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on behalf of **MURRAYLINK Transmission Partnership**

28 February 2003

Sebastian Roberts
Acting General Manager, Regulatory Affairs – Electricity
Australian Competition & Consumer Commission
GPO Box 520J
Melbourne VIC 3001

Dear Mr Roberts

Application for Conversion to a Prescribed Service and Maximum Allowable Revenue

On behalf of Murraylink Transmission Partnership, Murraylink Transmission Company ("**MTC**") appreciates the opportunity to provide its response to matters raised in the Commission's February 2003 Issues Paper dealing with the MTC Application of 18 October 2002 and the Commission's consultant's reports.

This response is supplementary to, and should be read in conjunction with, MTC's Application. This response is not final. MTC intends to respond further to any additional submissions made to the Commission by interested parties in relation to its Application, Commission staff have confirmed that the Commission will accept any such additional response from MTC.

Accordingly, this response deals with matters raised by:

- the Commission in its February 2003 Issues Paper;
- PB Associates in its *Review of MTP Service Standards*;
- PB Associates in its *Transfer Capability Review of Murraylink Application to ACCC*;
- Saha Energy International Limited in its *Review of MTC's Application of the Regulatory Test*

The Commission's February 2003 Issues Paper

The Commission identifies, in its Issues Paper, the significant matters raised by MTC's Application. Many of these issues arise from the unique nature of the Application and the broad discretion available to the Commission for its consideration and determination.

Our detailed response is contained in the **Attachment 1**, in which MTC makes the following important points:

- The only preconditions for conversion under clause 2.5.2(c) of the *National Electricity Code* ("**Code**") are that the network service is an existing network service and the network service ceases to be classified as a market network service. MTC satisfies the first precondition and MTC's Application is predicated on the second taking place.

- In the absence of specific criteria under clause 2.5.2(c), MTC agrees that the Commission should exercise its discretion to determine MTC's Application, the market objectives set out in the Code provide guidance to the Commission, and the Commission may have regard to the relevant Council of Australian Governments agreement.

- On this basis, when assessing MTC's Application, the Commission should ensure that Murraylink's regulatory asset value and MTC's revenue are determined in accordance with chapter 6 of the Code.

- The Commission's *Draft Statement of Principles for the Regulation of Transmission Revenues* ("**Draft Regulatory Principles**") currently describe the specific manner in which the Commission intends to apply chapter 6 of the Code and set down the optimised deprival valuation approach for regulatory asset valuation.

- The Commission's *Regulatory Test for New Interconnectors and Network Augmentations* ("**Regulatory Test**") does not set down an asset valuation approach for existing assets, but the approach it uses to define market benefits provides guidance for the manner in which an existing asset's economic value should be calculated.

- In consultation with the Commission, MTC developed and applied a regulatory asset valuation methodology that is consistent with the requirements of the Commission's Draft Regulatory Principles and the manner in which the Commission values other new and existing assets.

- MTC has proposed that Murraylink's regulatory asset value is equal to its deprival value. This approach ensures that the substantial contribution that Murraylink provides to the National Electricity Market is fairly recognised.

- Given that the Commission may also write down a regulatory asset value below its depreciated optimised replacement cost ("**DORC**") if the DORC exceeds the asset's economic value, it is appropriate that alternative projects are selected on the basis that they have a similar economic value to the asset under consideration.

- Burns and Roe Worley's ("**BRW's**") selection of alternative projects is appropriate in the context of a deprival value approach and thus provides no material advantage to MTC over other transmission network service providers whose assets are valued by Commission in accordance with the Draft Regulatory Principles.

- MTC's regulatory asset valuation methodology implicitly takes account of the prudence and efficiency of investment in Murraylink.

- MTC agrees with the Commission that MTC's application, consultation process, and application of the Regulatory Test (albeit a modified test) for measuring Murraylink's market benefits, is consistent with the requirements of clause 5.6.6 of the Code dealing with the establishment of new large network assets.

- MTC encourages the Commission to develop its Draft Regulatory Principles following the Commission's current assessment process for the MTC Application, especially in relation to the conversion and subsequent valuation process.

PB Associates' *Review of MTP Service Standards*

MTC is pleased that PB Associates endorses circuit availability as the only appropriate service standard for Murraylink and supports MTC's use of the CIGRÉ[1] reporting protocol. However, MTC has concerns with a number of PB Associates' other findings.

Our detailed response is contained in the **Attachment 2**, in which MTC makes the following important points are made:

- MTC continues to believe that the most appropriate target for Murraylink's circuit availability is 97%. MTC accepts PB Associates' recommendation that there be individual performance targets and proposes target values of 0.96%, 0.91%, and 1.13% for planned, forced peak and forced off-peak respectively. These targets are more realistic for Murraylink, given its location and the nature of Australian high voltage switching and isolation requirements.

- Unavailability of Murraylink arising solely from *force majeure* events should be excluded from the calculation of Murraylink circuit availability. These would include events that are beyond the reasonable control of MTC or its contractors given that MTC has undertaken all reasonable cost-effective mitigation measures to avoid them. MTC anticipates agreeing with the Commission a list of *force majeure* events within these criteria.

PB Associates' *Transfer Capability Review of Murraylink Application to ACCC*

MTC notes that PB Associates endorses all but one of the power transfer limits recommended in the TEA Report contained in Appendix A of the MTC application. MTC commissioned TransÉnergie Australia ("**TEA**") to respond to PB Associates' report and TEA's response is contained in **Attachment 3**.

In summary, TEA has arranged for additional dynamic power system studies to be undertaken and has commenced detailed discussions with affected transmission network service providers, in particular, VENCorp.

[1] The International Council on Large Electric Systems.

Saha Energy International Limited's *Review of MTC's Application of the Regulatory Test* ("SEIL Report")

In its report, SEIL deals with the fundamental components of the MTC Application:

- The calculation (by TransÉnergie US ("**TEUS**")) of Murraylink's market benefits and a review (by Charles River and Associates (Asia Pacific) ("**CRA**")) of TEUS's calculations;
- The selection and assessment (by BRW) of Murraylink's alternative projects;
- The application of the regulatory test to Murraylink's regulatory asset valuation.

In its report, SEIL provides a thorough analysis and assessment of TEUS's methodology contained in the TEUS Report in Appendix D of the Application. TEUS advise MTC that a number of matters raised in the SEIL Report require a response and TEUS's advice is contained in **Attachment 4**. In its advice, TEUS clarifies some of the issues raised in SEIL's report.

In its report, SEIL comments upon the CRA Report contained in Appendix E of the Application. MTC believes that the CRA Report provides substantial verification of TEUS's assumptions, inputs and methodology and their consistency with the Regulatory Test. MTC asked CRA to address the issues that SEIL raises in relation to the TEUS Report and the CRA Report and CRA's advice is contained in **Attachment 5**.

In their report, SEIL concurs with BRW's selection of alternative projects (except Alternative 4) and with BRW's conclusion that generation and DSM alternatives should not be considered as alternatives. SEIL raises some issues with the manner in which BRW has costed the alternatives. In particular, SEIL recommends that stronger evidence is required for the need for and extent of undergrounding in the alternative projects. In consultation with BRW, MTC sought further advice from Kellogg Brown and Root ("**KBR**") on the current practice of environmental assessment for similar power projects, the trend of regulatory bodies to require undergrounding so that these power projects avoid unacceptable levels of environmental impact, and the particular conditions that exist in the Bookmark Biosphere and around the townships of Lyrup and Red Cliffs. KBR's advice is contained in **Attachment 6**.

MTC has asked BRW to respond directly to the other issues SEIL raised. BRW's advice is contained in **Attachment 7**.

MTC is pleased that SEIL agrees with the conceptual approach to asset valuation taken by MTC and that it is consistent with deprival value techniques. In particular we note that SEIL states that "[i]n consideration of sunk costs, economic values such as the regulated asset value proposed by MTC provide a sound basis for assessment within the context of efficient resource allocation." MTC believes that SEIL's conclusions support strongly the approach it has taken to Murraylink's regulatory valuation as being an economically valid approach consistent with the Commission's Draft Regulatory Principles.

MTC notes that SEIL recommends a more comprehensive review and audit of TEUS's modelling procedures, inputs and outputs. MTC and TEUS will gladly cooperate with any review or audit instigated by the Commission at the earliest possible time. SEIL also recommend that additional sensitivity testing is required to verify Murraylink's regulatory asset value. MTC and TEUS would be pleased to discuss with the Commission the additional sensitivity studies that may be required to confirm the regulatory asset valuation set down in MTC's Application.

MTC appreciates the efforts of the Commission and its consultants to promptly and thoroughly assess MTC's Application. As always, we would be pleased to provide further information in relation to any matter that we have raised in this letter should the Commission request it.

Yours sincerely

Stéphane Mailhot
Chief Executive Officer
Murraylink Transmission Company

Attachments

1. Murraylink Transmission Company (Commission's February 2003 Issues Paper)
2. Murraylink Transmission Company (PB Associates' *Review of MTP Service Standards)*
3. TransÉnergie Australia
4. TransÉnergie US
5. Charles River Associates (Asia Pacific)
6. Kellogg Brown and Root
7. Burns and Roe Worley

Attachment 1

MTC's Response to the Commission's February 2003 Issues Paper

MTC provides comments on all the issues raised by the Commission in its Issues Paper.

Circumstances under which conversion applications may be made

Clause 2.5.2(c) of the National Electricity Code[1] ("**Code**") provides as follows:

> 2.5.2(c) If an existing *network service* ceases to be classified as a *market network service* it may at the discretion of the *Regulator* or *Jurisdictional Regulator* (whichever is relevant) be determined to be a *prescribed service* or *prescribed distribution service* in which case the *revenue cap* or *price cap* of the relevant *Network Service Provider* may be adjusted in accordance with chapter 6 to include to an appropriate extent the relevant *network elements* which provided those *network services*.

The Commission invites interested parties to comment on circumstances under which a market network service provider should be able to apply for conversion. MTC respectfully draws the Commission's attention to the fact that the only preconditions prescribed in Clause 2.5.2(c) for making a conversion application are that:

- the network service is an existing network service; and
- the network service ceases to be classified as a market network service.

Murraylink satisfies the first precondition and MTC's Application is predicated on the second taking place.

In those circumstances MTC is entitled, without further justification, to make its application for conversion. This was acknowledged by the Commission in its authorisation of the amendments to the Code, (including clause 2.5.2(c)) [2]:

> …as the clause is currently drafted no justification is required prior to reclassifying a market network service as a prescribed network service, although the regulator has the discretion to determine whether or not a network service may be classified as a prescribed network service.

[1] NECA 2002.
[2] ACCC 2001 p. 137.

The Commission must, therefore, exercise its discretion to determine such an application. That discretion is not intended to alter the fundamental rationale for the conversion process, namely that a market network service provider should, at its option and at any time, be permitted to apply to convert to regulated status.

Accordingly, MTC submits that it is entitled to make its application to convert Murraylink's network service to prescribed status without further justification. Moreover, MTC submits that in exercising its discretion the Commission should not introduce additional preconditions that would limit the opportunity for a market network service provider to make a conversion application.

Interpretation of clause 2.5.2(c) and other relevant provisions of the Code

MTC agrees with the Commission's interpretation of clause 2.5.2(c) that the Commission (as the relevant Regulator) is responsible for determining whether a market network service may be converted to a prescribed service, there is no specific criteria set down in the Code that the Commission must apply for conversion, and the determination of whether the conversion may take place is at the Commission's discretion.

While other Code provisions deal with matters of network planning (assessing network assets that do not yet exist) and network regulation (valuation, revenue and pricing of existing network assets), no other Code provisions are directly applicable to the conversion process itself or specify criteria that the Commission must apply.

Criteria for conversion that the Commission may choose to apply

In the absence of specific criteria under clause 2.5.2(c), the Commission considers that it should exercise its discretion in accordance with the market objectives set out in the Code and the relevant Council of Australian Governments ("**CoAG**") agreement[3].

