APPLICATION OF RIT-T TO MULTI-CONNECTION TERMINAL STATIONS (VICTORIA)

PREPARED BY: Planning

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This document accompanies AEMO's Cost Allocation Policy for Victorian Terminal Stations – Prescribed Transmission Services, and explains how AEMO intends to apply the Regulatory Investment Test for Transmission (RIT-T) to terminal station development or expansion costs that are to be recovered through charges relating to prescribed transmission services. It illustrates how the RIT-T (or cost-benefit analysis for works <$5M) is incorporated into the Victorian connection process.

Version Release History

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1 Purpose

This paper sets out how the Regulatory Investment Test for Transmission (RIT-T) would be applied to assess the merits of different generation connection options. It accompanies AEMO's Cost Allocation Policy for Victorian Terminal Stations – Prescribed Transmission Services, which explains how AEMO may allocate shared network costs relating to terminal stations between negotiated transmission services (provided to generation connection applicants (applicants) and transmission network connecting to the same terminal station on the Victorian Declared Shared Network (DSN).

The two generation connection options under assessment are:

- Base case or "do nothing" option: Multiple terminal stations in the same area, each accommodating a single standalone generation connection.
- Alternative option: One multi-connection terminal station, constructed initially to accommodate one or more connections with provision for future expansion to accommodate additional generation connections and, if necessary to meet capacity requirements, connection of multiple transmission circuits.

2 Methodology

2.1 Applying the RIT-T to multi-connection terminal stations

The RIT-T is applied (where required by the NER) to find out which of the two above generation connection options would provide the greatest net benefit to the National Electricity Market (NEM). The AER's RIT-T Guidelines outline the example of when a Transmission Network Service Provider (TNSP) may find it efficient to configure connection assets in such a way as to allow them to be easily augmented in the future should additional demand for connections arise, so this application of the RIT-T is already accepted.

However, the RIT-T cannot be used to determine what proportion of the generation connection costs should be recovered through charges for negotiated or prescribed transmission services. The RIT-T is indifferent to who is paying costs or providing benefits (that is, the TNSP or applicant) – all costs are assumed to be passed through to the end-user.

Because the RIT-T can give no guidance on how the total costs of connecting generating plant at a terminal station should be allocated, this decision needs to be made outside the RIT-T framework.

However, it should be noted that a RIT-T comparing generation connection options should not be used to subsidise a generation connection or, in other words, make a generating plant commercially-viable if it would not otherwise have been. If an option assessed in the RIT-T is changing the commercial decision of an applicant, then the RIT-T moves into justifying the generating plant itself. This is not the intended function of the RIT-T.

At a high level, this would mean that if an applicant was prepared to pay $X for an individual connection at its preferred location, the RIT-T should only be used to justify costs over and above $X. However, because the premise of a multi-connection terminal station is that it is less expensive overall than individual connections, by definition the total amount paid by the connecting applicants will be less at the multi-connection terminal station – on a probability-weighted basis.

A further difference under the multi-connection terminal station option is the relative cost associated with connection of successive applicants. The cost of establishing a new terminal station and connection of the first applicant may be greater under the multi-connection option while the works associated with connecting subsequent applicants may cost less than under the individual connection option.

AEMO's Cost Allocation Policy for Victorian Terminal Stations – Negotiated Transmission Services addresses the disadvantage otherwise faced by the first applicant by establishing how the overall

cost of connection will be shared between the first applicant and subsequent applicants. However, the occurrence and timing of subsequent connections is inherently uncertain. The first applicant has no incentive to shoulder any costs above that of a standalone connection because it will not receive the same benefits as the market overall would receive if subsequent applicants do connect at the same terminal station.

The RIT-T provides a framework for a TNSP to value the opportunities and risks associated with different connection options and to make the appropriate investment for the overall NEM. The RIT-T then enables the establishment of an economically-efficient terminal station without requiring connecting applicants to bear additional risk for which they will not receive commensurate benefits.

The RIT-T example that follows assumes that the TNSP proposes to make a transmission investment equivalent to:

- Any additional costs incurred up front to enable future expansion of the terminal station to allow for anticipated future connections
- The costs involved to correctly locate the terminal station over and above what the first applicant would pay to connect at its preferred location with an individual connection.

