed, with major lines materials procurement on an estimated 6 month delivery timetable.

Western Power is currently considering commencing early tendering processes to ensure that it is well placed to commence the works promptly and take advantage of current competitive market conditions for construction.

4.5.6 Interest During Construction

Interest During Construction (IDC) has been calculated from the forecast construction cash flow profile with interest applied at the most appropriate ERA approved cost of debt for regulated assets taken as 8.9%. The IDC has been de-escalated to be expressed in July 2010 dollar terms. The following tables (Table 13 and Table 14) provide details of the costs per quarter used for calculation of the IDC for these items.

Table 13 Cash Flow for ENB-ENT Line Construction

Real (July '10) $M	Q4/11	Q1/12	Q2/12	Q3/12	Total
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The IDC has been calculated at XXX for a total NFIT value of XXX

Table 14 Cash Flow for TST Construction

Real (July '10) $M	Q2/11	Q3/11	Q4/11	Q1/12	Q2/12	Q3/12	Q4/12	Q1/13	Total
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The IDC has been calculated at [redacted] for a total NFIT value (after removal of customer funded connection assets) of [redacted]

5 Eneabba Terminal to Three Springs Terminal 330kV double circuit – Section of line constructed by KML

5.1 Introduction

The following sections describe the proposed acquisition of the Eneabba Terminal to Three Springs Terminal (TST) line section being delivered by KML. It includes the double circuit 330kV line section from the future Eneabba Terminal to the TST, including the associated 132kV line demolition and distribution works.

This section includes the following items:

- Project cost estimates, providing details of the estimated costs of the proposed acquisition
- Acquisition strategy, providing details on how the augmentation project is proposed to be delivered in an efficient manner.

5.2 Transmission Line Scope of Works

The scope of works of the Eneabba Terminal to TST line is the design, procurement and construction of 58.3km of double circuit 330kV line. This includes the undergrounding of distribution crossings, and the demolition of the existing Eneabba to Three Springs 132kV wood pole line, which is a condition of the environmental approvals for the construction of this line by KML.

While this line is being constructed by KML, the line construction is carried out using the same methodologies as used by Western power, and with line designs and materials meeting Western Power's applicable design standards. Western Power is undertaking QA checks on this line to confirm acceptable build criteria are met.

5.3 Transmission Line Design for Efficient Acquisition Price from KML

5.3.1 Introduction

The design considerations and scope of work for this line section are contained in the estimate reports.

The transmission line is being built as double circuit with both sides strung as 330kV but only the west side of the circuit energised at this voltage. The east side of the circuit will be energised at 132kV and will be connected into 132kV substations at Eneabba and to Three Springs.

Designs have been prepared for two different line construction builds.

The design used for the NFIT submission estimation has been based on the most efficient tower designs available at the time of construction, as being issued for the actual construction. These were based on exiting North Country Reinforcement Wind Region B design standards. The line design has not run through the same Western Power optimised design process which has subsequently been established for the longer 201km MWEP project.

This 500m span line design has been based on the following inputs to provide an efficient design based on the available tower suite:

- Line route is based on KML's efficient line route selection

- The design has utilised KML's tower suite, which is based on WPC's NCR design for wind region B, the standard tower design at time of construction.
- Line design has been undertaken to maximise use of the tower designs, maximising spans to the tower suite parameters.

The second design for comparative purposes is based on utilising the optimised MWEP tower suite, with new tower designs incorporated for the wind region and line route selection, with the MWEP base 600m span design.

5.3.2 Environmental Considerations

The line route initially proposed by Western Power followed the existing Three Springs to Eneabba 132kV line, deviating from the existing 132kV line before Three Springs township. The line route selection follows selection criteria meeting Western Power's environmental and community requirements and obligations.

In undertaking the line design, KML undertook some minor changes to the line route, including line straightening where Western Power's criteria required deviations. This has produced a shorter, more efficient line route than was proposed by Western Power, with the resultant trade off of increased environmental costs. Overall KML's line route is a more efficient line route for construction. The line estimate has been created with the line route being constructed by KML.

5.3.3 Conductor Selection

The conductor selected for the ENT to TST 330kV line by KML was Hurdles conductor. KML have selected Hurdles as their preferred conductor, taking into account their lower line loads East of Three Springs. Hurdles conductor has sufficient capacity to meet Western Power's future load requirements. Accordingly, the design and estimate for this section of line by Western power is based on Hurdles conductor, as being the conductor being acquired.

5.3.4 Tower Suite

For the design based on the actual KML towers, the existing suite of NCR towers as utilised by KML has been used. This was the standard tower suite available at the time, with the tower suite shared between Downer/EDI and Western Power.

In order to obtain the most cost effective line design with this tower suite, an optimisation process was applied to the tower locations, with tower spans increased to make use of the additional strength inherent in the 2 degree suspension tower being used in a 0 degree application. This has lead to the following towers as the basis for the line design:

Structure Name	Structure Description	Number in Line
9ds2b	In-Line Suspension	106
9ds15b	15 degree Suspension	5
9da45b	45 degree Strain	4
9da90b	Terminal	4

5.4 Transmission Line Cost Estimates for Efficient Acquisition Price

5.4.1 Introduction

The total estimated project cost of this line section is based on Western Power undertaking a detailed cost estimate utilising the MWEP cost estimate database and methodology, with quantities revised for the different tower suites and quantities. The project cost estimate in these report provides an approximate ±10% level of estimation accuracy.

5.4.2 Cost Estimation Summary

The total estimated project cost for the construction of the ENT-TST double circuit line based on the use of the KML tower suite is XXX (constant July 2010 dollars). For reference, the estimated cost of constructing this line if the MWEP optimised 600m span towers were used is XXX (constant dollars). All dollar figures are presented in base July 2010 Australian dollars.

This cost includes all direct & indirect costs, overheads, contingencies and risk provisions but specifically excludes allowances for currency (EUR, USD, JPY & RMB) and commodity (Aluminium, Copper & Steel) price fluctuations. Sensitivity analysis has been performed on the commodity exposure which indicates that over the past year, the commodity costs and exchange variations work to provide a natural hedge to these variations (see section 4.4.4). The actual placement of this contract and order of materials has been within the past 12 months.

A description of the components of the breakdown line items as well as comments on costing estimates is provided in the project estimate reports.

5.4.3 Estimation Methodology

The cost estimate was developed by utilising the separate elements of the MWEP estimate and applying them to the ENT-TST line route on an actual and pro-rata basis. Numeric estimates have been used where discrete quantities have been identified, and previous quoted prices used. This relates to all major procurement and construction items, where tower, foundation and electrical materials have been provided.

The estimates are based on WP methodology, with the detailed cost estimate utilising the MWEP cost estimate database and methodology. Actual numbers and sizes of the towers and foundations were used for both estimates, based on both the existing designed NCR 500m spans and the optimised MWPE 600m spans.

To achieve an appropriate accuracy the MWEP estimate basis was prepared using good industry practice. This includes mostly deterministic estimating methods. Detailed unit costing was used extensively and wherever possible market quotations were sought for all major materials. Where necessary on less significant areas of the estimate, parametric and factoring methods were used.

The confidence level used to select the appropriate risk contingency was established at 80%[16] which is a Western Power Board mandated value for all similar projects.

[16] This means a 20% probability that the risk contingency provision will be exceeded on average.

5.4.4 Interest During Construction (ENT to TST)

Interest During Construction (IDC) has been calculated from the forecast construction cash flow profile with interest applied at the most appropriate ERA approved cost of debt for regulated assets taken as 8.9%. The IDC has been de-escalated to be expressed in July 2010 dollar terms.

Table 15 Cash Flow for ENT to TST Construction

Real (July '10) $M	Q3/11	Q4/11	Q1/12	Q2/12	Q3/12	Q4/12	Q1/13	Total
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The IDC has been calculated at [redacted] for a total NFIT value of [redacted]

5.5 Conclusions

Western Power is submitting the NFIT valuation for the acquisition of the ENT-TST double circuit 330kV line on the basis of the proposed for-construction tower and foundation designs, on KML's efficient line route, with tower spotting optimised for the full tower strength parameters.

The estimated costs of undertaking this line build, based on WPCs design using the tower suite available at the time of construction, optimised for the line route, is [redacted].

6 Benefits Assessment

6.1 Introduction

This section provides a summary of the methods employed to calculate the likely benefits derived from the MWEP (southern section).

The NFIT is defined in Section 6.52 of the *Electricity Networks Access Code 2004* (the Access Code). This section is focused on addressing Section 6.52(b)(i)(A) and 6.52(b)(ii). For convenience, these elements of the NFIT are reproduced as follows:

- Section 6.52(b)(i)(A): the *anticipated incremental revenue* for the *new facility* is expected to at least recover the *new facilities investment*. This will be referred to in this section as the Incremental Revenue Test.

- Section 6.52(b)(ii): the *new facility* provides a *net benefit* in the *covered network* over a reasonable period of time that justifies the approval of higher *reference tariffs*. This will be referred to in this section as the Net Benefits Test.[17]

The explanation of the application of the above elements is provided in the next section.

Western Power's application of the Incremental Revenue Test and the Net Benefits Test indicates that approximately 50 per cent of the cost of the MWEP can be justified under the Incremental Revenue Test and 70 per cent under the Net Benefits Test. Combining the separate and non-overlapping benefits estimated under the two tests indicates that the total benefit offered by the construction of the MWEP exceeds the cost. The aggregation of benefits indicates a benefit-cost ratio of 1.2.