The market objectives are set down in clause 1.3(b) of the Code and they are that:

(1) the *market* should be competitive;

(2) customers should be able to choose which supplier (including generators and retailers) they will trade with;

(3) any person wishing to do so should be able to gain access to the *interconnected transmission* and *distribution network;*

(4) a person wishing to enter the *market* should not be treated more favourably or less favourably than if that person were already participating in the *market*;

(5) a particular energy source or technology should not be treated more favourably or less favourably than another energy source or technology; and

[3] The relevant agreement was made on 19 August 1994.

(6) the provisions regulating trading of electricity in the *market* should not treat intrastate trading more favourably or less favourably than interstate trading of electricity.

MTC agrees that the market objectives provide guidance to the Commission for its determination of the MTC Application. In particular, MTC should not be treated more favourably or less favourably than existing transmission network service providers. Other existing regulated transmission network service providers may continue to obtain a regulated income for providing prescribed services solely on the basis that the regulatory asset value and regulated income for their network assets is determined in accordance with chapter 6 of the Code. MTC seeks to be treated no more (and no less) favourably.

MTC also agrees that the Commission may have regard to the 1994 CoAG Agreement, which in part 3(c), states:

(i) that Deprival Value[4] should be adopted as the preferred approach to valuing network assets;

(ii) that the approaches adopted for applying Deprival Value should be transparent and uniform across jurisdictions to avoid distortions to competition

MTC strongly supports the transparent and uniform application of regulatory asset valuation across the National Electricity Market ("**NEM**"). Later in this paper, MTC describes how its approach to determining Murraylink's regulatory asset value is entirely consistent with CoAG's preferred Deprival Value approach.

The Commission also confirms that it would be appropriate for the Commission to have regard to similar matters to those relevant to decisions made under chapters 5 and 6 of the Code. MTC agrees that the specific criteria relevant to decisions made under chapters 5 and 6 of the Code are relevant to the manner in which Murraylink's regulatory asset value and MTC's revenue should be determined. In particular, criteria in the Commission's *Draft Statement of Principles for the Regulation of Transmission Revenues*[5] **("Draft Regulatory Principles")** are relevant and, to the extent that Murraylink's economic value needs to be determined, the Commission's *Regulatory Test for New Interconnectors and Network Augmentations*[6] **("Regulatory Test")** is relevant.

On this basis, when assessing MTC's Application, Commission should ensure that Murraylink's regulatory asset value and MTC's revenue are determined in a manner consistent with the current application of chapter 6 of the Code. In its Application, MTC has assumed that the Commission will apply this approach and has made its case accordingly.

[4] The National Electricity Code defines "deprival value" to mean a value ascribed to assets which is the lower of economic value or optimised depreciated replacement value.
[5] ACCC 1999a.
[6] ACCC 1999b.

Commission's valuation of transmission network assets

Part B of chapter 6 of the Code sets down the general principles for the regulation of transmission revenue. The Commission's Draft Regulatory Principles set down the specific manner in which the Commission applies these principles.

Clause 6.2.3(c)(4)(iv) of the Code states that new and existing assets may be revalued on a basis determined by the Commission and, in particular, requires the Commission to have regard to the 1994 CoAG Agreement that states that deprival value should be adopted as the preferred approach to valuing network assets. The Commission's Draft Regulatory Principles[7] set down that its regulatory valuations of transmission assets will be based upon depreciated optimised replacement cost ("**DORC**") valuation principles and that, in recognition of clause 6.2.3(c)(4)(iv)(A), the Commission may also write down part of the transmission system below DORC in recognition of evidence suggesting that the regulatory asset valuation exceeds the optimised deprival value. Given that, according to the Code, "deprival value" means the value ascribed to an asset which is the lower of economic value or the DORC value, the Commission, in effect, is saying that it may value a transmission asset below DORC if the DORC valuation exceeds the economic value.

The Commission's Regulatory Test is designed to assess the costs and benefits of a range of possible network developments during the early stages of project planning before an asset has been constructed. It is not designed to determine the regulatory asset value of an existing network asset. It can, however, provide guidance for the manner in which an existing asset's economic value can be calculated.

In their report to the Commission of February 2003, Saha Energy International Limited[8] indicate that MTC's asset valuation methodology for Murraylink is broadly consistent with the optimised deprival valuation methodology as defined in the *New Zealand ODV Handbook*.

Valuation of Murraylink

In consultation with the Commission, MTC developed and applied a regulatory asset valuation methodology that is consistent with the requirements of the Commission's Draft Regulatory Principles and the manner in which the Commission values other new and existing assets.

In its Application, MTC has indicated that Murraylink's regulatory cost is the lesser of:

- the value of the gross market benefits Murraylink provides,
- the estimated life-cycle cost of the lowest cost alternative project that has the same economic value as Murraylink, and
- the estimated life-cycle cost of Murraylink itself.

[7] ACCC 1999a, p. xi.
[8] SEIL 2003, pp. 71-5

And Murraylink's regulatory asset value is equal to its regulatory cost less the net present value of its future operating and maintenance costs.

In this way, MTC has proposed that Murraylink's regulatory asset value is equal to its deprival value. This approach ensures that the substantial contribution that Murraylink provides to the NEM is fairly recognised.

To be clear, through this approach, MTC has adopted the following definitions:

regulatory asset value	The value upon which an asset's revenue is based, and which is determined, in effect, by the asset's deprival value.
deprival value	The lower of the economic value or the DORC value of an asset.
economic value	The value of an asset to the NEM (that is, the net present value of its gross market benefits less its future operating and maintenance costs)
DORC value	The sum of the depreciated replacement cost of the assets that would be used if the system were notionally reconfigured so as to minimise the forward looking costs of service delivery.
regulatory cost	The forward looking costs of service delivery of an asset, that is, (under the current regulatory regime) the sum of its regulatory asset value and the net present value of its future operating and maintenance costs [9].

The application of MTC's asset valuation approach is described in detail in MTC's Application and is summarised below:

1. Define the prescribed service of Murraylink
2. Calculate the market benefits Murraylink provides
3. Select the alternative projects that provide the equivalent level of prescribed service
4. Estimate the life-cycle cost of the alternative projects
5. Determine the regulatory cost of Murraylink
6. Determine the initial regulatory asset value

By increasing the capacity for energy to flow between the Victorian region and the South Australian region, Murraylink provides substantial and sustained economic benefits to those that produce, consume and distribute energy in the NEM. These benefits can arise from reductions in operating costs and avoidance or deferral of capital expenditure in the NEM. Together, MTC defined these as the gross market benefits of the asset.

[9] This definition is different to the Commission's interpretation in its Issues Paper (p. 5).

In Murraylink's particular case, this increase in capacity is controllable, compatible with run back schemes, and independent of the capacity of the other interconnector between the Victorian and South Australian region.

Murraylink's prescribed service is defined primarily in terms of its power transfer capability between the Victorian and South Australian regions. The scale and controllability of Murraylink's power transfer capability generates its market benefits. TransÉnergie Australia ("**TEA**") has assessed Murraylink's power transfer capability limits under several system conditions. TransÉnergie US ("**TEUS**") used TEA's recommended limits as inputs to calculate the market benefits Murraylink will provide as defined in the Regulatory Test. After reviewing TEA's assessment, PB Associates found that additional dynamic studies are required to confirm the power transfer limit recommended by TEA under one of the system conditions TEA examined. TEA has commissioned additional dynamic studies to support the limits that TEUS has used to calculate the market benefits of Murraylink.

MTC engaged Burns and Roe Worley ("**BRW**") to select and assess alternative projects for the purpose of determining the regulatory asset value of Murraylink. MTC agrees with the Commission that [BRW's] selection of alternative projects is consistent with an Optimised Depreciated Replacement Cost[10] valuation process. The DORC valuation process requires the selection and evaluation of alternative projects that provide services similar to those provided by the network asset that is being valued. Given that, under the deprival value approach, the Commission may also write down a regulatory asset value below DORC if the DORC exceeds the asset's economic value, it is appropriate that alternative projects are selected on the basis that they have a similar economic value to the asset being valued. The alternative projects selected by BRW provide a similar level of market benefits to Murraylink and, therefore, have a similar economic value.

In practice, the ACCC has previously only applied DORC valuations to existing and new assets. The real possibility that the Commission will write down the Murraylink's regulatory asset value below its DORC, makes the deprival valuation approach no less onerous in Murraylink's case. As such, BRW's selection of alternative projects is appropriate in the context of a deprival value approach and thus provides no material advantage to MTC over other transmission network service providers whose assets are valued by Commission in accordance with the Draft Regulatory Principles.

In the case of Murraylink, its economic value has been determined to be less that its DORC value. Therefore, its regulatory asset value is equal to its economic value, that is, its regulatory cost is capped at its gross market benefits. As a result, Murraylink's regulatory asset value is set lower than the actual capital cost of Murraylink.

Application of the Regulatory Test to Murraylink

Murraylink can provide a prescribed service and substantial economic benefits directly to those who consume, produce, and distribute electricity in the NEM. As such, it has an economic value as a

[10] MTC assumes that the "Optimised Depreciated Replacement Cost" valuation process is the same as the DORC valuation process.

regulated interconnector to the NEM. The Regulatory Test describes the manner in which Murraylink's economic value can be calculated.

MTC also agrees with the Commission that MTC's application, consultation process, and application of the Regulatory Test (albeit a modified test) for measuring Murraylink's market benefits, is consistent with the requirements of clause 5.6.6 of the Code dealing with the establishment of new large network assets.

The manner in which TEUS has calculated Murraylink's market benefits is consistent with the Regulatory Test and the manner in which NEMMCO calculated market benefits for its evaluation of SNOVIC400 and SNI.

MTC recognises the intent of the Regulatory Test by capping Murraylink's regulatory asset value at the lesser of its economic value and its DORC value. In doing so, MTC's regulatory asset valuation methodology implicitly takes account of the prudence and efficiency of investment in Murraylink under current market conditions.

Taking account of Murraylink's operation since October 2002

MTC's application and the reports contained in its appendices implicitly assume that Murraylink will operate as a regulated network asset for its whole asset life of 40 years. MTC will commission TEUS to recalculate the gross market benefits Murraylink provides for the balance of its remaining life when the likely date of Murraylink's conversion is known with more certainty. MTC will also adjust its projected depreciation accordingly.

Further development of the Draft Regulatory Principles

The Commission considers that the application of the Regulatory Test is likely to require modification when used to assess existing assets. Having recently been involved in a number of circumstances involving the application of the Regulatory Test, MTC would encourage the Commission to continue its process of improving the test so that it become a better tool with which proponents and regulators may assess prospective new network development. MTC understands that the Commission may consider a range of options including the incorporation of a competition benefits test.

However, it is the Draft Regulatory Principles rather than the Regulatory Test that will form the basis of regulatory asset valuations of all existing and new assets. MTC encourages the Commission to develop its Draft Regulatory Principles, especially in relation to the conversion and subsequent valuation process following the Commission's current assessment process for the MTC Application. Significant experience is being gained during the Commission's current assessment process for the MTC Application and MTC would be pleased to assist the Commission in due course.

References

Australian Competition and Consumer Commission ("**ACCC**") 1999a, *Draft Statement of Principles for the Regulation of Transmission Revenues*, Canberra

Australian Competition and Consumer Commission 1999b, *Regulatory Test for New Interconnectors and Network Augmentations*, Canberra

Australian Competition and Consumer Commission 2001, *Applications for Authorisation: Amendments to the National Electricity Code: Network pricing and market network service providers – Determination*, Canberra

Australian Competition and Consumer Commission 2003, *Murraylink Transmission Partnership, Application for Conversion to a Prescribed Service and a Maximum Allowable Revenue, Issues Paper*, Canberra

National Electricity Code Administrator ("**NECA**") 2002, National Electricity Code, Adelaide

Saha Energy International Limited ("**SEIL**") 2003, *Review of MTC's Application of the Regulatory Test*, Sydney

Attachment 2

MTC's Response to PB Associates' *Review of MTP Service Standards*

MTC highlights a number of issues raised by the PB Associates and provides its comments on each.