This means that if the first applicant pays $X to connect at its preferred location with an individual standalone connection, it will still pay $X to connect at the multi-connection terminal station. Any additional costs to establish the terminal station will be attributable to the provision of shared transmission services which are prescribed rather than negotiated, and may be recovered through prescribed transmission service charges subject to the RIT-T.

Subsequent applicants will then pay to connect at the terminal station, including the costs required to relocate to the terminal station and their share of the negotiated service component of establishing the terminal station.

The advantages of this approach are:

- As long as the terminal station is correctly located, the maximum any applicant will pay to connect at the terminal station is the amount they would have paid to connect with an individual connection at their preferred location.
- Each applicant will pay a share of the negotiated service component of the terminal station establishment costs in accordance with AEMO's Cost Allocation Policy so there is no first-mover disadvantage.
- Each applicant will have an incentive to locate as close to the terminal station as possible to reduce their connection costs.

2.2 Applying the RIT-T - worked example

The purpose of the RIT-T, as set out at clause 5.6.5 B (b) of the NER, is to identify the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market. Attachment 1 provides an example of how the costs would be allocated between three connecting applicants, as in Scenario 1 below.

The AER's RIT-T Guidelines describe the steps involved in applying the RIT-T as follows:

Step 1: Identify a need for the investment (known as the identified need)

The guidelines state that an identified need may consist of "an increase in the sum of consumer and producer surplus in the NEM". The guidelines note that, in describing an identified need, a TNSP may find it useful to explain what will or may happen if the TNSP fails to take any action.

In this case, the identified need relates to increasing the sum of the consumer and producer surplus in the NEM by facilitating economically efficient connections at a terminal station. If the TNSP did not take any action, the risk is that a series of dedicated individual connections will be required at an increased overall cost to the NEM.

Step 2: Identify the base case and a set of credible options to address the identified need

The base case is the “do nothing” scenario where each generating plant will have a dedicated individual connection. The alternative option is an investment in enabling provision of additional capacity at a terminal station in the future so that multiple generating plant may connect.

Step 3: Identify a set of reasonable scenarios that are appropriate to the credible options under consideration

The market benefit of a credible option is obtained by:

i. Comparing for each reasonable scenario:
   a. The state of the world with the credible option in place, with
   b. The state of the world in the base case.

ii. Weighting any positive or negative benefit derived in (i) by the probability of each reasonable scenario occurring.

A reasonable scenario consists of a set of variables or parameters that are not expected to change across each of the relevant credible options or the base case. The RIT-T states that the number and choice of reasonable scenarios must be appropriate to the credible options under consideration. The choice of reasonable scenarios must reflect any variables or parameters that are likely to:

- Impact the ranking of credible options, or
- Change the sign of the net economic benefits of any of the credible options.

The critical variable in this application of the RIT-T is the assumed timing and probability of anticipated generation projects proceeding.

In this example, we assume three applicants are interested in connecting in the vicinity of the proposed terminal station. The first connection is committed, while the other two are at different stages in the planning process, as shown in Table 1. This example has used the number of commitment criteria met by each generation project to determine the probability of committing for illustrative purposes only.

For a RIT-T application, the following criteria would be analysed to determine probabilities of commitment:

- Number of generation enquires and connection applications.
- Concentration of energy resource around the location – wind resource, access to gas pipelines, etc.
- Accessibility for construction and availability of suitable transport infrastructure.
- Ability to mitigate environmental impacts and planning permit overlays around the location.
- Availability of land for line easements or terminal stations.

Table 1 Generation Commitment Status

Generating Plant Connection	Stage of Process	Assumed year of commitment	Probability of commitment
G1	Committed (5 out of 5 criteria met)	Year n	100%
G2	Planned (3 out of 5 criteria met)	Year n+ 3	60%
G3	Possible due to resource in area (0 out of 5 criteria met)	Year n + 8	10%

Table 2 shows the reasonable scenarios considered, and the probability of each scenario occurring, based on the probabilities shown in Table 1.

Table 2 Reasonable Scenarios

Scenario	Description	Probability
Scenario 1	All 3 applicants commit	6%
Scenario 2	G1 and G2 commit	54%
Scenario 3	G1 and G3 commit	4%
Scenario 4	Only G1	36%

For a RIT-T application, it is likely that the set of reasonable scenarios would also include scenarios where applicants commit to the connection, but a year or two later than proposed – again, past history of connection applications could be used to inform the likely probabilities. Sensitivities on discount rates and capital costs would also be included.