The source of the benefits is based on:

- The step-change in the demand for electricity derived from iron ore (magnetite) mining.

- The establishment of new wind turbine generation in the Mid West Region.

- Reduction in system losses.

- Deferral of planned network reinforcements.

6.2 Application of the NFIT Elements

The Incremental Revenue Test and the Net Benefits Test have been applied in a manner that is consistent with both the definitions in the Access Code and the Authority's application of these elements as described in an issues paper (the NFIT Issues Paper).[18]

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[17] Note that Section 6.53(b)(iii) of the Code provides an alternative test, the Safety and Reliability Test. However, there is no suggestion that an assessment of the benefits and costs is required or allowed. Moreover, Western Power has determined that this test is not applicable to the evaluation of the MWEP.

[18] Economic Regulation Authority (26 September 2008). *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*, Government of Western Australia, http://www.erawa.com.au/cproot/7331/2/20090219%20Final%20Determination%20on%20the%20New%20Facilities%20Investment%20Test%20for%20a%2066-

The italicised phrases in the definition of the Incremental Revenue Test and the Net Benefits Test have defined meaning in the Access Code. These are reproduced as follows:

Anticipated incremental revenue for a new facility means:

(a) the present value (calculated at the *rate of return* over a reasonable period) of the increased income from charges (excluding any *contributions*) reasonably anticipated to arise from the increased sale of *covered services* on the *network* to one or more users (where "increased sale of covered services" means sale of *covered services* which would not have occurred had the *new facility* not been commissioned),

minus

(b) the present value (calculated at the rate of return over the same period) of the best reasonable forecast of the increase in non-capital costs directly attributable to the increased sale of the covered services (being the covered services referred to in the expression "increased sale of covered services" in paragraph (a) of this definition,

where the **"rate of return"** is a rate determined by the *Authority* in accordance with the *Code objective* and in a manner consistent with Chapter 6, which may (but does not have to) be the rate of return most recently approved by the *Authority* for use in the *price control* for the *covered network* under Chapter 6.

"new facility" means any capital asset developed, constructed or acquired to enable the *service provider* to provide *covered services* including assets required for the purpose of facilitating competition in retail markets for electricity.

"new facilities investment", for a *new facility*, means the capital costs incurred in developing, constructing and acquiring the *new facility*.

"**net benefit**" means a net benefit (measured in present value terms to the extent that it is possible to do so) to those who generate, transport and consume electricity in (as the case may be):

(a) the *covered network*; or

(b) the *covered network* and any *interconnected system*.

"covered network" means a *network* that is *covered*.

"contribution" means a *capital contribution*, a *non-capital contribution* or a *headworks charge*.

"network" has the meaning given to "***network infrastructure facilities***" in the Act.

{Note: At the time this Code was made, the definition of section 103 of the Act was:

' **"network infrastructure facilities"** means:

11%20kV%20Medical%20Centre%20Zone%20Substation%20Expansion%20and%20Voltage%20Conversion%20of%20the%20Distribution.pdf [accessed 1 June 2010].

(a) the electrical equipment that is used only in order to transfer electricity to or from an electricity network at the relevant point of connection including any transformers or switchgear at the relevant point of connection or which is installed to support or to provide backup to that electrical equipment as is necessary for the transfer; and

(b) the wires, apparatus, equipment, plant and buildings used to convey, and control the conveyance of electricity,

which together are operated by a person (a "network service provider") for the purpose of transporting electricity from generators to other electricity networks or to consumers. '}

The above definitions clearly indicate that both the Incremental Revenue Test and the Net Benefits Test are to be conducted as benefit-cost analysis using the discounted cash flow (**DCF**) method. This approach is consistent with established investment appraisal methods employed almost universally by industry.

The ERA's NFIT Issues Paper provides further guidance on the application of these tests. In particular, Figure 1 (page 10) indicates that in the case where a new facility does not satisfy one of the tests, the non-overlapping benefits estimated under each test may be aggregated.

6.3 Method Used In Applying the Incremental Revenue Test

In order to apply the Incremental Revenue Test, it is necessary to calculate the anticipated incremental revenue using the DCF method. However, the Access Code definition of the Incremental Revenue Test uses phrases such as "expected to" and "reasonably anticipated to arise". This suggests that some form of risk assessment is required.

One approach to conducting this risk assessment is contained in Western Power's Contributions Policy. This approach limits the time period in which incremental revenue is calculated up to a period not exceeding 15 years. In a formal NFIT assessment of the medical centre zone substation, the Authority stated the following[19]:

> "…On the matter of the period of time used to calculate incremental revenue for the purposes of the new facilities investment test under section 6.52 of the Access Code, the Authority considers that the period of time should not be restricted to a maximum of 15 years when the economic life of the assets in question are reasonably expected to be in service beyond a 15 year period. The Authority accepts that this creates a potential conflict with Western Power's capital contributions policy. However, application of the new facilities investment test must be guided by the [Access] Code objective of efficiency in investment in the network, which supports consideration of the incremental revenue over the foreseeable economic life of the assets…"

The key issue is the mismatch between the maximum of 15 years allowed in the application of the Contributions Policy and the life of the asset, which in the case of the MWEP would be 60 years for transmission lines and around 40 years for substation equipment.

[19] Economic Regulation Authority (19 February 2009). *Final Determination on the New Facilities Investment Test for a 66/11 kV Medical Centre Zone Substation Expansion and Voltage Conversion of the Distribution Network*, p. 13, paragraph 63, Government of Western Australia, http://www.erawa.com.au/cproot/7331/2/20090219%20Final%20Determination%20on%20the%20New%20Facilities%20Investment%20Test%20for%20a%2066-11%20kV%20Medical%20Centre%20Zone%20Substation%20Expansion%20and%20Voltage%20Conversion%20of%20the%20Distribution.pdf [accessed 1 June 2010].

Given that this approach to risk assessment appears to have been ruled out by the Authority[20], alternative approaches have been adopted. The main source of incremental revenue is the establishment of new magnetite iron ore mines. New generation (specifically wind turbine generation) offers a secondary source of incremental revenue.

Two different approaches to risk assessment have been conducted for two distinct types of new demand for network services. Different approaches have been taken because the risk profiles of both types of demand are fundamentally different.

- The key source of risk from the iron ore industry is market-based and is largely reflected in movements in iron ore prices.

- The main source of risk with respect to generation is changes to government policies and subsidies.

For the risk assessment of iron ore mining, Western Power has integrated Monte Carlo simulation techniques and real options analysis with the DCF method. For generation, Western Power commissioned ACIL Tasman to assess the most likely generation profile . ACIL Tasman applied two economic models: *RECSMark*; and *WA PowerMark*. A brief description of both approaches is provided in sub-sections 6.3.1 and 6.3.2.

6.3.1 Risk Assessment of Mining Demand

The main risks associated with iron ore mining are:

- Variability in the timing of mine commencement.

- The stability of demand over time. This is divided into: the risk of temporary shut-down due to volatility in commodity markets; and variability in the economic life of the new mines.

The fundamental source of these risks is attributed to:

- Volatility in iron ore prices.

- The economic characteristics of the mines. In particular, high fixed (and largely sunk) capital costs.

External sources of information relating to all of the underlying assumptions were employed:

- Economic Consulting Services (**ECS**) was commissioned to collect information about the economic characteristics of mines located in the North Country Region[21].

- This information was supplemented by input from Western Power's System Forecasting section.

- The Department of State Development checked the report produced by ECS as well as providing updates of information used by System Forecast Branch.

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[20] That is, shortening the period of the Incremental Revenue Test. See Appendix 2 (p. 64) for additional discussion of this issue.

[21] Western Power refers to defined regions: North Country; South Country; and Central. The portion of the North Country Region referred to in this application largely coincides with the Mid West and Wheatbelt regions.

- Where available, mining company announcements are also used.
- Statistical information related to iron ore prices was sourced from the Department of Mines and Petroleum and from academic papers.

The information derived from these sources was used as input to the risk-based DCF modelling. While every effort has been made to ensure that up-to-date and accurate information is used in modelling the incremental revenue, there is uncertainty associated with each input. Hence, the modelling was supplemented with Monte Carlo simulation techniques.

The Monte Carlo approach to simulation analysis broadly describes any method that approximates solutions through statistical sampling.[22] This method recognises real-world uncertainty through the use of probability distributions. Uncertainty is represented in Monte Carlo simulation by repeatedly drawing random numbers from specified probability distributions. Each random draw is used as input to a model of a system (in this case an economic system) and the impact is gauged in terms of the distributions of specified output variables.

A key strength of Monte Carlo simulation analysis is the ability to gauge the likelihood of a future event occurring. An extension of this method is the ability to quantitatively define the circumstances in which a specified event is likely to occur. The modelling also provides insight into the critical level of important variables. The real-world values of these variables can then be monitored with an understanding of the implications in relation to specified outcomes.

Within a DCF modelling framework, Monte Carlo simulation requires the assignment of statistical distributions with defined parameters (such as mean and standard deviation) to key inputs. Model iterations generate random draws from these distributions, which are used as inputs to the model and, via model calculations, determine the outputs. Repeated draws define a distribution of each model output, thereby reflecting the risk of variability.

The key output is an estimated distribution of incremental revenue from which the expected present value of incremental revenue can be calculated.