Scope of circuit availability

MTC supports PB Associates' finding that the circuit availability offered by MTC is the only appropriate service standard for Murraylink, inter-regional constraints on Murraylink's transfer capability due to conditions in the broader network are beyond Murraylink's control, and these inter-regional constraints, including those that result in an automatic run-back of the Murraylink power transfer, should not be taken into account for the measurement of Murraylink's circuit availability.

CIGRÉ reporting protocol

MTC supports PB Associates' finding that it is appropriate for MTC to adopt the protocol established by a CIGRÉ Working Group for calculating and reporting the availability of HVDC transmission systems: *Protocol for reporting the Operational Performance of HVDC Transmission Systems*.

Annual calculation of performance incentives

MTC is prepared to accept PB Associates' recommendation that its Murraylink performance incentive scheme be based on annual calculations.

Duration of planned outages

Section 3.3 of PB Associates' report confirms the need for Murraylink's yearly scheduled maintenance: 48 hours per year. In addition, monthly maintenance is required. Valve enclosures and the reactor room require inspection each month, and, for both, the system must be isolated, earthed and under access permit. Therefore, as there would be a minimum of 1.5 hours switching, isolation and restoration required, no less than 3 hours per month can be allowed for these routine maintenance inspections. This adds 3 x 12, or 36 hours per year to scheduled maintenance, giving a total of 36 + 48 = 84 hours per year (0.96%).

Duration of forced outages

When estimating the time to rectify forced (including unplanned) outages, in addition to the time quoted in the ABB Reliability and Availability Prediction, account should be taken of:

1. The time required to organise and mobilise equipment in the event of an forced outage, especially given Murraylink's remote location. In the event of an unplanned outage, travel times should also be allowed.
2. Switching times to isolate, earth and issue Electrical Access Permits ("**EAPs**") in accordance with the Victorian "Blue Book". At least 1.5 hours should be allowed for isolation, issuing of permits, cancelling of permits and restorations.
3. In the event of a replacement of a transformer, the time to complete the works, even with equipment mobilised and isolations completed, would be at least 24 hours

MTC believes that PB Associates overlooked these factors.

Proposed total unavailability

MTC continues to propose a total energy unavailability of 3.00%, that is, 0.96% for planned outages and 2.04% for forced outages.

Proposed individual performance targets

PB Associates is mistaken in that there are 75 peak hours between 7 am and 10 pm on weekdays each week. MTC accepts PB Associates' recommendation that there be individual performance targets and proposes target values of 0.96%, 0.91%, and 1.13% for planned, forced peak and forced off-peak respectively. As such MTC's overall circuit availability target would be 97%. These targets are more realistic for Murraylink, given its location and the nature of Australian high voltage switching and isolation requirements.

Revenue at risk

MTC concurs with PB Associates that its performance incentive scheme for Murraylink should place 1% of MTC revenue at risk.

Review of targets

MTC supports a review of its performance targets after five years.

Force majeure events

Unavailability of Murraylink arising solely from *force majeure* events should be excluded from the calculation of Murraylink circuit availability. These would include events that are beyond the reasonable control of MTC or its contractors given that MTC has undertaken all reasonable cost-effective mitigation measures to avoid them. MTC anticipates agreeing with the Commission a list of *force majeure* events within these criteria.

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28 February 2003

Mr Stéphane Mailhot
Chief Executive Officer
Murraylink Transmission Company
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Riverside Centre
BRISBANE QLD 4001

Dear Mr Mailhot,

TransÉnergie Australia Response to PB Associates Report:
"Transfer Capability Review"

TransÉnergie Australia ("**TEA**") is pleased to have this opportunity to respond to the review conducted by PB Associates of TEA's *Murraylink Power Transfer Capability Report* ("**TEA Report**"), which forms part of the MTC Application (as Appendix A).

In general TEA concurs with the findings of the PB Associates review, which in turn generally support the TEA Report.

In relation to the Murraylink's transfer capability under peak load conditions when incremental generation is available in the Victorian region, TEA accepts PB Associates comments that dynamic studies are required to confirm the Murraylink 220 MW transfer capability and the corresponding augmentation strategy put forward in the TEA Report. TEA has already received these studies (through independent consultants) and has also commenced discussions with affected transmission network service providers ("**TNSPs**") regarding the implementation of this particular strategy.

TEA is confident that the outcome of its discussions with the TNSPs will lead to transfer levels necessary to deliver the market benefits identified in the Application.

Dr Tony Cook
Managing Director
TransÉnergie Australia

28 February 2003

Comments on Issues Raised in SEIL's Review of Murraylink Market Benefits

Prepared for

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By

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Contents

Introduction

The Australian Competition and Consumer Commission (ACCC) engaged Saha Energy International Ltd. (SEIL) to review and comment on the estimate of Murraylink's Gross Market Benefits prepared by TransEnergie US Ltd. (TEUS) in October 2002. The TEUS analysis was submitted to the ACCC as Appendix D of Murraylink Transmission Company's (MTC) "Application for Conversion to a Prescribed Service and a Maximum Allowable Revenue for 2003-2012". TEUS has reviewed the document prepared by SEIL and offers several comments on a number of points raised by SEIL.

The principal comments submitted herein by TEUS are:

- The SEIL report is a thorough review of TEUS' methodologies and assumptions used.
- The SEIL report does not identify any specific assumptions (other than the limit of 220 MW on transfers from Victoria to South Australia, which at this time is subject to confirmation by dynamic load flow simulations) or methods that introduce a bias that would overstate the gross market benefits.
- The sensitivity analyses conducted by TEUS for SEIL support TEUS's calculation of Murraylink's gross market benefits of $214.2m.
- The models used by TEUS to conduct the benefits analysis represent current "best practice" within the industry.
- The overall modeling methodology is conceptually appropriate, internally consistent, and produces a robust estimate of market benefits

Finally, TEUS wishes to express it's willingness to further investigate any areas where the ACCC believes additional study may be helpful.

Specific Comments

The numbered items that follow provide TEUS comments and, in some cases, additional information, relating to issues raised by SEIL. To reduce the effort required for readers who wish to refer back to SEIL's report while reading, the issues and TEUS' comments are presented in the same order as originally raised in SEIL's report, with a brief quotation from SEIL's report and a page reference.

1. *"The way in which TEUS has modelled merchant generation entry (in the "with" and "without" Murraylink scenarios) is a case in point, where the conceptual framework for analysis appears to us as appropriate, but further review of the detailed modelling techniques, assumptions and outcomes is warranted …" [p. 5]*

   TEUS notes that it has adopted a simple and clearcut decision rule to apply to the merchant entry determination, to make the analysis as repeatable and objective as possible. As described in Appendix D of MTC's Application, Merchant plants are added in the size increments specified by the IRPC Stage 1 Report only when PROSYM-simulated prices are high enough to allow the entering plant to earn annual energy revenues equal to its annualized fixed costs (i.e. each new plant breaks even). Sufficient plants are added in each region such that any additional plants would not be able to break even. More complex or sophisticated approaches that depend in their implementation upon the judgement of the analyst would, in the end, be less robust and would produce a less certain estimate of market benefits.

2. *"We are generally comfortable with the choice of modelling tools employed by TEUS in their assessment of market benefits in terms of the practical alternatives available, but note that the findings provided are sensitive to a number of features underlying those models, and that they are subject to error in estimation. This is, of course, the case with other commonly utilized modelling tools as well." [p. 5]*

   TEUS agrees that the final result of any modeling exercise will be dependent upon the input assumptions, and the result will be more sensitive to some inputs than others. TEUS has been reasonably and appropriately conservative in its use and application of assumptions that were predominantly established by the IRPC and other industry organizations. The use of assumptions vetted by industry experts, and a conservative approach applied to those necessary input assumptions not available from previously published sources was designed to mitigate the possible adverse consequences of potential errors in estimation.

   SEIL notes that the modeling concerns they have raised are common to other electricity market modeling tools as well. The PROSYM and MARS models are the best available tools for the task of conducting ten year hourly simulations of energy cost and reliability in the NEM. There is no commercially available model that can both commit and dispatch generation to minimize cost while respecting dynamic

transmission constraints, and simultaneously optimize merchant entry over an extended multiyear planning horizon. Such a tool would indeed be helpful in the estimation of interconnector market benefits. The fact that such a tool does not exist, does not and should not reflect negatively on the market benefits estimate prepared by TEUS.

3. *"Given the potential for error in the estimation of net market benefits, the sensitivity of this variable to key assumptions, and the impact that this error could have on the setting of the maximum allowable revenue, we think it prudent to undertake a more comprehensive assessment of the setting of the regulatory asset value, with attention given to the summary measures used to "build up" the value of market benefits - thus the regulatory asset value." [p. 7]*

   TEUS would be pleased to facilitate a full assessment of its work in conjunction with any review instigated by the Commission.

4. *"...it would be useful to refine the framework for estimation of market benefits, including the setting of key parameters underlying the estimation of market benefits." [p. 7]*

   TEUS has closely followed the framework already in place to implement the regulatory test, recognizing the differences that arise from the application of the test to proposed facilities as compared to operating facilities seeking conversion to regulated status. If the ACCC believes changes in the framework are necessary, TEUS will be glad to conduct and submit additional analyses to quantify the impact of any changes on Murraylink's gross market benefits.

5. *In reference to the PROSYM and MARS models, SEIL notes that they "have not provided a view in regard to the internal integrity of those models." [p. 10]*

   TEUS intentionally selected commercially available, widely used state-of-the-art electric industry modeling tools for this reason. Such models are quite complicated and difficult to develop. Both Henwood Energy Systems and General Electric, the respective developers of the modeling tools, have excellent longstanding reputations. TEUS is confident that any fundamental errors or flaws affecting the internal integrity of either model would have long since been identified and corrected by the vendor. In the United States, the PROSYM model is widely used to support project pro formas for merchant generation, and is well accepted by the major financial institutions that finance these project. The MARS model has long been a primary reliability planning tool within the New York Power Pool, and more recently has been adopted by the Independent System Operator of New England to quantify the impact of reliability problems in specific subregions as an important input to New England's transmission planning process.

6. *"The New South Wales, Victoria and South Australia regional traces were then apportioned into sub-regional load traces by prorating them with sub-regional off-take allocations derived from data based on 2003/4 summer peak demand conditions." [p. 21]*

   The source of the locational load distribution during 2003/04 summer peak demand conditions was the 2003/04 Summer Peak load flow case prepared by the Interconnector Options Working Group (IOWG).

7. Regarding the methodology used in analyzing load uncertainty, SEIL comments: *"A different distribution assumption or a different number of "bins" would have produced different results." [p. 24]*

   Ten is the maximum number of bins allowed by the MARS software. The assumption that load uncertainty would follow a normal distribution was not made in a completely arbitrary manner. The NECA Reliability Panel made a similar assumption of normality in the past (see Item 3.0 on page 122 of the IRPC Stage 1 Report, 26 October 2001).

8. *"The TEUS algorithm does not have look-ahead capability. In the TEUS algorithm the investment decision is determined only by the plant's profitability in its commissioning year." [p. 29]*

   Most investment decisions are heavily influenced by the recent past and the expected near term. Simulating market entry decisions using first-year profitability is not an unreasonable approximation of what is in reality a very complex, individualized decision for each market entrant.

   TEUS applies its algorithm successively, year by year. The starting point for each new year is the generation mix from the prior year. With continuous load growth and no technological improvement, plants that are profitable in a particular year would only become unprofitable in future years if there is over-entry at some future point. With the TEUS algorithm, by definition, this will not happen. Merchant plants are added only if profitable. A merchant plant that resulted in over-entry would itself be unprofitable, and therefore would not be added. It can happen that the addition of a large baseload plant could be profitable at the time of entry, and by its entry make prior merchant peaking plants temporarily unprofitable. In the scenarios analyzed by TEUS, this situation was infrequent, and it did not occur at all in the Base Case.

9. *"As a result, the algorithm may be biased toward commissioning more low capital cost/high operating cost generation capacity than would be least cost in the long run. There is clearly a trade-off between the benefits of deferred market entry and fuel cost savings here, which PROSYM is not designed to handle." [p. 30]*

   The "trade-off" between operating costs and capital costs does not take place within the PROSYM model. As SEIL indicates, this is outside the scope and capabilities of PROSYM. It does, however, take place as part of the merchant entry decision.