Step 4: Quantify the expected costs of each credible option

The costs in a RIT-T are defined as the present value of the direct costs of a credible option. The direct costs include the:

- Costs incurred in constructing or providing the option.
- The operating and maintenance costs in respect of the operating life of the credible option.
- The costs of complying with any mandatory requirements in relevant laws, regulations and administrative requirements.

It is necessary to define “the option” before calculating the direct costs. The identified need under this RIT-T is to connect multiple generating plant in an economically efficient way, and to do this requires:

- Correct sizing of connection and shared network assets at the terminal station.
- Correct location of the terminal station.

Given that the identified need of this RIT-T is not a need to supply additional generation capacity, the RIT-T should not be used to justify any costs an applicant would pay to connect without the terminal station.

The option and the direct costs will therefore consist of only the difference between the works required to connect the first applicant at its preferred location and the works required to establish the terminal station. This difference in costs will be allocated to prescribed transmission services and subtracted from the costs of establishing the terminal station.

The remaining non-prescribed costs of establishing the terminal station will be shared between future connecting applicants under the standard cost allocation policy.

The capital cost estimates assumed for this RIT-T example are shown in Table 3.

Table 3 Capital cost assumptions

Works	Cost ($M) in year n dollars	Comment
Dedicated connection (per generating plant)	100	eg. cut into a line to create a terminal station at generator's preferred location and sized to the generator's needs
Connection at multi-connection terminal station (per generating plant)	10	eg. connecting at existing multi-connection terminal station
Costs per km to get to multi-connection terminal station	1	eg. for line to get from applicant's preferred location to multi-connection terminal station location
Upfront work at time of first connection to create multi-connection terminal station	10	eg. additional land and works to allow for correct sizing of multi-connection terminal station

The connection assumptions for this example are shown in Table 4 .

Table 4 Connection data

Generator	Assumed year of commitment	Distance from multi-connection terminal station (km)
G1	Year n	10
G2	Year n+3	20
G3	Year n+8	40

The direct costs are the difference between what the applicant would pay to connect at its preferred location and the total costs to establish the multi-connection terminal station as shown in Table 7.

Table 5 Direct costs

G1 costs for Individual connection	Multi-connection terminal station connection	Direct costs $M (in year n dollars)
$100	$100 + $10 + 10 * $1	20

Step 5: Quantify the expected market benefits of each credible option – calculated over a probability weighted range of reasonable scenarios

The total benefit of a credible option includes the changes in consumer and producer surplus, noting that these benefits can be both positive and negative. The RIT-T requires that all classes of market benefits must be considered as material unless:

- Reasons can be provided as to why a particular class of market benefit is not likely to materially affect the outcome of the assessment of the credible options, or
- The estimated costs of undertaking the analysis to quantify the market benefit is likely to be disproportionate to the scale, size and potential benefits of each credible option being considered.

Table 6 shows the classes of market benefits under the RIT-T and their inclusion in this application of the RIT-T to assess a multi-connection terminal station.

Table 6 Classes of market benefits

Class of benefit	Inclusion	Reason for exclusion
Generation dispatch costs	Excluded	Computationally intensive, likely to be minor (assume construction outages at off-peak times and both connection options designed to similar reliability levels)
Voluntary load curtailment	Excluded	Computationally intensive, likely to be minor (assume construction outages at off-peak times and both connection options designed to similar reliability levels)
Involuntary load shedding	Excluded	Computationally intensive, likely to be minor (assume construction outages at off-peak times and both connection options designed to similar reliability levels)
Changes in cost for parties other than the TNSP due to differences in timing of new plant, capital costs, and operational and maintenance costs	Included	
Differences in timing of transmission investments	Included	
Changes in network losses	Excluded	Computationally intensive, likely to be minor
Changes in ancillary services costs	Excluded	Computationally intensive, likely to be minor
Competition benefits	Excluded	No impact (no changes in generation projects)
Additional option value	Excluded	Weighted scenario approach already valuing option value
Renewable energy target penalty	Excluded	No impact (no changes in generation projects)

The market benefits under the multi-connection terminal station RIT-T consist of differences in costs for parties other than the TNSP, due to differences in capital costs and timing of transmission investments.