Given the complexity inherent in applying Monte Carlo analysis, the incremental revenue model was developed in a software package called GoldSim. The main benefits offered by GoldSim are:

- The availability of built-in statistical distributions that can be easily integrated with the DCF method.
- Enhanced transparency of the calculations. The graphical orientation of the software platform allows non-modellers to more easily audit the model.

Real options analysis was also applied in order to overcome the deficiencies of the traditional approach to the DCF method. An important shortcoming of traditional DCF is the implicit assumption that the only relevant investment choice is between investing now and

[22] http://www.goldsim.com/Content.asp?PageID=511 [accessed 28 June 2011]

never investing.[23] In reality, investors often have the choice of investing now or investing later. Hence, in the face of uncertainty, there is a benefit in deferring investment decisions.

Consequently, for investment cases involving large irreversible and sunk costs, the traditional DCF method will be a poor predictor of the likely timing of investments. The timing of the step-change in the demand for electricity is crucial to developing risk-based estimates of incremental revenue. In support of this position, there is growing empirical support for the application of real options analysis to investment appraisal.[24]

More broadly, real options analysis focuses on the development of flexible strategies designed to mitigate risk. Incorporation of this kind of strategic thinking in incremental revenue modelling will likely deliver more accurate predictions of actual behaviour.

A more detailed description of the methodology described in this sub-section can be provided on request.[25]

6.3.2 Risk Assessment of Generation

ACIL Tasman was commissioned primarily to conduct an assessment of the net benefits offered by the MWEP (southern section). As part of this assessment, ACIL Tasman needed to develop an understanding of how the SWIS generation portfolio is likely to evolve in two scenarios:

- with the MWEP (southern section); and
- without the MWEP (southern section).

This requires, among other things, an assessment of the competitiveness of each type of generation including:

- Diesel generation
- Coal-fired generation
- Open cycle gas turbine generation
- Combined cycle gas turbine generation
- Renewable generation (including both wind turbine and solar generation).

In order to conduct this assessment, ACIL Tasman maintains detailed databases about the economic characteristics of each type of generation. The information is used as input into a range of economic models (including *WA PowerMark* and *RECMark*) that determine the optimal generation portfolio. These models also take into account non-generation market characteristics such as load growth, changes in the location of major loads, as well as government programs and subsidies (e.g. the Renewable Energy Certificates Scheme (**RECS**) and the Carbon Pollution Reduction Scheme (**CPRS**)).

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[23] See Pindyck, R.S. (2008), "Sunk Costs and Real Options in Antitrust Analysis", in *Issues in Competition Law and Policy*, pp. 619-640 (ABA Section of Antitrust Law 2008).

[24] For example, see Bulan, L., Mayer, C. and Somerville, C.T. (2009). "Irreversible investment, real options and competition: Evidence from real estate development", *Journal of Urban Economics* 65, pp.237-251.

[25] DM 7000942

In order to determine the robustness of the estimated generation portfolios, ACIL Tasman conducted sensitivity analysis by varying assumptions related to:

- The timing of the CPRS
- Capacity reserve payments for wind generation
- Changes in assumptions related to the Frequency Ancillary Control Services (load following).
- Changes in the average rate of load growth.

An additional risk is the likely location of wind turbine generators. ACIL Tasman reviewed wind data and ascertained the competitiveness of the Mid West Region in this respect.

The results of the sensitivity testing indicated a robust case for increased wind turbine generation located in the Mid West Region.

6.3.3 Method Employed to Calculate Anticipated Incremental Revenue

The preceding discussion provides an explanation of how the risk assessment of prospective loads and generators has been conducted. This section provides an explanation of the determination of incremental revenue.

Expected (median[26]) estimates of iron ore mine CMD were used as the measure of load demand. Note that this risk-based approach differs from the Western Power's forecast Central and High load cases used for planning purposes, which are based on the state of development of individual projects. For reference, the official Western Power forecasts are based on the following block load scenarios:

- Central Load Case: only Karara Mining Limited's Stage 1 expected CMD was used.
- High Load Case: is comprised of the expected CMD based on Karara Mining Limited's Stage 1, Stage 2+, and Asia Iron Holding's Extension Hill Stage 1 CMD.

By comparison, the risk assessment suggests that the Extension Hill magnetite mine is equally likely to proceed. Consequently, the risk-based model results include it in the estimate of incremental revenue. Discussion with System Forecasting established that strict criteria are applied before allowing it to form part of the central load case. In terms of the risk-based method employed in this study, the equivalent planning criteria would b 95 per cent level of certainty.

In the interests of brevity, the following discussion focuses on the 50th percentile case and discusses a range around that case (i.e. the 25th and 75th percentiles[27]) to provide an indication of the level of risk attached to the revenue stream[28].

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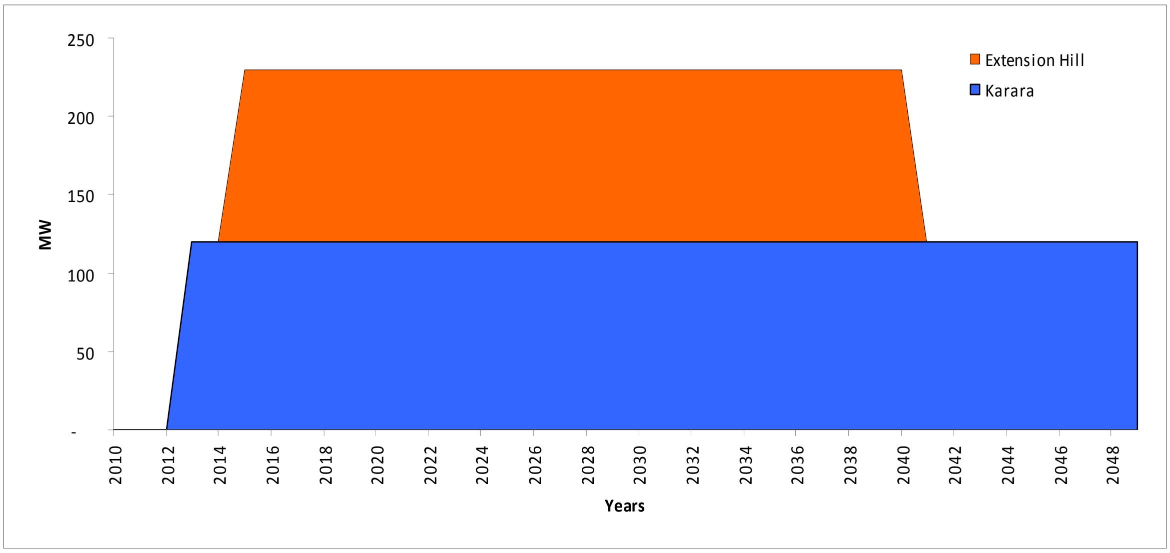
[26] The median outcome was chosen to ensure that the estimated incremental revenue is not skewed by outliers.

[27] Note that the 75th percentile is different to the concept of probability of exceedance (POE). The 75th percentile indicates that there is a 75 per cent chance of an outcome lower than the nominated value and a 25 per cent chance of an outcome higher than the nominated value. So the POE would be 25 per cent, indicating that the odds are in favour of a lower value. Using the 25th and 75th percentiles as a range indicates a 50 per cent chance of an outcome within a nominated range.

[28] See Appendix 2 (p. 64) for additional discussion of why the timeframe for estimating incremental revenue is set at 40 years.

Figure 1 50th percentile (Median) Case CMD used in incremental revenue estimates

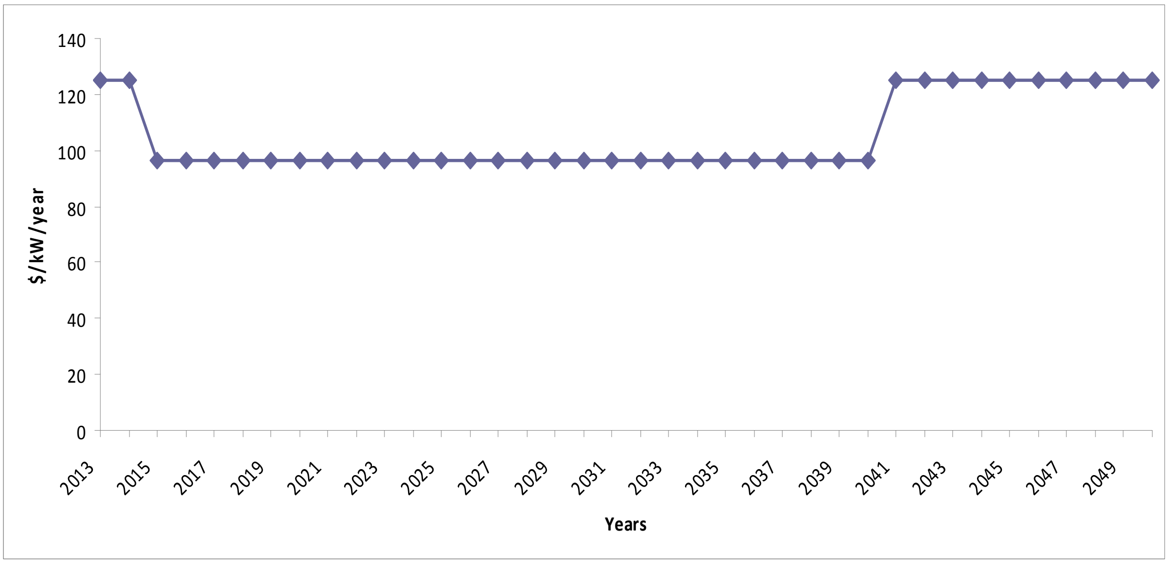


Source: DM 8094186

Figure 1 provides a visual depiction of the CMD for the 50th percentile case. The 25th and 75th percentiles are close to the 50th percentile, indicating that there is relatively little risk of variation in CMD.