When energy revenues are sufficient to cover the annualized fixed costs, merchant plant will enter. The PROSYM model is run iteratively, with merchant plants added or deferred as indicated by their profitability in the most recent PROSYM iteration. This directly simulates a *market* entry process, not a centralized planning process, as would seem appropriate for market entry plant.

10. *"Discrete changes in the commissioning schedules can also be caused by minimum unit sizes being assumed for new plant and annual (rather than quarterly or monthly) commissioning dates." [p. 30]*

    A unit size increment of 50 MW is actually small for most new construction. The decision to have new plant enter on January 1st of each year was a modeling convenience. Given the seasonal nature of loads, it's likely that most new generators would work hard to be in commercial operation by December of each year to capture the high prices anticipated in the summer season. This is very close to the assumed in-service date used by TEUS.

11. *"…with higher offer prices the generation deferral may possibly stabilise in the model at around 100 MW." [p. 30]*

    At SEIL's request, TEUS analyzed an alternate market development scenario where generator bids were assumed to be 200% of SRMC. The 200% SRMC Extended case reflects higher energy benefits, lower deferred merchant entry benefits (around 100 MW), and approximately equal reliability benefits, with no change in the Riverland Deferral benefit. The energy, merchant entry, and reliability benefits are all tightly interlinked. An increase in one is generally accompanied by a decrease in another. In this case, a 200% increase in energy bid prices leads to an overall increase in market benefits. SEIL's focus on the sensitivity of individual benefit components to assumptions overlooks the interdependency of the components and the robustness of the overall modeling.

12. *"Another test for long run equilibrium is to continue extending the computations to include additional years until the 40 year market benefit calculations stabilise. As can be seen from the chart below, extending the last year of computations by up to 5 years beyond 2012 would have markedly increased the 40 year NPV. Only when the computations extend to 2018 in the base case does the market benefit drop back toward the value estimated when the computations were made out to 2012." [p. 31]*

    TEUS believes this analysis, performed at SEIL's request, is a clear example of the conservatism built into the TEUS estimate. Of all the possible simulation termination years in the 2012-2018 period, the year used in the MTC's application, 2012, produces the lowest estimate of market benefits.

13. *"We believe particular attention is warranted in regard to the modelling technique applied in estimation of merchant generation entry, in which further analysis should*

be undertaken to more clearly assess its robustness to a well defined set of key assumptions. The aim here is to obtain a robust estimate of the value of generation deferrals." [p. 44]

Changes in assumptions or the market entry algorithm will cause changes in the market entry schedule. The more important question is how will it affect market benefits. The energy, capacity deferral, and reliability benefits are all strongly intertwined. Changes in merchant entry that increase the benefits of deferred merchant plant will generally be offset by reductions in energy benefits or unserved energy benefits. This is caused by the very nature of the equilibrium "balancing" process that determines merchant entry. Focus on the merchant entry schedule in isolation is inappropriate and potentially misleading. As discussed previously, the total gross market benefits are robust because the modeling process is internally consistent.

Conclusion

The SEIL report contains a thorough review of TEUS's methodologies and assumptions used. SEIL has commented that such modeling is complex and difficult, and the assumptions used will influence the results – some more than others.

TEUS would agree with this assessment, and is pleased to note that the SEIL report does not identify any specific assumptions (other than the limit of 220 MW on transfers from Victoria to South Australia, which at this time is subject to confirmation by dynamic load flow simulations) or methods that they believe introduce bias that would overstate the gross market benefits. In general, SEIL has found the methodology and assumptions to be "reasonably transparent" and "not clearly inappropriate". We believe this stems from the substantial similarity between the TEUS modeling and prior work done by others when evaluating market benefits for the Regulatory Test.

The sensitivity analyses conducted for SEIL support TEUS's calculation of Murraylink's gross market benefits of $214.2m submitted in MTC's Application.

TEUS will be happy to provide further analysis to address any issues that may remain of concern to the ACCC.

MEMORANDUM

TO: Stéphane Mailhot
Murraylink Transmission Company

FROM: Deb Chattopadhyay, Charles River Associates

DATE: February 27, 2003

SUBJECT: **Comments on SEIL Review of Murraylink Market Benefit Assessment**

1. Purpose of this note

This note discusses the comments made by SEIL[1] on the CRA review of the TransEnergie US (TEUS) study on assessment of Murraylink market benefits. The purpose of this discussion is to either assert or refute some of the observations made by SEIL. The following documents, or parts therein, have been extensively referred in the remainder of this note:

- SEIL report
- CRA's original review[2],
- TEUS report[3], and
- The regulatory test.

[1] Saha Energy International Limited (SEIL), *Review of Murraylink Transmission Company Pty Ltd's Application of the Regulatory Test*, Final Report submitted to the Australian Competition and Consumer Commission. February 2003. Appendix A (page 83-88) of the SEIL report titled "Charles River Associates Report – Murraylink Market Benefits" is the primary focus of the present discussion.

[2] Charles River Associates (Asia Pacific) Limited, "Assessment of Murraylink Market Benefits – Comments on TransEnergie US Study", Appendix E of Murraylink application dated 18 October 2002.

[3] TransEnergie US Limited, *The Estimation of Murraylink Market Benefits*, Appendix D of Murraylink application dated 18 October 2002.

2. Purpose of the original CRA review

To start with, it should be emphasised again the intent of the CRA review was to examine the:

- Models employed by TEUS for the analysis and the modelling process, or methodology, which defines how the models are used for specifically addressing the NEM issues. This also encompassed the fundamental theoretical and computational complexities in modelling an electricity market as well as what is desirable and practicable, including how some of these issues have been dealt in the Australian context by IRPC in the context of evaluation of SNI;

- Compliance of the methodology to estimate market benefit with the intent of the regulatory test; and

- A broad review of the data, and assumptions used, to identify any major gaps and the results to check if they are reasonable within the limitations of the available data, assumptions and modelling theory and implementation.

The SEIL report (Appendix A, section 1.1 and 1.2) recognises the scope of CRA review and also what the scope of the review specifically excluded. However, SEIL goes on to comment (section 1.3), "*CRA has endeavored to judge whether the TEUS market benefit study is sufficiently accurate for the purpose intended, but it does not discuss this purpose or consider its implications. Its judgments, therefore, may be of limited value with regard to whether the results are of sufficient quality to establish a regulatory asset value.*" This comment is potentially misleading. It does not specify the implications that CRA should have discussed.

The purpose of CRA's report is clearly stated to be the review of TEUS's calculation of market benefits attributable to Murraylink, that is, whether this calculation has been made using an appropriate set of models, inputs and assumption and a methodology consistent with the intent of the regulatory test. Each of these issues has been carefully addressed in the CRA review and a satisfactory resolution of these issues defines the accuracy of the modelling results.

The most significant and relevant implication of the TEUS study results is the level of market benefit itself. Surely, both the TEUS study and its review by CRA focus on this aspect. There could potentially be a gamut of other issues and implications that could be analysed using the same models and methodology, but obviously that was not the purpose of the original study, or the review. It should be noted that the scope of CRA's review was limited to the market benefit assessment framework and obviously one has to judge the fuller implications of the market benefits as to where, how and why the market benefit results are used – nevertheless, it does not diminish the importance of assessing the calculation of market benefits.

3. "Inaccuracy" issues

There are two "inaccuracy" issues that SEIL discusses in the main report that are worthy of further consideration, namely, the inability of PROSYM to ensure optimality of the market entry, and the simplicity of the PROSYM transmission model. These and other specific issues will be dealt in more detail later in this note. However, a few broad comments on these two are worth stating up front as they feature throughout SEIL's discussion on modelling issues.

The first of these issues has been discussed in the CRA review[4] and it is clearly an area where the market modelling theory and computational developments are inadequate rather than the selection of PROSYM as a modelling tool being the source of inaccuracy. The evaluation of SNI was also performed using the ROAM model that has no "look ahead" capability to ensure optimality of the market entry. This issue is more general than just the capability of PROSYM and ROAM models - there is no industry grade market model that can do a detailed hourly production simulation and multi-year capacity expansion optimisation simultaneously[5].

The second issue of the simplicity of PROSYM's transmission model also pertains to the inadequacies in the current state of mathematical programming and computational theory. Ideally, evaluation of interconnectors should recognise the full level of technical complexities of a transmission system. However, such complexities cannot be adequately reflected in a long term optimal planning exercises due to limitations in optimisation theory and in commercially available software. The relatively naïve transmission model of PROSYM is an example of this. SEIL does not indicate how important the specific shortcomings, namely outage of transmission lines and dynamic flow constraints, are or if there is a practicable means of modelling their impacts. There are many more transmission complexities which could be added to the list of shortcomings, but there is no model in the world that can precisely and comprehensively deal with these issues in a long range planning framework. Industry grade planning tools such as PROSYM incorporate the compromise needed to get around these hurdles. The CRA review identifies these issues and indicates that TEUS's selection of the modelling tools is reasonable and is consistent with the current state of market modelling theory and commercially available time-tested tools.

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[4] For example, Table-1 on overview of methodological issues clearly identify this as a major issue.

[5] See for example, the discussions in: B.F. Hobbs, M.H. Rothkopf, R.P. O'Neill, and H.-p. Chao, eds., The Next Generation of Unit Commitment Models, International Series in Operations Research & Management Science, Kluwer Academic Publishers, Norwell, MA, 2001. Also, B.F. Hobbs, "Models for Integrated Resource Planning by Electric Utilities, Invited Review," European J. of Operational Research, 83(1), 1995, 1-20.

4. Estimation of capacity deferral benefits

SEIL's concerns relating to the following specific points will be addressed further in this section:

> *SEIL has noted the potential for the results of the analysis to be affected by the choice of software and the configurations of the model(s).*
>
> > *"The methodology for calculation of capacity deferral benefits using a profitability test is reasonably accurate and matches the intent of the regulatory test."*
> >
> > *"TEUS have adopted a reasonable compromise (to the problem of commissioning future generation) by using a 'profitability test' around detailed dispatch model i.e., PROSYM… (This is) consistent with the methodology adopted by IRPC/ROAM for evaluation of SNI." (p8)*

Estimation of capacity deferral benefits should take into account both optimisation of capacity entry over a long term and the short run operation of all existing and new entry plants to meet energy and reliability requirements of the system, while observing all short term operational constraints and long term limits on new entry. As discussed before, there is no model/algorithm that can satisfactorily deal with all three aspects and ensure the optimality of both the capacity plan and operation, at least for a system as large and complex as the NEM. TEUS methodology lays emphasis on the operational details and accurate measurement of reliability. TEUS methodology relies on a profitability test to decide the long term capacity entry. SEIL aptly raises this issue. However, the conclusions, that SEIL draws, that such an approach may lead to biased estimates of the type, timing, and amount of new entry[6] from it are certainly debatable, namely:

[6] P.29-30 of the SEIL Report.

a. It is possible in theory to check the profitability of the plants following its commissioning years and revise the planting schedule. The profitability test implemented by TEUS is an *iterative* process, precisely to overcome any obvious sub-optimality of the entry plan. Although the process does not guarantee finding the best solution, it gets back to the earlier discussion on inadequacy of the current optimisation theory, rather than a shortcoming of the TEUS implementation. It should also be questioned whether such sub-optimality is material. Given the increasing energy demand and relatively similar load shape of projected demand, it is unlikely that too many new entry plants will have a swing in profitability from being positive in early years to negative in the latter years. Hence, there are enough reasons to believe that the profitability test is a reasonable approach both on a theoretical ground and in terms of practical implementation;

b. The second conclusion that SEIL draws regarding the optimal mix of plants is essentially a data/assumption issue – if a range of capacity options are provided, the profitability test would involve evaluating the trade-off between capital and operating costs of all options and arrive at an entry profile that ensures the correct mix of plants. In fact, this is precisely what the TEUS algorithm does. It was understood that a reasonably broad mix of coal and gas entry options for each state of NEM has been used as per the IRPC report and also discussed by SEIL in their report. The lack of high fixed cost base load plant entering into the simulations merely follow the IRPC assumptions, and not a deficiency of the TEUS algorithm. There is not, therefore, any clear basis for SEIL's argument.

c. SEIL further argues that PROSYM is not designed to handle the trade-off between deferred market entry and fuel cost savings. This is clearly a misinterpretation of the TEUS methodology. The whole purpose of conducting a profitability test around PROSYM was to evaluate this trade-off.

d. Finally, SEIL notes that the market premium earned by new generation is a function of interruptible load costs and VoLL price events. SEIL observes TEUS methodology does not accurately estimate it because MARS output is not fed back to PROSYM. This is partially correct. PROSYM does calculate the unserved energy and interruptible loads, but it does not do so as accurately as MARS does, and there is no meaningful way of "feeding MARS output back to PROSYM". This also relates to the deterministic vs stochastic treatment of uncertain events to accurately estimate the unserved energy/interruptible loads because in a deterministic world, there will be no divergence between MARS and PROSYM outcomes. Ideally, the production simulation and profitability test should have as detailed a Monte Carlo scheme as MARS employs in calculating the reliability indices and any divergence of unserved energy and interruptible load is an indication of the asymmetry of the level of details. However, it should be noted in support of the TEUS methodology that,

   - The computational burden of running a detailed Monte Carlo in PROSYM could be prohibitively high; and

   - PROSYM does perform a convergent Monte Carlo scheme that is computationally much less burdensome to enumerate the unserved energy and interruptible loads. Hence, PROSYM's calculation of market premium, in theory, should be reasonably close to those estimated by MARS depending upon the efficiency of the convergent Monte Carlo scheme employed.

   Regarding the representation of the transmission system, it was noted in the CRA review, and SEIL has also raised essentially the same issue, that *"Both MARS and PROSYM use relatively simplistic representation of transmission and the time/season varying MW limits are the only means to represent the transfer capability in both their models."*. SEIL has also noted (paragraph 1, p.18) the inability of PROSYM to handle (a) multiple interconnector between two regions (b) *dynamically represent flow constraints that occur on each interconnector*. The first one is irrelevant given that PROSYM does not represent the electrical characteristics of the transmission system[7] and the "work around" employed by TEUS using a dummy node is appropriate. The usage of the word "dynamically" is ambiguous. It may mean time-varying or temporal flow limits (e.g., hourly/monthly/seasonal flow limits), or refer to dynamic non-linear transmission phenomena such as dynamic stability constraints. PROSYM does allow for temporal flow limits. If, on the other hand, dynamic flow constraints refer to not merely temporal flow limits but

[7] It may be worth noting in this regard that the NEM pre-dispatch and real-time dispatch/pricing model and process does not recognise them either.

also inter-relationship among flow with load (and hence "dynamic" losses), and generation, stability, other flows, etc, as captured by the so called "generic constraints" in NEM dispatch – PROSYM and MARS are indeed not capable of capturing all of these aspects. Nevertheless, it should be emphasised that an accurate representation of these aspects in a long range interconnector benefit analysis is a very formidable task which is both computationally and data intensive and is one that has not been attempted in other NEM studies. One should also question both the materiality and relevance of these issues for the evaluation of an interconnector benefit over the longer term.

5. Alignment with the regulatory test

SEIL writes that the CRA review does not clearly state whether the TEUS study aligns with the intent of the regulatory test. This is not true. The CRA review (p.17) does state "*....the TEUS methodology and models have been used to estimate the market benefits that align well with the intent of the regulatory test.*" SEIL also opines that the eight points that CRA puts forward in support of the above statement do not all relate to the regulatory test. Again, SEIL's view cannot be concurred with. All the points that CRA had mentioned and that are reproduced below lead to the conclusion that TEUS's analysis adheres to the principles laid out in the regulatory test:

1) *Consideration of existing supply of generation is consistent with NEM realities and their representation in MARS and PROSYM models is appropriate;*

2) *Consideration of new generation alternatives is consistent with the norms laid out by IRPC;*

3) *Representation of transmission in MARS/PROSYM is consistent with the NEM realities;*

4) *There is appropriate consideration of uncertainties in generation/transmission outages as well as alternative load growth scenarios performed;*

5) *The methodology for calculation of market benefits for energy savings using the PROSYM methodology is sufficiently detailed and matches the intent of the regulatory test;*

6) *The methodology for calculation of capacity deferral benefits using a profitability test is reasonably accurate and matches the intent of the regulatory test;*

7) *The methodology for calculation of reliability benefits using the MARS model is accurate and captures the inherent physical uncertainties well which is consistent with the NEM planning process and the intent of the regulatory test; and*

8) *Externalities including environmental externalities and ancillary services cost issues are not considered in the analysis which are consistent with the treatment of these issues in the prior IRPC[8]/ROAM study;*

The regulatory test, for instance, requires consideration of "*the efficient operating costs of competitively supplying energy to meet forecast demand from existing, committed, anticipated and modelled projects including demand side and generation projects*". TEUS analysis takes into account the generation and DSM projects identified by the IRPC and documented in its Stage 1 report on SNI. PROSYM's dispatch optimisation ensures the existing/new generators are efficiently utilized to meet the projected demand. The regulatory test also clearly specifies the requirements of building in a reasonable degree of uncertainty with respect to critical parameters as well as certain degree of realism with respect to how NEM operates in reality e.g., power flows across the states. The test also stipulates that total market benefits should encompass reliability related benefits. Finally, the test is specific about disregarding any environmental benefits that are not incurred to meet the requirements of existing and anticipated laws/standard. These considerations are given due considerations in determining both the inputs and setting up PROSYM and MARS for the Murraylink analysis by TEUS. CRA comments (1)-(8) above relate to these issues and support the conclusion that TEUS's procedure for estimating Murraylink's market benefit is compliant with the intent of the regulatory test.

6. Market driven scenarios and generator bidding

Regarding the second of CRA's eight points above, in relation to new generation alternatives, SEIL comments "*A point that CRA could have made in item (2) above is that the IRPC's SNI study models new reliability-driven generation by using two offer price scenarios—one at VOLL (similar to TEUS's approach) and one at SRMC. TEUS has not undertaken an SRMC pricing scenario for reliability-driven generation and, in fact, has not incorporated reliability-driven generation in its modelling. The IRPC (3.4.2.2 of the IRPC Stage 1 report) implicitly regards the two price offer scenarios for reliability-driven generation as important, as in its view it constitutes the distinction between the 'market-driven' scenarios and the "least cost market" scenario required by the regulatory test.*"

8 IRPC Stage 1 report, p.34 suggests that externalities are not to be included and specifically mentions the future environmental costs are "poorly defined" at the moment.

SEIL comment above appears to be confusing in so far as the usage of the word "market *driven* scenario" is concerned. The ROAM/IRPC study, just like the TEUS study, did not go beyond cost based analysis. ROAM/IRPC study considered a scenario where all reliability generators are offered at SRMC and (rightly or wrongly) refers to it as the "least cost planning scenario". Their analysis considers a second scenario where reliability generators offer at VoLL and this is equivalent to the TEUS approach. In fact, whether such generators are explicitly represented in the dispatch modelling is not material. The second scenario does not cater to the purpose of a market *driven* scenario as required by the regulatory test. The test specifically requires such scenarios to reflect a degree of realism with regard to how generators/loads offer their generation/load in NEM: "*The market-driven market development approach mimics market processes by modelling spot price trends based on existing generation and demand and includes new generation developed on the same basis as would a private developer (where the net present value of the spot price revenue exceeds the net present value of generation costs). The forecasts of spot price tends should reflect a range of market outcomes, ranging from short run marginal cost bidding behaviour to simulations that approximate actual market bidding and prices, with power flows to be those most likely to occur under actual systems and market outcomes*." The test therefore requires estimation of projected spot prices based on not merely costs or cost-based based bids but also those that reflect their actual behaviour (presumably) as seen by NEM in the last few years of operation. The latter is not fully achieved by simply representing "reliability generators" offering in at VoLL prices.

The IRPC/ROAM study describes the SRMC/LRMC bidding scenarios and variations therein as market *development* scenarios – but these are fundamentally cost based scenarios that serve a purpose different from a realistic market bidding one discussed above, namely: these capture the variation of market benefit under alternative market development regimes as described in the regulatory test: *In determining the market benefit, the analysis should include modelling a range of reasonable alternative market development scenarios, incorporating varying levels of demand growth at relevant load centres (reflecting demand side options), alternative project commissioning dates and various potential generator investments and realistic operating regimes*.

7. A range of market outcomes

SEIL puts forward the view that the fourth of CRA's eight points in clause 5 above, in relation to uncertainty in generator outages and alternative load growth scenarios, is misleading in that it seems to suggest these are *"sufficient to meet the regulatory test requirement"*. CRA's point suggests that some of the critical scenarios have been considered in the TEUS analysis. SEIL astutely points out that "*The regulatory test requires, for example, that "The forecasts of spot price trends should reflect a range of market outcomes, ranging from short run marginal cost bidding behavior to simulations that approximate actual market bidding and prices."* However, there is an obvious difficulty in constructing market based bidding scenarios in the absence of any available benchmarks and hence without making a raft of potentially subjective assumptions regarding generator behaviour over the next 10-15 years based on limited information

available on generator bids. This is clearly a dilemma which TEUS resolved by performing cost based analysis alone similar to the IRPC/ROAM study and it is worth reiterating that the latter study also relied on cost based scenarios only. Given the difficulty in creating a realistic bidding scenario that is objective, the precedent set by IRPC in SNI evaluation, and the availability of adequate volume of data and information, CRA considers that the TEUS methodology and implementation represent a reasonable compromise in meeting the requirements of the regulatory test.

8. Benefits of reactive support

In section 1.6 of its report, SEIL comments that TEUS has incorporated reactive support in the calculation of market benefits in at least one respect, and that the CRA report appears to indicate otherwise. It is true that the subject statement on page 9 of the CRA report is unclear. The intent was to indicate that the TEUS PROSYM and MARS modelling did not attempt to factor in the costs of dispatching and operating the NEM in a manner that considers the provision of the reactive power related services to maintain nominal voltage level and voltage stability. It is true that the Riverland deferral benefit does incorporate a small amount related to reactive support.

9. Terminal year

In section 1.8 of Appendix A, SEIL raises a concern regarding the selection of the terminal year of the analysis. This is always an issue in *any* investment modelling exercise and one is bound to make a subjective judgement within the limitations of data, computational time and other resources. The conclusions in the CRA report was obviously based on a study conducted using a limited time horizon and was simply reflecting the fact that there was no obvious divergence of the solution towards the end of the planning period (which in fact happened to be the case for the IRPC/ROAM study). This was comforting but perhaps not very conclusive as has been alluded to in CRA's discussions with TEUS who ran sensitivities for the base case by extending the horizon till 2013 and 2014. These sensitivities seemed to confirm that the solution had, in fact, equilibrated. There is also a question of what margin of variation does one believe to be "tolerable". In the SEIL graph above, 2013-2014 are not materially different from 2011-2012. However, the new results furnished to SEIL by TEUS extending the horizon further shows substantial variation in the share of benefits. This is not totally surprising – planning horizon can indeed be a difficult one to judge without infinite amount of data, time and patience! If there is a major shift in the demand-supply paradigm in a particular year – this is likely to show up in the relative share of market benefit components.

Based on TEUS's results of an extended planning period presented by SEIL in Appendix A, it seems that the results for 2015-2018 clearly indeed shows a shift in the share of benefits which was not apparent in the model runs that extended only through 2014. Ideally, one would like to extend the planning horizon to cover the entire life of the asset. However, this might not be a material issue – the break up of the total market benefit is somewhat artificial. The composition of the benefits is only indicative of whether the planning horizon was arbitrarily cut off, or not, before a relatively stable demand-supply condition was reached in the market. This was not meant to be, nor was it described in the review as, a "fool proof" test. If there is not a substantial change in the NPV of total benefit as a result of the change in the break up, one need not pay too much attention to the specific details of the overall results beyond 2015 anyway.