For information, Figure 2 presents the indicative tariffs used to calculate the incremental revenue associated with the CMD.

Figure 2 Indicative (average) tariffs used to estimate the incremental revenue benefit associated with iron ore loads (in July 2010 dollar terms)



Source: DM 8094186

Figure 3 shows that the tariff reduces from $125/kW to $96/kW between 2013 and 2015. The cause of this reduction is the commencement of the Extension Hill magnetite mine, which is modelled as commencing full operations in 2015. Note the increase in tariffs in 2041. This is due to the assumed retirement of wind turbine generation. Given reduced demand, the annual required return on the MWEP capital expenditure is shared over fewer customers, resulting in an increase in the tariff.

The method employed to estimate the initial tariff is in accordance with the policy set out in Appendix A of the Approved Access Arrangement "Price List Information". The declining tariff in 2015 reflects the improved utilisation of assets as the forecast loads increase over time.

Given the inclusion of network operation and maintenance (O&M) costs in the network access tariff, that component has been deducted from the full revenue amount so that the remainder of the revenue relates to capital costs only. The annual network operation and maintenance cost was calculated according to the following formula:

Annual network O&M charge = 2.1% x Replacement cost less net benefits

= 2.1% x ($381 million - $271 million)

= $2.3 million

The net cash flow was discounted to present value terms using a real, pre-tax discount rate of 7.98 per cent over 40 years.

In addition to the incremental revenue associated with new iron ore loads, there is also incremental revenue anticipated to be earned from the connection of wind turbine generation. It was assumed that connecting generation pays 20 per cent of the tariff applied to loads.[29] Hence, the incremental revenue associated with new wind turbine generation is calculated according to the following formula:

Annual incremental revenue (generation) = $Gen\ Tariff_t \times 1{,}000 \times \sum DSOC$

where DSOC means Declared Sent Out Capacity.[30]

The DSOC estimate was derived from ACIL Tasman's report, specifically 230 MW projected to enter the Wholesale Energy Market by 2014 in the Base Case scenario.[31]

6.4 Application of the Net Benefits Test

The Net Benefits Test can be loosely interpreted as a market benefits test in which externalities[32] have been explicitly ruled out of consideration. In developing the approach to calculating the present value of net benefits, Western Power has followed the guidance

[29] Western Power (April 2010), *2010/11 Price List Information*, Section 4, http://www.erawa.com.au/cproot/8551/2/20100514%20D29041%20Western%20Power%20-%202010-11%20Price%20List%20Information.PDF [accessed 28 June 2010]. Pricing is based on the actual cost to supply each customer group. Specifically, generation accounts for 20% of the total Shared Network Services Cost (see Use of System for Generators Cost Pool, p. 17). By contrast, loads accounts for 80% of the total Shared Network Services Cost (i.e. 30% for the Common Service for Loads Cost Pool and 50% for the Use of System for Loads Cost Pool). The ratio of 20% over 80% yields 25%. Hence, as a rough guide, generation tariffs are about one quarter of load tariffs.

[30] This term is defined in Western Power's Electricity Transfer Access Contract, p. 48.

[31] ACIL Tasman (June 2010), *Net market benefits of the North Country transmission link*, Chart 21, page 34.

[32] An externality or spill-over of an economic transaction is an impact on a party that is not directly involved in the transaction (source: http://en.wikipedia.org/wiki/Externality [accessed 1 June 2010]). In this case, an example of a positive externality would be increased royalty revenue accruing to government derived from the commencement of mining.

provided in the Authority's NFIT Issues Paper. In particular, this excludes the estimated incremental revenue. Revenue would be considered a benefit in a standard benefit-cost analysis.

It is understood that the term "net benefits" refers to benefits accruing to the market less any additional cost (other than network augmentation costs) that need to be incurred in order to realise a benefit. It is further understood that the net benefit should exclude transfers of benefits between generators, transporters and consumers.

Another point to note is that neither the Access Code nor the NFIT Issues Paper refers to the need for a risk assessment in applying the Net Benefits Test.

Benefits that can be included are those that are likely to be captured by generators, transporters and/or consumers. ACIL Tasman was commissioned to estimate benefits that are likely to be derived from:

- Reductions in the total cost of energy to consumers (i.e. energy cost savings).
- Increase in generation revenue.

Western Power estimated the benefit that would be realised by:

- Deferring planned network reinforcements that would need to be implemented if the MWEP is not built to maintain a safe and reliable supply to customers.
- Reduction in network losses.

These benefits would be captured by both generators and consumers.

In order to develop estimates of energy cost savings to consumers and increases in generation revenue, it is necessary to utilise economic models of the entire market. ACIL Tasman employed two market models: *RECMark* and *WA PowerMark*. ACIL Tasman utilises *RECMark* to examine the outlook for renewable generation developments in response to the enhanced Renewable Energy Target (**RET**). The main underlying assumptions in *RECMark* determining the dispatch of new renewable energy projects include:

- currently committed and proposed renewable projects (including efficiency, capital costs or operating costs);
- future possible renewable projects;
- black energy price and other income for all electricity generating regions;
- REC shortfall penalty; and
- limited banking/borrowing of RECs.

Based on these assumptions the model determines the profitability of renewable projects over their lifetime and consequently schedules the entry of renewable energy across Australia. The model results are used as input to *WA PowerMark*.

WA PowerMark employs a linear program to calculate the optimal (long-run least cost) generation dispatch profile for the South West Interconnected System (**SWIS**) to meet forecast load in 30 minute increments over a period of 20 years.[33] Three regions are represented in the model (North, Central, and South) along with interconnection constraints between North and Central and Central and South.[34] A more detailed explanation of both *RECMark* and *WA PowerMark* and the assumptions used can be found in ACIL Tasman's report *Net market benefits of the North Country transmission link: Assessment of the market benefits of the southern stage of the proposed North Country transmission line to Eneabba*. This report is included for reference in Attachment 4.

6.5 Summary of Estimated Benefits

As mentioned earlier, the benefits estimated under the Incremental Revenue Test and the Net Benefits Test indicates that the MWEP (southern section) satisfies the requirements of NFIT. This sub-section provides a summary of the benefits estimates applicable under each test and the key assumptions that underpin the estimates.

Table 16 NFIT present value benefits estimates (2010 $M)

NFIT element	Estimation period	Benefit estimate 50th percentile case^
Safety & Reliability Test	not quantified	not quantified
Incremental Revenue Test	40 years[35]	$206 M
Net Benefits Test	20-40 years[36]	$271 M
Total		**$477 M**

Note: the benefits estimates are expected estimates.
^ Note that the "50th percentile case" refers to median outcome for incremental revenue in the incremental revenue risk model. This implies that the incremental revenue is less than what would be calculated via a deterministic scenario in which revenue is earned as implied in connection applications.

Source: DM 8094186

Table 16 provides a summary of the main source of benefits. The incremental revenue estimate is comprised of revenue derived from connecting new iron ore loads and wind turbine generation. Note that there are other sources of revenue that are likely to add to this estimate. These other sources are typically classified as "natural load growth". The rationale for the exclusion of natural load growth is that it is not a primary source of revenue growth for the MWEP (southern section) and, in the absence of the step-change in demand, would probably be captured via alternative network reinforcement options. In addition, there are other potential block loads that have not been included. These other block loads

[33] See Appendix 2 (p. 64) for additional discussion of why the timeframe for estimating net benefits is set at 20 years
[34] There is no direct link between North and South that bypasses Central.
[35] See Appendix 2 (p. 64) for additional discussion of why the timeframe for estimating incremental revenue is set at 40 years.
[36] See Appendix 2 (p. 64) for additional discussion of why the timeframe for estimating net benefits is set at 40 years.

are located further to the north and would require reinforcement that is additional to the MWEP (southern section).

As indicated in Table 16, there is a difference in the timeframe used to calculate the incremental revenue and the market benefits. The incremental revenue benefits already takes into account the risk of early or temporary mine closure. In addition, the risks are mainly market-based and can be reasonably treated in risk-based modelling. A 20 year timeframe of Net Benefits has been chosen as the policy risks associated with market modelling benefits are too uncertain beyond a 20 year timeframe.

6.5.1 Incremental Revenue Estimates

Table 17 provides a breakdown of the estimated incremental revenue to show the difference in contribution between iron ore mining loads and wind turbine generation. Note that these are risk-weighted estimates of incremental revenue. The iron ore block loads contribute 76 per cent of the incremental revenue. The estimate of iron ore mining is largely accounted for by KML's Stage 1 and Asia Iron's Extension Hill magnetite projects. A relatively small portion is assigned to Karara Mining Limited's Karara future proposed Stage 2 expansion.

Table 17 Incremental Revenue Test present value benefits (2010 $M)

Source of revenue	Benefit estimate 50th Percentile Case
Iron ore mining	$187 M
Wind turbine generation	$19 M
Total	**$206 M**

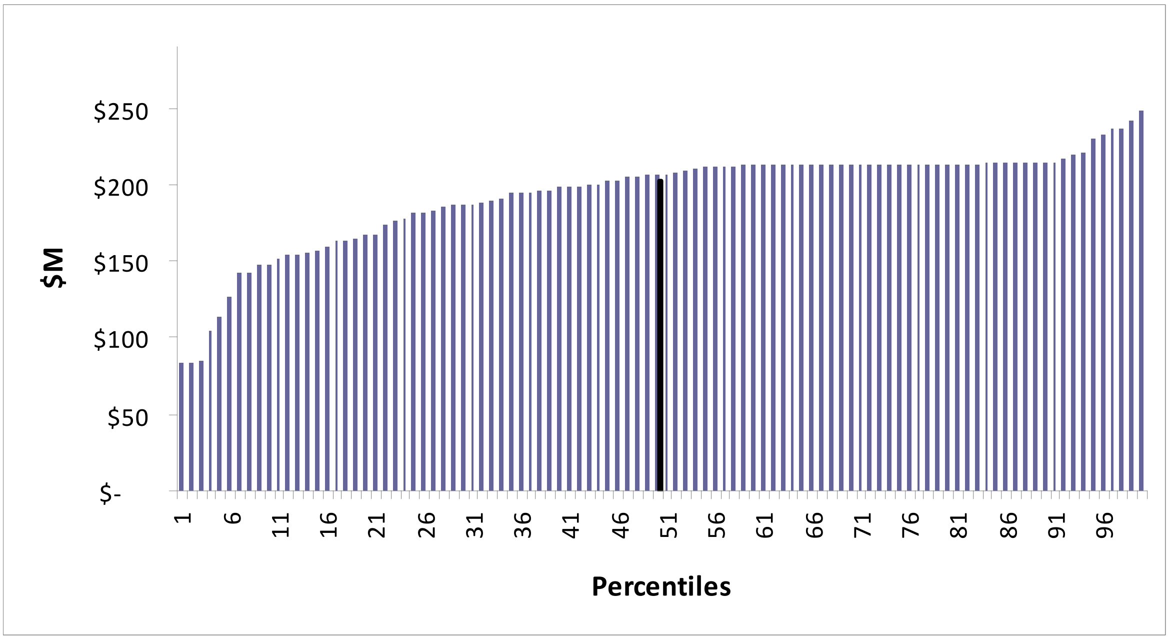
Note: estimate includes $15 million of interim incremental revenue from Karara Mining Ltd.
Source: DM 8094186

According to Economic Consulting Services, Sinosteel's magnetite iron ore project provides a potential additional source of demand. Western Power's understanding is that this project is at a relatively early planning stage and has therefore been excluded from the benefit estimates.[37]

Note that wind farms would be likely to have a life of about 20-25 years and, in order to continue operating, would face a significant reinvestment milestone at the 15-20 year mark. Therefore, it was considered prudent to assume that wind farm revenue is likely for the first 25 years, but not beyond 25 years[38]. Compelling evidence supporting wind farm capital renewal at the 25 year mark would need to be provided before any incremental revenue could be considered for this NFIT application.

[37] The project referred to here is not Sinosteel's Weld Range project.
[38] A period of 25 years is used because that is the expected life of wind turbines

Figure 3 Distribution of incremental revenue derived from iron ore mining and wind turbine generation



Source: DM 8094186

Figure 3 provides a summary of the distribution of incremental revenue expected from iron ore mining and wind turbine generation. The 50th percentile case is highlighted as the black column. The figure indicates that there is a relatively large degree of confidence associated with achieving the 50th percentile revenue.

6.5.2 Net Benefits Summary

As with incremental revenue, the "net benefit" estimate is comprised of several key components. These are shown in Table 18. The market-based benefit is estimated by ACIL Tasman and consists of cost reductions to consumers and increased generation revenue. Reduction in system losses is associated with improved thermal efficiency ratings and delivers an additional benefit to consumers and generators not captured by the ACIL Tasman study. In addition, there are cost savings associated with deferring other network reinforcements if the MWEP (southern section) project proceeds as planned.

Table 18 Net benefit break down

Source of net benefit	Net benefit estimate
Market-based benefit (ACIL Tasman)	$236 M
Deferral of other network expenditure	$26 M
Reduction in system losses	$9 M
Total	**$271 M**

Source: DM 8094186

6.5.3 Net Benefits Associated With Changes In Energy Prices and Generation

The net benefits estimated by ACIL Tasman are comprised of benefits accruing to generators and consumers. A summary of the results are shown in Table 19.

Table 19 Estimated generator and consumer present value benefits by scenario ($M, 2010)

Scenario	Generators	Consumers	Total
Central Case	**$ 72 M**	**$153 M**	**$225 M**
Scenario 1	-$ 32 M	$ 48 M	$ 16 M
Scenario 2	-$ 49 M	$380 M	$331 M
Scenario 3	$ 74 M	$ 150 M	$224 M
Scenario 4	$ 59 M	$149 M	$207 M
High Case (Scenario 5)	**$ 87 M**	**$149 M**	**$236 M**
Scenario 6	$ 71 M	$148 M	$219 M

Source: DM 7254479, Table 32, p. 55

Scenario 5 is highlighted because Western Power believes this is the most likely scenario given prevailing economic conditions. This view is supported by the incremental revenue risk modelling, which indicates that Western Power's High Load forecast is the more likely outcome. However, all of ACIL Tasman's scenarios are presented in this NFIT application to allow independent evaluators to form their own view of the most likely outcome.

As indicated, the summary benefits shown in Table 19 change according to the scenario modelled. A description of the Central Case and supplementary scenarios are as follows:

Central Case: medium load growth incorporating greater new wind capacity in the case with the MWEP (southern section) than without but with no new wind north of Eneabba. The Central Case uses $10/MWh load following costs for wind farms and capacity credit allowance of 40% of wind farm capacity.

Scenario 1: medium load growth with the same new plant assumptions both with and without the MWEP (southern section) project.

Scenario 2: medium load growth but incorporating greater new wind capacity, including north of Eneabba, incorporated in the MWEP (southern section) model run. This is the same as the Central Case except for new wind capacity north of Eneabba has been included in the with MWEP (southern section) modelling.

Scenario 3: medium load growth with decreased revenue for wind farms. This is based on the same assumptions as the Central Case except for a reduced capacity payment for wind farms – down to 20 per cent of their capacity from the current 40 per cent.

Scenario 4: medium load growth with increased load following costs ($15/MWh) and capacity credits reduced to 20 per cent of wind farm capacity. This is based on the same assumptions as the Central Case except for increased load following costs of $15/MWh and reduced capacity credits for wind farms.

Scenario 5: (High Case) high load growth incorporating greater new wind capacity in the case with the MWEP (southern section) than without but with no new wind north of Eneabba. As with the Central Case, Scenario 5 uses $10/MWh load following costs for wind farms and a capacity credit allowance of 40 per cent of wind farm capacity.

Scenario 6: high load growth with increased load following costs ($15/MWh) and capacity credits reduced to 20 per cent of wind farm capacity. This is based on the same assumptions as the Central Case except for the higher load forecast and an increased load following cost of $15/MWh for wind farms and reduced capacity credits for wind farms.

Scenarios 1-4 represent Central Case sensitivity analysis around three key assumptions: load growth; the cost of load following; and capacity credits available to wind turbine generation. Scenario 5 corresponds to the High Load Case and Scenario 6 is a sensitivity outcome for the High Load Case. The medium and high load growth scenarios match IMOWA's projections. *RECMark* modelling indicated that wind turbine generation located in the North Country Region is likely to be the most competitive renewable energy projects in Australia based for the following reasons:

- Reserve capacity credits for WA wind farms are more generous than in the National Electricity Market (**NEM**).
- North Country Region wind resources are among the best in Australia. Hence wind turbine capacity factors are likely to be higher.
- The black energy price in the SWIS is higher than in the NEM.

Consequently, the sensitivity analysis focused on assessing the market impact of connecting new wind turbine capacity, which implies increased demand for load following services. The sensitivity analysis explicitly reflects possible policy changes based on a causer-pays principle.

Note that the Central Case assumes that new wind turbine generators would pay for additional load following services. At present, wind turbine generators do not pay for the full cost of load following services and it is possible that the current policy will persist.

There are also risks associated with policy changes to the CPRS[39] and RET schemes. Western Power decided that these should not be included in sensitivity analysis as net changes to policy are uncertain. For example, the deferred CPRS may be further deferred or abandoned altogether. In this event, it is possible that other policies would be introduced or extended in order to deliver a similar market result as the CPRS. Consequently, Western Power considered it prudent to defer sensitivity analysis on these policies due to their high cost and dubious potential benefits.

6.5.4 Net Benefit Associated With the Deferral of Other Network Reinforcement

An additional source of benefit can be attributed to the change in planned network reinforcements.[40] In order to assess this, consideration was given to what form of reinforcement would need to be undertaken to ensure maintenance of supply in the absence of the MWEP (southern section). To quantify any potential cost-benefit[41] a comparison between two scenarios has been completed, namely:

- a preferred (least cost) network solution to meet the natural load growth needs of Geraldton (without Karara) was determined – a baseline case; and

- an alternative (least cost) network solution was identified for the condition where the 330 kV MWEP (southern section) was in place.