MURRAYLINK ALTERNATIVES ASSESSMENT

Environmental and Planning Issues

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Acknowledgments

Limitations Statement

The sole purpose of this report and the associated services performed by Kellogg Brown & Root Pty Ltd (KBR) is to provide advice to TransEnergie Australia Pty Ltd on likely undergrounding requirements for Murraylink Alternatives in accordance with the scope of services set out in the contract between KBR and TransEnergie Australian Pty Ltd ('the Client'). That scope of services was defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

KBR derived the data in this report primarily from examination of records in the public domain, interviews with individuals with information about the subject matter. The passage of time, manifestation of latent conditions or impacts of future events may require further exploration at the site and subsequent data analysis, and re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, KBR has relied upon and presumed accurate certain information (or absence thereof) relative to the type of project provided by government officials and authorities, the Client and others identified herein. Except as otherwise stated in the report, KBR has not attempted to verify the accuracy or completeness of any such information.

The findings, observations and conclusions expressed by KBR in this report are not, and should not be considered, an opinion concerning the environmental approval process as it applies to specific projects. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings, observations and conclusions are based solely upon information in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between KBR and the Client. KBR accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

CONTENTS

Summary

The development of electricity generation and transmission projects involving the construction of structures such as towers, poles, lines and wind turbines can have significant environmental and social impacts. These types of proposals are generally rigorously assessed under the environmental and planning processes of each of the relevant local and State governments, and the Commonwealth government. That is, the one project can be subject to multiple assessments under various legal jurisdictions. Sometimes these processes are combined by direct agreement between the various governments, but in most instances, they are conducted separately, in parallel with each other. It is possible for each jurisdiction to make a different decision on the environmental acceptability of a proposal based on their different statutory limits and political imperatives.

The range of environmental and social impacts associated with these types of developments includes, but is not limited to; clearance of native vegetation and fauna habitats, direct and indirect removal of listed endangered species and ecological communities, fragmentation of remnant vegetation habitats and reserves, fragmentation of land tenure and effects on property management, and visual impacts.

The environmental and social impacts of these types of proposals must be assessed by the relevant assessment authorities and decision making Ministers in each jurisdiction to be environmentally acceptable before the project can proceed. In many instances, assessments of electricity generation and transmission projects have resulted in changes to the design, technology, and location of a project to address environmental and community concerns raised during the assessment process. Examples of where this has occurred include; Basslink, Beenup Transmission Line, Brunswick to Richmond Transmission line, and Portland Wind Energy Farm. These projects are either examples of where a proponent has made significant and costly changes to a proposed project to obtain a favourable Ministerial assessment, and/or have been required to make a range of changes to ameliorate unacceptable environmental effects. The projects all demonstrate that the environmental and planning assessment process can and does have a significant affect on the design, technology and location of projects.

KBR has examined three alternatives to the Murraylink project put forward by Burns and Roe Worley to provide advice on the environmental and community issues that are likely to be associated with the various alternatives developed for Murraylink, and environmental management responses to these issues, particularly in regard to the use of tactical undergrounding to minimise potential impacts. Tactical undergrounding to minimise impacts on matters of State, national and international environmental significance is really the only relevant environmental management measure available,

given that the physical electrical network connection points required for equivalent Murraylink alternatives do not allow for the selection of a route which completely avoids environmental and community concerns.

Alternative 1 crosses broadacre agricultural land, the Bookmark Biosphere Reserve and a Ramsar wetland. Potential impacts on international, national, and State matters of environmental significance are generally associated with the area of the Bookmark Biosphere Reserve, the Ramsar wetland, and associated species and communities. It is likely that this alternative would be subject to rigorous environmental assessment under the South Australia, New South Wales, and Commonwealth processes. The SNI project which follows a similar route to Alternative 1 is currently being assessed separately under each of these processes.

Alternatives 2 and 3 cross the highly developed horticultural areas of Red Cliffs and Lyrup, the Murray Sunset National Park (Victoria), the Lyrup Forest Reserve – part of Bookmark Biosphere Reserve, and the Murray River (South Australia). It is likely that these alternatives would also be subject to rigorous environmental assessment under South Australia, Victorian, and Commonwealth processes because they also raise matters of State, national and international significance. Impacts on horiticultural activities in Lyrup and Red Cliffs as a result of development of an overhead transmission line could result in significant community opposition.

Based on direct knowledge and experience of the environmental assessment processes in each jurisdiction, direct experience with the assessment of transmission line proposals, and direct experience with environmental and planning assessments in the Sunraysia and Riverland regions, it is envisaged that:

- It is likely that Alternative 1 would require an estimated 30km of undergrounding to avoid environmental impacts to the Bookmark Biosphere, Ramsar wetlands and associated listed threatened species and ecological communities, and migratory species. If the assessment authorities and decision making Ministers wished also to avoid/minimise the fragmentation of reserves, impacts on farming, and visual impact on commercial tourism activities in the Bookmark Biosphere Reserve, this undergrounding could be increased by a further estimated distance of 30km, in order to enable the transmission line to traverse the reserve.
- It is likely that Alternatives 2 and 3 would require an estimated 25km of undergrounding to minimise community concerns and objections at the horticultural communities of Red Cliffs and Lyrup, and to cross the Lyrup Forest Reserve and the Murray River. If an overhead transmission line were to be viewed as an unacceptable impact on the Sunset National Park, a further estimated 15km of undergrounding may be required. Re-routing of the transmission line to avoid the Sunset National Park is not an option given the size and extent of the park.

1 Introduction

Kellogg, Brown & Root (KBR) has prepared this report for the Murraylink Transmission Company to provide advice on the environmental and community issues that are likely to be associated with the various alternatives developed for Murraylink by Burns and Rowe Worley. The main objective of this report is to determine the circumstances under which a transmission line would need to be developed underground, and to estimate the extent of undergrounding that could be required.

This advice is based on published documents, and direct experience with environmental and planning assessments in both the State and Commonwealth jurisdictions.

2 Key environmental and social issues associated with the development of transmission lines

Power projects involving external structures such as towers, poles, lines and wind turbines can have significant environmental impacts. Key environmental and social impacts associated with transmission line construction and operations include, but are not limited to:

- clearing of native vegetation and fauna habitats along the transmission line alignment, generally for the width of the transmission line easement, for tower pad sites, and for equipment laydown areas;
- soil stability and erosion in the construction of towers and line winching operations;
- fragmentation of remnant vegetation, habitats and reserves;
- direct impacts on avian fauna (e.g. birds) through birdstrike on transmission lines;
- fragmentation of land tenure and effects on property management;
- electromagnetic radiation (or EMF); and
- visual impacts.

It has been our experience that communities are generally hostile to new overhead transmission lines for a range or reasons. One reason is that communities believe that overhead transmission lines are visually intrusive, and destroy the character and amenity of their surrounding environment, particularly in rural areas. Linked to this are people's fears regarding the health impacts from transmission lines due to EMF. Transmission lines also tend to follow a route which suits the overall transmission line alignment. This alignment generally traverses properties rather than following property boundaries, which can cause conflict with the property owners' farm management practices. That is, placement of towers and lines can have significant effects on a farmer's ability to sow and reap harvests due to restrictions on machinery use around towers and under lines. It can also significantly affect the type of irrigation system that can be used, particularly overhead spray and pivot irrigation systems. Underground transmission lines, by their very nature, remove all of these community concerns because they are not seen, and generally do not have structures which adversely impact above-ground management of the land.

As a result of the range of potential impacts associated with the development of overhead transmission lines, they are usually subject to rigorous environmental impact assessment under the relevant legislation of the local, State and/or Commonwealth governments. That is, the one project can be subject to multiple assessments under various legal jurisdictions. Sometimes these processes are combined by direct agreement between the various governments, but in most instances, they are conducted separately, in parallel with each other. It is possible for each jurisdiction to make a different decision on the environmental acceptability of a proposal based on their different statutory limits and political imperatives.

The environmental assessment requires extensive field and literature studies, community consultation, and the preparation of documentation detailing these investigations and consultations, and the inter-relationship between this and the design and management of the proposal. The impacts must be assessed by the relevant regulatory bodies as being acceptable before the project can proceed to construction and operation.

In undertaking an environmental assessment of proposals, proponents are required to address guidelines issued by the relevant statutory authority, and in particular, need to clearly demonstrate that the proposal takes into account the sensitivity of the area to be impacted, and can be developed and operated in a manner which minimises impacts on the environment to the greatest extent practicable. It also needs to demonstrate that it has taken into account community concerns, which are often very strong. The three key management measures available to address the above impacts include:

- selecting a route which avoids sensitive areas, conservation reserves and communities;
- selecting a route which minimises clearing of native vegetation to the greatest extent possible;
- using poles instead of towers to minimise visual impacts; and
- undergrounding the transmission line, either in total, or through sensitive areas.

If the assessment authority and the decision-making Minister find that the impacts of a project are unacceptable, they have the power to influence or require proponents to vary their project's location or technology to lower the impacts to an acceptable level. This power has been demonstrated on numerous occasions. There are examples of power projects recently assessed where the proponent has failed to demonstrate that they have minimised environmental impacts as far as practicable, particularly in regard to matters of State, national and international significance. Ramsar wetlands, the Bookmark Biosphere reserve, threatened species and communities, and listed migratory species are examples of matters of State, national and international significance.

Ultimately, decisions by Ministers on the environmental acceptability of a proposal seek to balance environmental management objectives and requirements against political imperatives, and the cost and commercial feasibility of the environmental management measures required to minimise impacts as far as possible. As such, these decisions are difficult to predict.

There are numerous examples of where projects have had to be redesigned in order to obtain regulatory environmental approvals.

Basslink

The Basslink proposal, an interconnector between Tasmania and Victoria (which completed assessment in October 2002), is a particularly relevant example of where due to community pressure, and environmental matters of State, national and international significance, the proponent was required to:

- change the subsea cable technology from a sea-earth return system to a metallic return system (this extra capital cost was variously estimated to be between $30 million and $100 million)
- change the shore crossing point;
- underground 6.5km of the transmission line from the shore crossing point across the coastal plain;
- utilise a route which was not identified as their preferred route in their EIS documentation to lower impacts on high conservation areas; and
- use poles instead of towers when crossing the Merriman Creek Valley in Victoria to lower visual impacts.

All of the above changes were as a direct outcome of the environmental assessment of the proposal. The proponent actively resisted all of the above requests for changes. They were all imposed as conditions of approval, apart from the metallic return which was offered by the proponent post release of the draft assessment report. This report had made it clear that the proposal would not receive recommendation for approval without a change in subsea cable technology (Basslink Joint Advisory Panel, March 2002. Basslink Joint Advisory Panel, June 2002. Minister for Planning, September 2002).

Portland Wind Energy Farm

The Portland Wind Energy Farm provides significant benefits from both an economic and environmental perspective. However, it was still reduced in size as a result of decisions made by the Minister for Planning at the conclusion of the environmental assessment process, due to the elimination of wind turbines from the tip of Cape Bridgewater because of their unacceptable landscape impacts. In addition, the proponent offered underground cables located in access roads, coupled with location of roads and cables to avoid native vegetation, thereby minimising and avoiding impacts on remnant native vegetation in the area. (Minister for Planning, August 2002).

Policy and planning guidelines for the development of wind energy facilities in Victoria

During the assessment of the Portland Wind Energy Farm and other wind energy farms in Victoria, the issue of a requirement for the State government to formulate policy to guide the acceptable development of individual projects arose.

The purpose of the guidelines is to outline how the Victorian government will facilitate the appropriate development of wind energy facilities (turbines and

associated cabling to connect the turbines to the electricity grid), balancing environmental, social and economic outcomes.

The policy clearly states that although wind energy projects provide broad benefits, including environmental benefits, such as meeting renewable energy targets and reducing greenhouse gas emissions, they can have significant environmental impacts in critical areas and on local and cultural values.