The options were compared under differing load growth scenarios (central, high and low) to determine the sensitivity of the costs to uncertainty in load forecast. Results are summarised in the table below:

Table 20 Net present cost of alternatives

	Central	High	Low
Baseline option (132kV)	$170 M	$190 M	$140 M
With MWEP option	$134 M	$164 M	$111 M
Net cost benefit[42]	$ 36 M	$ 26 M	$ 29 M

TST: Three Springs Terminal

Source: DM 7139434 Northern Section Planning Report - Attachment 2

The deferral benefit is obtained by subtracting the cost of the reinforcement option with MWEP (southern section) from the cost of the baseline option that assumes MWEP

[39] Indeed in the 12 months since Western Power began this detailed investment appraisal, the Commonwealth Government has changed policy tactics and is now proposing that the CPRS begin with a carbon tax to establish a low, stable price on CO2 equivalent atmospheric emissions. Currently, Western Power understands that the CPRS (or some variation) is still being proposed. This experience underscores the point on policy risk for this project.

[40] See DM 7139434v2 for more detail.

[41] The term “cost-benefit” refers to avoided costs or cost savings. Cost savings are a form of economic benefit.

[42] The differences relate to the need to undertake different reinforcement strategies for the respective high, central, and low forecasts, further details can be found in the Northern Section planning report included in Attachment 2.

(southern section) does not proceed. The deferral benefit to be ascribed to this component of the NFIT assessment for the project is $26M (high load forecast).

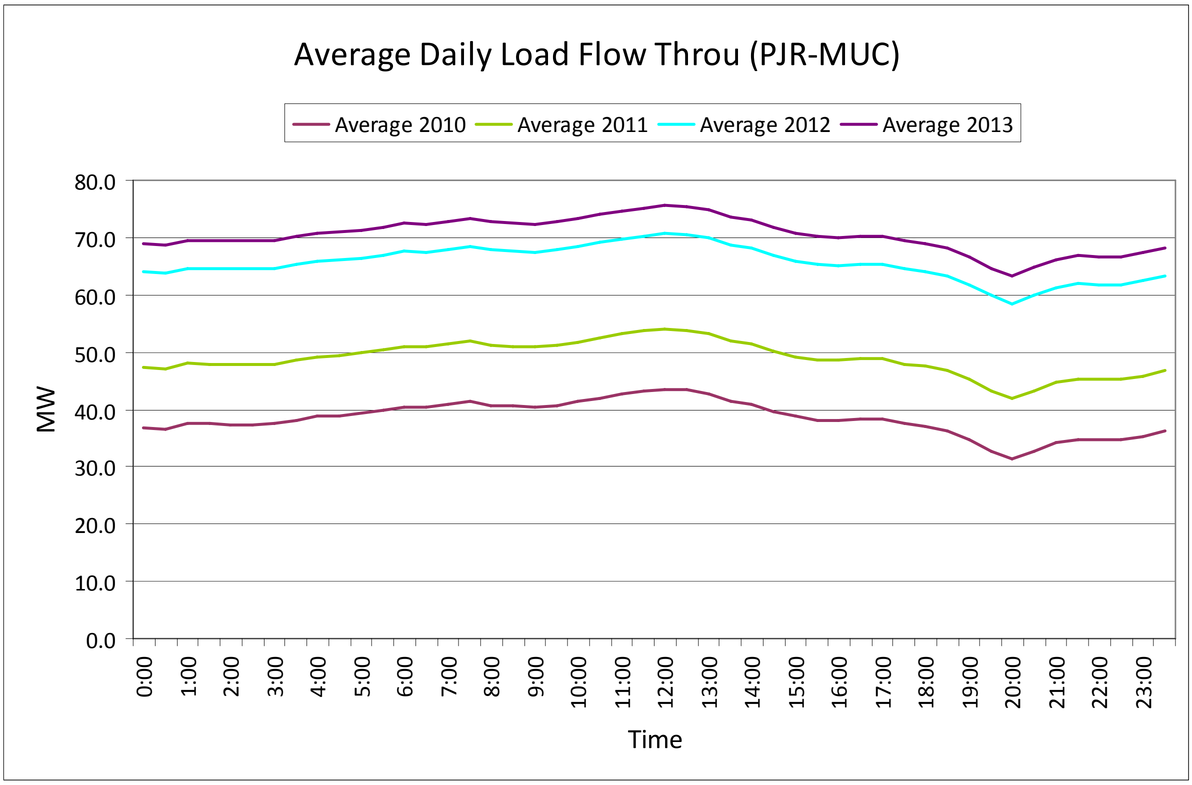
Establishing the 330/132 kV injection at Three Springs stiffens the Northern 132 kV network increasing the voltage stability limit and thereby deferring other augmentations.

6.5.5 Net Benefits Associated With Reduction in Network Losses

The connection of the 330 kV MWEP (southern section) will provide the additional benefit of a reduction in losses for the underlying forecast. A large component of this load (more than 80 per cent of the underlying load) will flow through the 330 kV line compared to the 132 kV network.

The reduction in losses has been calculated using a set of load flow cases modelling the average daily load for 2010 at a ½ hour resolution. The loads in these cases were scaled to reflect the actual growth in demand, to generate load flow cases for 2011, 2012 and 2013. These load flow cases were used to calculate the annual network losses with and without the MWEP (southern section) in service. Figure 4 shows the average daily power flow north of Pinjar and Muchea in 2010 and the expected increase each year with load growth[43].

Figure 4 Average daily flow through (Pinjar to Muchea to the North Country Region)



Source: DM 8076800

Figure 5 presents the results of the system study. Throughout the year the average variation in system losses shows a range between 1.9 MW and 3.0 MW. The maximum loss reduction occur around midday and the minimum occurs at 8 PM.

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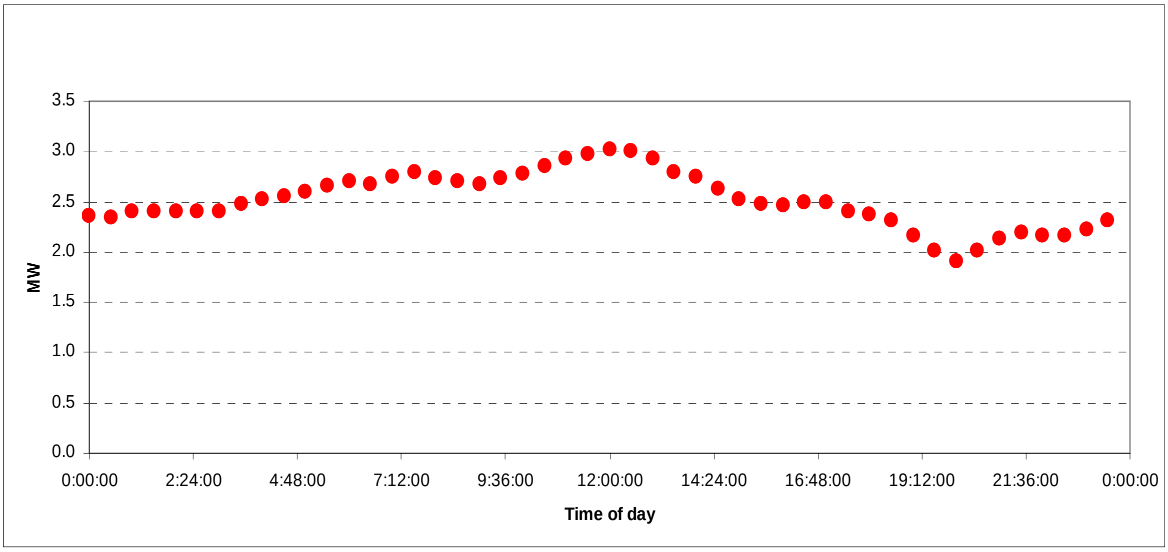
[43] See DM 8171626 for more details on the study results on the reduction in losses.

Figure 5 Change in electrical losses (without MWEP less with MWEP)

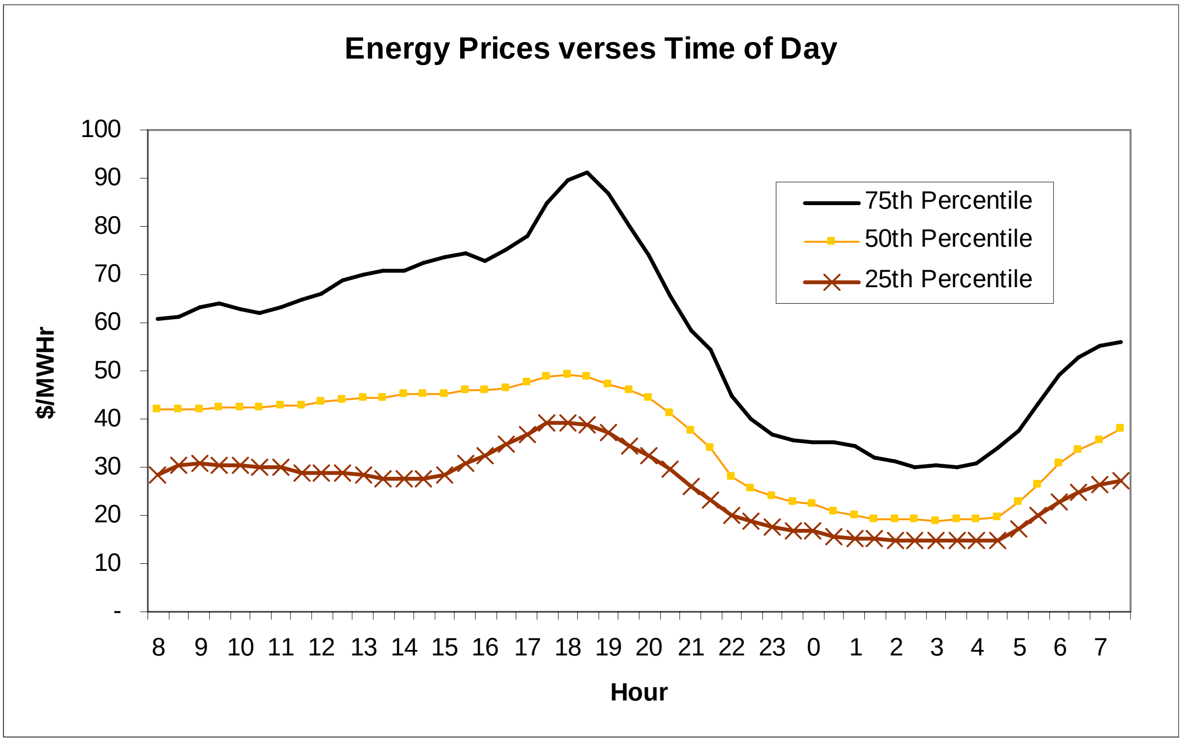


Notes: case year is 2012/13; System reduction is that observed on the circuits between Moora and Muchea, and Pinjar and Regans / Cataby, and Pinjar and Eneabba.
Source: DM# 8171626v1

A review of actual Short Term Energy Market (**STEM**) prices from June 2008 to April 2011 has been used to calculate the average daily cost of energy from the SWIS network. As indicated in Figure 6, the price series exhibits considerable variation. The average difference between Quartile 3 (75th percentile) and Quartile 1 (25th percentile) is $31.64/MWHr, reaching a maximum of $52.41/MWHr and a minimum of $15.00/MWHr. The data also exhibits considerable skewness, suggesting that a time-weighted average would not be a good measure of the central tendency. In order to develop a meaningful average price, the median or 50th percentile (Quartile 2) price was selected.[44]

[44] See DM 8171936 for more details

Figure 6 Actual Short Term Energy Market prices



Source: IMOWA historical data (http://www.imowa.com.au/n117,45.html)

The 50th percentile daily energy cost captures some of the variation, but is not as susceptible to extreme shifts in price evident in the raw data as the simple average.[45]

Table 21 presents a summary of the calculations related to quantifying the benefit of reduced system losses. On average, the reduction in system cost associated with losses is expected to be approximately $0.8M/year. Assuming a real discount rate of 7.98%, this translates to a present value benefit of $8.9M over 40 years.

[45] Note that extreme upward shifts in prices reflected in the skewness of these data risks over-stating the benefit of reduced system losses, this impact is reduced by using the 50th percentile energy costs.

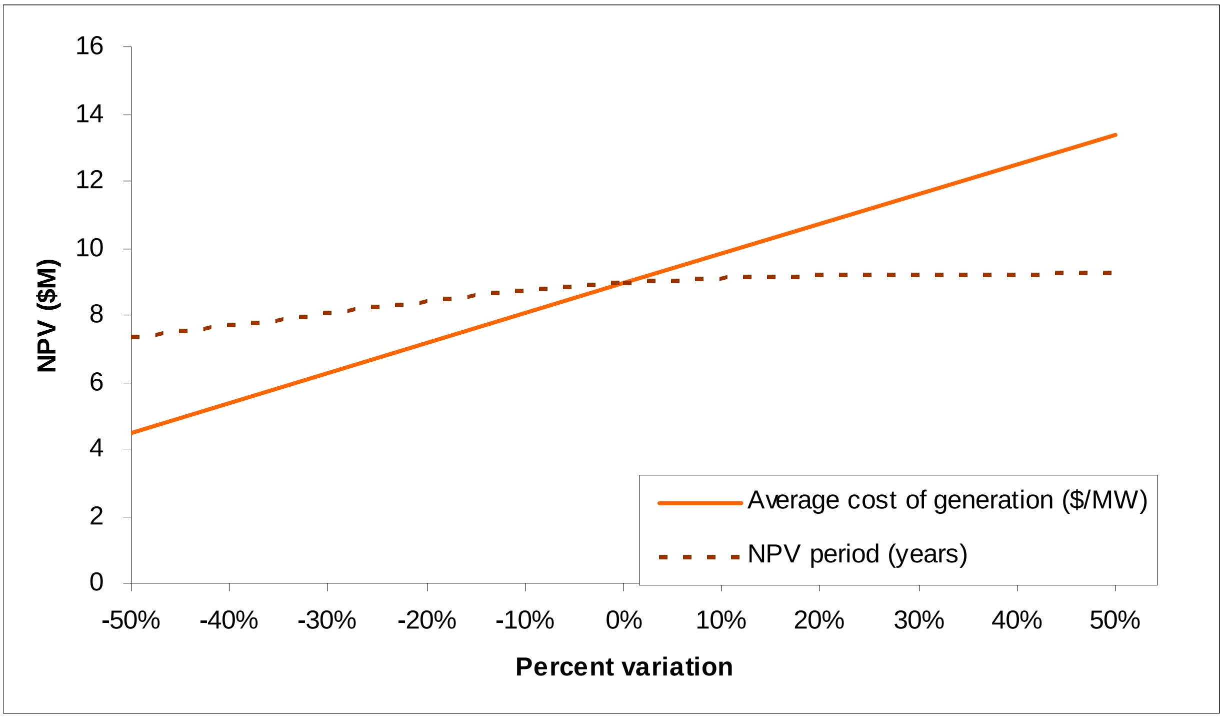
Table 21 Benefit of reduction in system losses (base line estimate)

Benefit	Unit	Value
Number of years considered for reduction in electrical losses	years	40
Average system loss (MW) per year	Average MW (loss) / year	2.57
Average cost of generation per year	$/MWHr	$35.84
Annual average value of reduced system losses	$/MWHr * 8760 (hours / year)	$806,720
Discount rate (real)	%	7.98%
Reduction in system losses (PV, 40 years)	$M	$8.9M

PV: present value
Source: DM# 8171626v1

Note that there are a range of assumptions that impact on the benefit estimate. Two important assumptions are: the average value of system losses; and the period (in years) used to calculate the present value. Figure 7 shows the impact of +/-50% variation in these assumptions. The chart indicates that a 50% reduction in the average value of system losses causes a reduction in benefit of $4.5M, whereas a 50% increase causes an increase in benefit of $4.5M. Change in the period over which the present value is calculated indicates substantiall y less variation, ranging between a reduction of $1.6M and an increase of $0.3M.

Figure 7 Results of sensitivity analysis on the benefit of reduced system losses



Source: DM# 8171626v1

Using a sound method for calculating system losses and reasonable assumptions, it is apparent that the MWEP (Southern Section) is likely to deliver a reduction in system losses, resulting in a present value of $8.9M, with a range around the base line estimate +/-$4.5M.

The value of loss reduction would increase significantly following the introduction of a national carbon price. The wholesale energy market price including carbon pricing has been included as part of the ACIL Tasman market benefits report included in Attachment 4 (Chart 31 pg 63). Hence the analysis presented here for the assessment of losses is a low conservative estimate.

6.6 Conclusion

Western Power's application of the Incremental Revenue Test and the Net Benefits Test indicates that combined, non-overlapping benefits estimated under the two tests indicates that the total benefit offered by the construction of the MWEP exceeds the cost by a 20 per cent margin.

The assessment is based on extensive economic modelling that is both soundly based on economic principles and is as transparent as possible.

While there are many assumptions underpinning this assessment, Western Power has exercised diligence in ensuring the assumptions are based on credible information. In addition, Western Power has implemented sensitivity analysis to assess the impact of uncertainty on the results. In areas where judgements are required, Western Power's assessment has typically opted for a conservative approach. Overall, the results are robust to relatively large changes to key assumptions.

7 Conclusion

From the above information, Western Power has determined that the value of the proposed augmentation for the MWEP (southern section) that meets the NFIT is $383.4M.

Table 22 presents an itemised summary of the proposed new facilities investment.