In recognition of this, wind energy developments and associated infrastructure such as transmission lines are excluded from land reserved under the *National Parks Act (1975)*. This position excludes wind energy development from approximately 43% of the Victorian coastline and from approximately 32% of the area within 1km of the coast. (Sustainable Energy Authority, 2002). This position illustrates the government's commitment to protection of sensitive environmental and cultural values, despite broad benefits to be gained from specific proposals.

Nirranda Wind Farm Project

The Minister for Planning has determined that an environment effects statement is required for the Nirranda Wind Farm Project. The guidelines to be addressed in the preparation of the impact statement require a description and evaluation of the impacts of all facilities including associated transmission lines and upgrades of existing transmission infrastructure. (Minister for Planning, June 2002)

Beenup Mineral Sands Mine

The State Energy Commission (SEC) in Western Australia proposed a 132kV transmission line to connect the Beenup Mineral Sands Mine to the Manjimup substation. The transmission line route proposed crossed high value Karri forest. The Environment Protection Authority accepted this route on the basis that 6.2km through the Karri forest would be placed underground to protect the forest's conservation values (Environment Protection Authority, 1991). The SEC responded by finding an alternative route that did not impact on the high conservation value Karri Forest.

Brunswick to Richmond Transmission Line

A 220 kV transmission line was proposed between Brunswick and Richmond to provide an alternative supply to the Richmond terminal station. It was originally determined (in the late 1970s) that an environmental impact statement would not be required for the new line as it was sited on land with an accustomed use for transmission lines. However, the announcement of the proposal caused considerable public opposition. The proposal was then referred to a committee to be in the early 1980s for review in the context of the whole basis of electricity supply to Melbourne. At this stage, opposition was expressed to the alignment of the transmission line being located in the river and creek valley environments, and requests were made for the use of undergrounding cables instead. The review committee concluded that the environmental impacts were not significant enough to warrant the much higher cost for underground cable. However, they did recommend that the line proceed as an overhead line on poles, rather than towers, with a 1km underground section buried under suburban streets to avoid an area assessed as the most environmentally sensitive.

As a result of the assessed environmental sensitivity, the Victorian Government determined in early 1985 that an environmental impact statement would be required for the project. In 1987, despite community opposition, a fully overhead line was approved. Construction of the line commenced in early 1988 and was strongly opposed by members of the public. Following conflict between public protestors and the police, the government ordered that work on the line be stopped. The transmission line proposal was then required to undergo further assessment. At the conclusion of this review, the transmission line was deemed to be an inappropriate development in the river and valley, and was required to be constructed as an underground cable mainly along major roads. (Wallace & Strong, 1991)

Murraylink

Murraylink is an interconnector between South Australia and Victoria. Following initial assessment of the social and natural environment of the area, community issues, and likely approval requirements (as outlined in the Murraylink Scoping Report, 1999), the owners of Murraylink chose to underground the line as a means of mitigating the potential environmental impacts and community opposition. This approach was instrumental in influencing the decision in both Victoria and South Australia that an environmental impact statement would not be required for the project. This reduced the approval process in each State significantly, and therefore time taken to reach and undertake construction of the project.

All of the examples given clearly show that energy projects are generally required to undergo a rigorous environmental approval process, and that governments balance the environmental and social impacts against the economic benefits of the project in deciding what is environmentally and socially acceptable. The examples also demonstrate that the environmental assessment and decision making process can be and is, instrumental in requiring design and route changes to address environmental and social issues.

3 Murraylink Alternative 1

3.1 THE ROUTE

Alternative 1 as proposed traverses a route from Buronga in New South Wales to the Monash Substation in South Australia. This route is similar to that proposed by TransGrid for the South Australia-New South Wales interconnector, known as the SNI proposal.

3.2 KEY ENVIRONMENTAL AND SOCIAL ISSUES FOR ALTERNATIVE 1

The route for Alternative 1 (and SNI) crosses the Bookmark Biosphere Reserve in South Australia, and also extends along the northern boundary of a Ramsar wetland contained in the Reserve. This is the Chowlla Floodplain and Anabranch system, known as the Riverland Wetlands.

Biosphere Reserves are an international entity under the United Nations Educational, Scientific and Cultural Organisation (UNESCO), Man and the Biosphere Program. The international network of biosphere reserves was originally implemented by UNESCO to protect the world's major ecological units. Australia has thirteen Biosphere Reserves, one of which is the Bookmark Biosphere Reserve. The Bookmark Biosphere Reserve was first designated in 1977, and extended in 1995. It covers an area of 900,000 hectares (Environment Australia website). It is made up of several different land tenures including conservation reserves, game and forestry reserves, pastoral leases and private land. The Riverland communities play an active role in the management of the Biosphere Reserve (Brunckhorst, 1999).

As summarised on Environment Australia's website, Ramsar wetlands are sites that are recognised under the Convention of Wetlands of International Importance (the Ramsar Convention) as being of international significance in terms of ecology, botany, zoology, limnology or hydrology. Any Australian wetland, or part of a wetland, that has been nominated by the Commonwealth under the Ramsar Convention for inclusion in the List of Wetlands of International Importance is automatically a declared Ramsar wetland, and is therefore, protected by the *Environment Protection and Biodiversity Conservation (EPBC) Act.* Australia has 63 Ramsar wetlands, including the Riverland Wetlands in the vicinity of Alternative 1 (and SNI).

Under the *EPBC Act*, actions that will, or are likely to have a significant impact on any matter of national environmental significance, are regulated. This means that such actions will be subject to a rigorous environmental assessment and approval regime under the *EPBC Act.*

It should be noted that actions that are taken in contravention of the EPBC Act may attract a civil penalty of up to $5.5 million, or a criminal penalty of up to $46,200 or, in extreme cases, up to seven years' imprisonment.

3.3 THE NEED FOR ENVIRONMENTAL ASSESSMENT AND POSSIBLE UNDERGROUNDING

A route such as that proposed in Alternative 1 would require assessment under the *EPBC Act* because its development would potentially affect three matters of environmental significance:

- Ramsar wetlands of international significance (including relevant actions that occur outside the boundaries of a Ramsar wetland);
- listed threatened species and ecological communities; and
- listed migratory species (Environment Australia, 2000).

The *EPBC Act* assessment and approval provisions also apply to actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land). Calpernum Station, which is crossed by Alternative 1 was purchased by the Commonwealth government in partnership with the Chicago Zoological Society in 1993, and leased to the Director of National Parks. It forms part of the Bookmark Biosphere Reserve.

Due to the potential environmental impacts associated with the development of the transmission line, the proposal would also be formally assessed under the relevant South Australian and New South Wales environmental assessment procedures. This is evidenced by the fact that the Commonwealth, South Australian, and New South Wales governments have all required TransGrid to prepare an Environmental Impact Statement (EIS) to support the SNI proposal. The Commonwealth's and States' guidelines for the preparation of the SNI EIS are 37 pages long in total, plus attachments, and show the level of detail and information required to be addressed by the EIS (Major Developments Panel South Australia, 2002. Department of Planning NSW. Environment Australia, 2001). Alternative 1 would likely attract similar guidelines, given the similar nature of the route.

It is our understanding from comments received during consultation undertaken for the Murraylink project that there were significant objections to the route of the transmission line through the Bookmark Biosphere Reserve, and because of the visual, perceived health (EMF), and property management issues associated with the development of an overhead transmission line.

The SNI EIS does not propose any undergrounding of the transmission line as a management measure to minimise impacts. However, Environment Australia has not yet accepted the final EIS for the SNI proposal because environmental management issues have not been satisfactorily addressed at this point in time (Pers. Comm. Environment Australia, 14 February 2003). Until Environment Australia accepts the final EIS for SNI, the assessment of this project will not proceed at the Commonwealth level. It is possible that if this project gains environmental and planning approvals at the completion of the assessment process, it may be required to utilise tactical undergrounding to manage issues associated with the Bookmark Biosphere Reserve and the Ramsar wetland.

This view is based on direct experience and on the outcomes of recent assessments (e.g. Basslink) as described in Section 2 of this report. That is, if the environmental management objective is strongly held, then decision makers are likely to determine either that some undergrounding of transmission lines should be undertaken, or that the transmission line route should be altered to protect the environmental values identified.

Based on this, it would not be unreasonable to assume that regulatory approvals for Alternative 1 would include a requirement for tactical undergrounding of the transmission line past the Ramsar wetland within the Bookmark Biosphere Reserve in South Australia, a distance of approximately 30km. Ramsar wetlands, migratory species, nationally threatened species and ecological communities are all matters of national environmental significance under the *EPBC Act* (Environment Australia, 2000). These are strong environmental values which would provide sufficient impetus for decision-makers to view tactical undergrounding as a reasonable measure to achieve environmental management objectives, despite the increased capital cost. This level of undergrounding would be insufficient to address wider social and environmental issues such as fragmentation of reserves, impacts on farming, and the visual impact on commercial tourism activities in the reserve. The transmission line would need to be undergrounded for approximately 60 km in total to address these issues.

4 Murraylink Alternatives 2 & 3

4.1 THE ROUTE

Alternatives 2 and 3 traverse a route from Red Cliffs in Victoria to the Monash substation in South Australia. This route is similar to the existing Murraylink transmission line route which has already been constructed and is operating as an underground transmission line.

The route crosses the horticultural communities of Red Cliffs (Victoria) and Lyrup (South Australia), the Murray Sunset National Park (Victoria), Lyrup Flats – part of the Bookmark Biosphere Reserve (South Australia), and the Murray River (South Australia).

4.2 KEY ENVIRONMENTAL AND SOCIAL ISSUES FOR ALTERNATIVES 2 AND 3

Red Cliffs is a highly developed irrigated horticultural district that grows mostly grapes and citrus fruits. Lyrup is also a horticultural district. Both of these areas are irrigated to a large extent by overhead sprinkler systems. The remainder of the route crosses broad acre agricultural and pastoral land, with the exception of the Murray Sunset National Park and the Lyrup Flats in South Australia, the latter now being part of the Bookmark Biosphere Reserve.

The Murraylink project is a directly relevant example of the type of community and environmental issues that would likely be encountered for both Alternatives 2 and 3.

A scoping study and consultation program to identify all key issues, key stakeholder concerns, preliminary routes, and likely approval requirements was undertaken at the start of the Murraylink project. The outcomes of this study were provided to TransEnergie Australia Pty Ltd in a scoping report (*Murraylink Scoping Report*, 1999). The key issues identified related to:

- minimising clearance of native vegetation and consequential impacts on fauna habitats
- impact on landscape;
- impact on cultural and heritage values; and
- impacts on existing and/or proposed conservation reserves.

It was clear at the start of the Murraylink project that the type of environmental and planning assessment required would depend on the route of the transmission line and whether it would be developed as an overhead or underground line. The location and development of the converter/substations at each end also raised issues of noise and visual impacts. The majority of government departments, community groups, and

individuals consulted were initially confused about the difference between the TransGrid (SNI) proposal and the TransEnergie (Murraylink) proposal. Many meetings required an initial discussion to explain that Murraylink was a different proposal, following a different route (road and rail reserves), using a different technology. Also, many of the farmers along the potential route had recently experienced the installation of a pipeline through their property, and were not happy about either the location of the pipeline, the method of construction, or financial compensation received. As such, many farmers strongly expressed their opposition to the location of further infrastructure on their land. Once it was established that the transmission line would be constructed underground in road and rail reserves, many of the community concerns regarding impact on their properties, farm management practices, and visual and health issues were allayed.

Environmental and planning assessment requirements were negotiated in Victoria and South Australia with the relevant Ministers and government agencies, receiving written confirmation that an EIS/EES would not be required, mostly because the transmission line would be constructed underground, and the Ministers' confidence that environmental and planning issues could be adequately addressed at a lower level of assessment, given the lower level of impact associated with an underground transmission line. In South Australia, this assessment remained at the State and local government level, and in Victoria, permits were to be issued by local government on the advice of relevant State government agencies.