Table 22 Summary of works

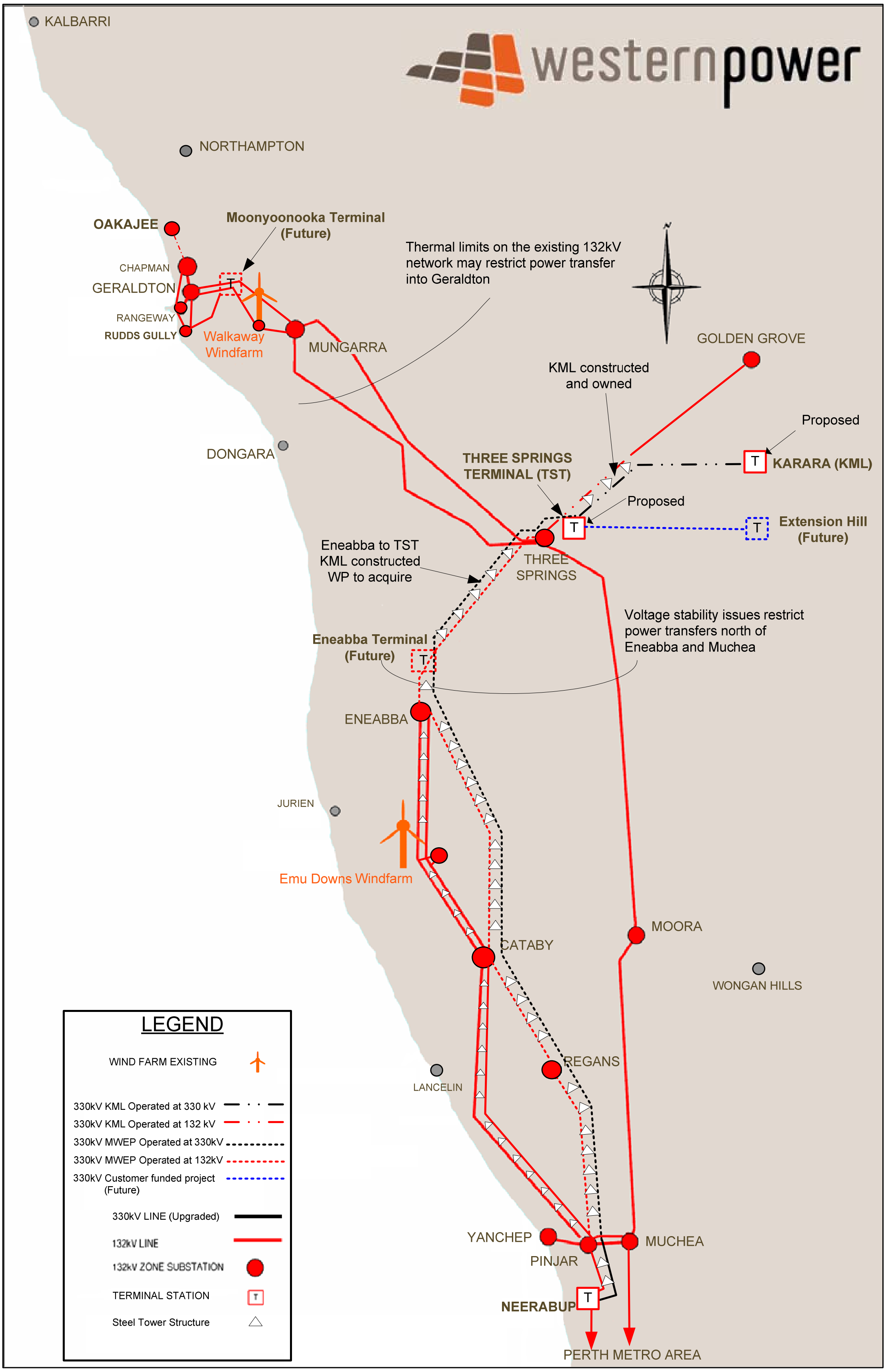
Element of Works	Cost that meets NFIT	Comment
Three Springs Terminal 330kV dedicated assets.	$0M	Fully funded by customer. [redacted]
Neerabup Terminal to Three Springs Terminal 330kV line including the Three Springs Terminal works	$383.4M	The NFIT assessment is based on the MWEP (southern section) and Eneabba to Three Springs Terminal 330kV line acquisition from KML, (includes Interest During Construction (IDC) for Eneabba to Three Springs Terminal 330kV line and Three Springs Terminal)
Total cost of works that meets NFIT	$383.4M	

Western Power's application of the Incremental Revenue Test and the Net Benefits Test indicates that approximately 50 per cent of the cost of the MWEP can be justified under the Incremental Revenue Test and 70 per cent under the Net Benefits Test. Combining the separate and non-overlapping benefits estimated under the two tests indicates that the total benefit offered by the construction of the MWEP exceeds the cost. The aggregation of benefits indicates a benefit-cost ratio of 1.2.

The MWEP (southern section) complies with Section 6.52(a) of the Access Code which requires Western Power to ensure that any new facilities investment to be added to the capital base does not exceed the amount that would be invested by a service provider efficiently minimising costs. Western Power has sought extensive benchmarking against a previous Western Power 330kV construction, Powerlink Queensland, Downers KML construction and Worley Parsons, and peer review of designs and standards. The delivery of the project (including acquisition) cost of the new facility has been demonstrated to be efficient.

KML are fully funding all early works with a provision that certain capital costs will be rebated (either via refund provisions or purchase agreements) when these assets are subsequently included into Western Power's regulated asset base (subject to an NFIT determination of value by the ERA). All these values will be rebated at costs that do not disadvantage other system users. The price being submitted for NFIT is Western Power's determination of the efficient price based on works being delivered in an efficient market-based supply arrangement and standards available at the time of construction.

Appendix 1 Configuration of MWEP (Southern Section)



Appendix 2 Choice of the Benefits Estimation Timeframe

A2.1 Choice of incremental revenue timeframe

Western Power's Contributions Policy (section 5.3(a)) refers to a maximum of 15 years when applying the incremental revenue test.

In various NFIT determinations, the ERA has questioned whether the 15 year period is a reasonable timeframe for the incremental revenue test. For example, in the Final Determination for the Medical Centre Zone Substation, paragraph 55, the ERA stated:

> "....The Authority considered it reasonable to consider incremental revenue over a longer period than that undertaken by Western Power, given the likelihood that the medical centre would continue to operate for many decades..."

In extending the period in which the incremental revenue was estimated, it is apparent that the underlying principle is that the determination of a reasonable period should be linked to the timeframe in which the connecting customer is likely to require the level of electricity supply specified in its connection application.

However, it is arguable that an unstated assumption embedded in the ERA's reasoning is that the customer will exist for the entire timeframe or that subsequent future customers will take up any supply capacity relinquished by the connection applicant. In the case of the Medical Centre Zone Substation, the connection applicant was a State Government funded hospital located in the Perth metropolitan area. Hence, the unstated assumption is likely to be considered reasonable.

Applying this principle (of matching the incremental revenue period to the expected life of the connection applicant's requirements) to the MWEP (southern section) requires an evaluation of the likely timeframe in which the current connection applicants will need their respective stated levels of electricity supply. Inspection of Karara Mining Limited's and Extension Hill Pty Ltd's published iron ore resource estimates indicated that Karara's resource could last more than 60 years (which is the expected life of the MWEP steel towers) and Extension Hill's resource would be likely to last for 40 years. Applying this principle separately to each connection applicant would require estimation of Karara Mining Limited's incremental revenue period over 60 years while Extension Hill's incremental revenue would be estimated over a 40 year period. However, Western Power deviated from this principle by estimating incremental revenue over 40 years for both connection applicants.

The risk attached to the incremental revenue over such a long timeframe is a key commercial issue. The usual risk mitigation practice is to secure long-term commercial contracts with connection applicants. While it is Western Power's stated intention to secure firm contracts before proceeding with the MWEP (southern section) it is considered appropriate to adjust the incremental revenue contained in this NFIT pre-approval application according to the estimated increase in systematic risk[46].

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[46] Western Power's approved weighted average cost of capital already includes a market risk premium to compensate equity holders (i.e. the State Government) for the systematic risk attached to future revenue. However, in Western Power's view, the large scale of the MWEP (southern section) necessary to supply the connection applicants (who are exposed to significant risk associated with global commodity markets) represents a significant increase in the level of systematic risk. Hence, in the absence of firm contracts, the additional adjustment for risk is warranted.

It is important to note that the incremental revenue is uncertain and that the incremental revenue estimate is adjusted downwards for risk using the Monte Carlo method. This is a more complex approach to risk adjustment when compared to shortening the incremental revenue period to adjust for risk. However, the Monte Carlo method is a transparent way of assessing the risk profile of MWEP incremental revenue.

A2.2 Choice of net benefits time period

ACIL Tasman's advice is that 20 years was the longest reasonable timeframe having regard to government policies (e.g. the Renewable Energy Certificate Scheme) and the economic characteristics of the SWIS (e.g. the age profile of generation). Beyond a 20 year timeframe, the risk of unanticipated government policy changes and how such changes might affect investment in the replacement of generation as it retires is too large to be useful.

A2.3 Reconciling the use of different timeframes for the incremental revenue and net benefit estimates

The primary task in estimating benefits according to NFIT criteria is to determine how much of the cost of the proposed new facility is likely to be offset by benefits realized by the SWIS electricity market. For this task, it is necessary to consider the longest reasonable timeframe having appropriate consideration for risk. Given the different risk profiles, it is considered reasonable to evaluate the incremental revenue test and the net benefits test independently and that, as part of the independent evaluation, the timeframes for each evaluation can be different.

However, given that the estimated net benefits are linked to the connection of the Mid West iron ore mines, there is a need to be satisfied that that these mines are likely to be present for at least 20 years. Based on intensive analysis, Western Power is satisfied that this is likely to be the case.

Attachment 1 – Design Reports

MWEP (southern section) Substation Design Report (DM# 7355185),

MWEP (southern section) Line Design Report (DM# 7075162)

Attachment 2 – Planning Reports

Mid West Energy Project (southern section) Planning Considerations (DM# 8473229)

Mid West Energy Project (northern section) Planning Report (DM# 6957480)

Attachment 3 – Delivery Strategy Reports

Delivery Strategy (DM# 7897666)

Delivery Strategy Attachment (DM# 8334047)

Attachment 4 – Net Benefits

Incremental Revenue Test (DM# 7000942)

Net market benefits of Mid West transmission link (DM# 7254479 and DM# 8491462)

Attachment 5 – Scope for Estimate – Mid West Energy Project (South Section)

Scope for Estimate (DM# 7170020)

Attachment 6 – Sourcing Strategy

Sourcing Strategy Summary (DM# 7969391)