A detailed Application Report (127 pages plus appendices and maps) was prepared to accompany the separate planning and environmental approval requirements in each State (*Murraylink Application Report*, 2000). Not withstanding the detailed nature of the information contained in the Application Report, in a letter dated 10 April, 2000 the Department of Natural Resources and Environment requested that further information be provided with regard to location of the transmission line within road carriageways or on private land, and more detailed information on proposed vegetation clearance. Extra detail was subsequently provided by Kinhill (now KBR), in a response letter dated 19 May 2000. This demonstrates that although Murraylink was being designed as a completely underground transmission line within a construction corridor limited to 4m in width (as opposed to an overhead transmission line easement width of approximately 55m), the statutory authority responsible for advising on the environmental acceptability of the required vegetation clearance was reluctant to provide support until it was satisfied that the proponent had offered every possible measure of minimising environmental impacts. In addition to written information provided, a number of field inspections and meetings were held with Department representatives to discuss and address ongoing issues of concern.

Despite the general community's acceptance of the underground transmission line, the residents of Red Cliffs in the vicinity of the proposed converter station opposed Murraylink due to concerns about noise and visual impact of the converter station. Mildura Rural City Council refused to grant planning permits for the project although the decision was overturned on appeal by TransEnergie to Victorian Civil and Administrative Appeals Tribunal.

4.3 THE NEED FOR ENVIRONMENTAL ASSESSMENT AND POSSIBLE UNDERGROUNDING

An overhead transmission line along the route proposed by Alternatives 2 and 3 is likely to attract rigorous environmental assessment under both State and Commonwealth processes due to the types of issues discussed in Section 2 of this report. These issues include community and environmental concerns.

Given the objections raised by members of the Red Cliffs and Lyrup communities to the SNI and Murraylink proposals (the latter at least in the early scoping stage), it is highly probable that undergrounding the transmission line through these developed areas would be required to avoid significant community opposition, and therefore, potential refusal of approval to construct and operate the project. Community opposition to an overhead transmission line would be based on visual impacts, perceived health impacts, and impacts on farm management practices such as irrigation and harvesting techniques. This could result in undergrounding of approximately 25km of the route.

It is highly likely that the broad acre farmers along the remainder of the route would not support the proposal, but given the experience of Basslink, the relevant Ministers may be willing to disregard this, particularly considering that a route crossing the broad acre agricultural land will assist in keeping clearance of native vegetation to a minimum. This is of particular relevance in this region given that there is only approximately 5% of native vegetation remaining.

The remaining key issues for Alternatives 2 and 3 would be the crossing of the Sunset National Park, the Murray River and the Lyrup Forest Reserve. Once again, based on experience with the Murraylink assessment, consent to access National Parks would be required. This is a two step process administered by the Department of Sustainability and Environment (formerly the Department of Natural Resources and Environment). If the transmission line is considered to have substantial effect, approval is required form the Governor in Council. Re-routing of the transmission line to avoid the National Park is not an option given the size and location of the park. The only management measure available, if an overhead transmission line is deemed to be unacceptable due to environmental impacts, is to underground the transmission line through the National Park. This would require approximately a further 15 km of undergrounding.

The Lyrup Forest Reserve is a major fauna habitat in South Australia. Its proximity to the Murray River adds to its value as fauna habitat. The value of this area as a wildlife habitat is further increased by factors such as its generally intact nature, diversity of available habitat, and the ecotone at the margins of vegetation communities usually supports a more diverse fauna than surrounding vegetation communities. The South Australian National Parks and Wildlife Service required that Murraylink minimise the impact of habitat fragmentation and vegetation clearance within this reserve. This was achieved through appropriate route selection and undergrounding of the transmission line.

An overhead transmission line across the Murray River and the Lyrup Forest Reserve would likely trigger a number of environmental issues under the *EPBC Act* (Ramsar wetlands, listed threatened species and ecological communities, and listed migratory species). Our advice on the undergrounding distance through Lyrup includes an

allowance for undergrounding across the Lyrup Forest Reserve (part of Bookmark Biosphere) and the Murray River.

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Attention: Stephane Mailhot
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MURRAYLINK COMMENTS ON ACCC APPLICATION OF THE REGULATORY TEST FINAL REPORT

Dear Stephane

Burns and Roe Worley Pty Ltd (BRW) has reviewed Saha Energy International Limited's (SEIL) "Final Report to the ACCC: Review of Murraylink Transmission Company Pty Ltd's (MTC) Application of the Regulatory Test" dated February 2003. A number of the issues in relation to the Alternative Projects and BRW's report have been the subject of discussion with the ACCC and Saha Energy International (SEIL) with subsequent clarifications having been submitted to the ACCC. The final report does not reflect acceptance of the clarification of particular issues raised by SEIL through questions and discussions.

Section 3.4.5 Conclusions on BRW's selection of alternative projects

Section 3.4.5 (last paragraph) questions that Alternative 4 should be considered as an alternative to Murraylink. BRW's report acknowledged that Alternative 4 was not a close equivalent and BRW's response to the ACCC on the SEIL draft report is restated below:

> ***"Section 3.4.5, last paragraph and Executive Summary***
>
> *BRW advises MTC that the rationale for including alternative 4 was that it achieves the same technical services as detailed in section 3.1.2 of BRW's report Murraylink – Selection and Assessment of Alternatives by which all alternatives were selected and assessed.*
>
> *SEIL suggested that Alternative 4 should not be considered because it "....does not provide a direct linkage between the South Australian and NSW market regions." However, BRW points out that Murraylink, and Alternatives 2 and 3 all connect the Victorian and South Australian market regions. Only Alternative 1 connects the NSW and South Australian regions.*

BRW readily acknowledges that Alternative 4 possesses some characteristics that are significantly different to the other options. This is stated in section 4.6.2 of the BRW report, namely that Alternative 4 "...is not a close equivalent because it is subject to differing constraints and cannot provide voltage support to the south-west NSW system." In effect, SEIL is agreeing with BRW's statement"

This response appears not to have been considered or has been rejected by SEIL. As pointed out in BRW's original response, SEIL's statement regarding the direct linkage between the South Australia and New South Wales energy markets is also incorrect.

SEIL has also questioned the need and extent of undergrounding and it is understood that Kellog Brown Root will be responding directly to MTC on this matter.

Section 3.5.4 Conclusions on the base cost estimates

Section 3.5.4 (last paragraph, page 59) indicates that "most of the sources of the costs of laying underground cables appear to be confidential". BRW indicated in its presentation and subsequent discussions that these estimates had been obtained from direct discussion with a cable supplier. The estimates were provided on a planning basis from Olex cables and the company's experience on other projects, the source of these estimates is not confidential.

Section 3.5.5 Contingency and treatment of risk

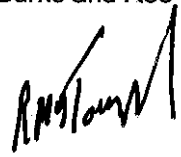
The issue of contingency levels and the use of a P75 versus a P50 cost estimate has been the subject of a number of discussions with ACCC and SEIL leading to further clarification by BRW through MTC. SEIL's final report indicates that "the P75 cost estimate is on overly conservative basis for valuation".

BRW has sought the formal opinion of Dr. Patrick Tuohey on the issue of the appropriate level of contingency for the project cost estimates. Dr. Tuohey is the Director of Risk Management for Worley Limited and an acknowledged specialist in the area of commercial and business risk management relating to major projects. His conclusion is as follows:

"The use of the P75 contingency levels is consistent with both known industry practice, and with the contingency level which would have been applied if a deterministic methodology had been used. If anything, the levels of contingency derived at the P75 level are considered to be quite lean. The P50 contingency levels are significantly lower than would be expected by any realistic approach to this issue, and are rejected on that basis."

A copy of his opinion has been attached.

Yours sincerely
Burns and Roe Worley



R McD Touzel
General Manager, Consulting

Att:

Worley

MURRAYLINK TRANSMISSION COMPANY

DETERMINATION OF CONTINGENCY IN CAPITAL COST ESTIMATES FOR MAJOR RESOURCE INDUSTRY PROJECTS

By

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27 February 2003

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CONTENTS

1. INTRODUCTION

The purpose of this note is to clarify the philosophy behind the application of contingency to a capital cost estimate. A project capital estimate always needs to have a contingency applied to the base estimate to allow for items such as the uncertainties in the level of definition of the engineering scope at the time of estimating, omissions from the estimate, exchange rate uncertainties, etc. The contingencies are therefore real cost elements, albeit for *unspecified* scope. Contingency is never used as comprehensive cover for each and every uncertainty, or as insurance against *force majeure* risk.

This note looks at the methods for determining contingency commonly used by cost estimating professionals, and seeks to provide a sanity check for the appropriate level of contingency which should be applied for the Murraylink Project.

2. DETERMINISTIC COST ESTIMATES

The traditional method for the development of a capital cost estimate for a major resource industry project has been by the use of deterministic cost estimating techniques. Under this methodology, the estimator creates the base estimate from his known engineering scope at the time of estimate, and then adds contingencies in a deterministic manner. Generally, the estimator adds what is considered reasonable by him, based on heuristics built up over many years and over many projects, and by general corporate policies.

A review of the estimating philosophies of a number of major international resource industry operating and contracting companies and of publications of the foremost professional body, the Association for the Advancement of Cost Engineering International (AACEI), (*formerly the American Association of Cost Engineers*) can be summarised in the levels of an estimate for major resource industry developments as follows:

Estimate Level	Estimate Class	Estimate Accuracy Range (typical)	Estimate Contingency (typical)
1	Screening	-40% to +40%	15 to 25%
2	Study	-25% to +25%	10 to 15%
3	Budget	-15% to +15%	8 to 12%
4	Control	-10% to +10%	4 to 6%

The level of definition of the scope of the Murraylink Project is somewhere between that of a Level 1, Screening Class Estimate and a Level 2, Study Class Estimate. A reasonable contingency level using a traditional, deterministic estimating approach would be 10% to 15% of the base estimate.

3. PROBABILISTIC COST ESTIMATES

The rising availability of readily accessible Monte Carlo computing engines over recent years has lead to increased use of risk based uncertainty analysis, particularly in the estimating of capital costs.

In simple terms, the probabilistic approach is to estimate a range (low and high estimates) around the base estimate for key project cost items and for project risk factors known to be applicable from previous project experience, producing a 3-point estimate (low, medium, high), instead of the single point estimates implicit in the traditional deterministic approach. These 3-point estimates are then "added", using the Monte Carlo simulation technique to produce a probabilistic outcome for the capital cost.

The calculated contingencies at the P50 and P75 levels from the probabilistic cost estimates for the 3 alternative projects can be summarised as follows:

	Alternative 1	***Alternative 2***	***Alternative 3***
P50 Contingency	2.1%	3.5%	3.7%
P75 Contingency	4.4%	8.5%	6.5%

4. SANITY CHECK

The deterministic contingency for this project would be in the range of 10% to 15%. The application of the probabilistic approach is known to have the tendency to reduce the contingencies somewhat, but the P50 contingencies (2.1%, 3.5% and 3.7%) are unacceptably low. The P75 contingencies (4.4%, 8.5% and 6.5%) are also significantly lower than the deterministic heuristics would suggest, but definitely represent a more realistic level.

5. A PRUDENT DEVELOPER

What level of contingency would a prudent developer choose in establishing its capital estimate for this project?

As has been argued previously, a prudent developer would seek lump sum turnkey prices from competent Engineer/Procure/Construct (EPC) contractors. Most Australian-based EPC contractors continue to use the deterministic methodology for contingency determination, in which case a 10% to 15% contingency would apply. More advanced contractors have started to use the probabilistic approach, and they are known to price projects at probability levels from P75 to P90.

6. PORTFOLIO OF PROJECTS

An argument which suggests that a P50 level of contingency determination is the appropriate level because, with a portfolio of projects, the mean would tend to this number ignores the fact that there is not a portfolio of projects to balance out the risk. There is a single project only, and it is unreasonable to expect a single project to carry such little risk contingency.

7. CONCLUSION

The use of the P75 contingency levels is consistent with both known industry practice, and with the contingency level which would have been applied if a deterministic methodology had been used. If anything, the levels of contingency derived at the P75 level are considered to be quite lean. The P50 contingency levels are significantly lower than would be expected by any realistic approach to this issue, and are rejected on that basis.