For each reasonable state of the world these two categories of costs are then calculated in the state of the world without the option (the base case) and the state of the world with the option in place.

Table 7 shows the calculations of these costs under each of the reasonable scenarios.

Table 7 Market Benefit calculations

Scenario	Base case (dedicated connections)	Credible option (multi-connection terminal station connection)
Scenario 1	$100 (year n) + $100 (year n+3) + $100 (year n+8)	$100 (year n) + $10 + 20 * $1 (year n+3) + $10 + 40 * $1 (year n+8)
Scenario 2	$100(year n) + $100 (year n+3)	$100 (year n) + $10 + 20 * $1 (year n+3)
Scenario 3	$100 (year n) + $100 (year n+8)	$100 (year n) + $10 + 40 * $1 (year n+8)
Scenario 4	$100 (year n)	$100 (year n)

Table 8 shows the present value of the gross market benefits for each reasonable scenario using a 10% discount rate.

Table 8 Market Benefits (all $ in year n dollars)

Scenario	Scenario Description	Probability of scenario	Base case costs $M	Credible option costs $M	Gross Market benefits $M
Scenario 1	All 3 generating plant	6%	267.3	166.3	101.1
Scenario 2	G1 and G2	54%	187.1	126.1	60.9
Scenario 3	G1 and G3	4%	180.3	140.1	40.1
Scenario 4	G1 only	36%	100.0	100.0	0.0
Probability weighted			160.3	119.7	40.6

Step 6: Quantify the expected net economic benefit of each credible option and identify the preferred options as the credible option with the highest expected net economic benefit

Table 9 shows the net market benefits for each reasonable scenario, which is the market benefit of the credible option minus the direct cost of providing that option.

Table 9 Net market benefits

Scenario	Scenario Description	Probability of scenario	Direct cost ($M)	Gross Market benefits ($M)	Net Market benefits ($M)
Scenario 1	All 3 generating plant	6%	20.0	101.1	81.1
Scenario 2	G1 and G2	54%	20.0	60.9	40.9
Scenario 3	G1 and G3	4%	20.0	40.1	20.1
Scenario 4	G1 only	36%	20.0	0.0	-20.0
Probability weighted			20.0	40.6	20.6

The probability weighted net benefits are $20.6 M and the preferred option is the multi-connection terminal station.

3 RIT-T process

The RIT-T must be applied when a TNSP intends to undertake a transmission investment in response to an identified need and the most expensive credible option identified has direct costs of more than $5 M.

The TNSP must publish a project specification consultation report detailing:

- The identified need.
- A description of all credible options identified.
- Classes of market benefits unlikely to be material and why.

This report will then be made available to NEM registered participants and interested parties for a consultation period of at least 12 weeks.

Within 12 months of the end of this consultation period, the TNSP must prepare a project assessment draft report including, or include in its annual planning report:

- A summary of any submission to the project specification consultation report.
- A description of each credible option assessed.
- Quantification of costs and classes of market benefits.
- A detailed description of methodology used to quantify costs and market benefits.
- The results of the net present value analysis of each credible option.
- The proposed preferred option including construction timetable and commissioning date.

This report will then be made available to NEM registered participants and interested parties for a consultation period of at least 6 weeks.

As soon as practicable after the consultation period for the project assessment draft report the TNSP must publish a project assessment conclusions report.

This report must include those matters required under the project assessment draft report and a summary of any submissions made to that report.

The RIT-T is not required where the most expensive credible option identified has direct costs of less than $5 M. In such cases, the TNSP will perform a cost-benefit analysis to determine which option would provide the greatest net benefit to the NEM. The TNSP will then normally publish a consultation report, either as part of its Annual Planning Report or as a separate document.

4 Allocation of Terminal Station Costs to Prescribed Services

The Victorian connection process is divided into six stages as illustrated in the Connection Process Map [1]. The process for identifying expansion capability of a new connection terminal station as a prescribed transmission service, whether or not a RIT-T is required, falls within the first five stages of the connection process as described below.

i. Pre-feasibility

- AEMO identifies in the Victorian Annual Planning Report (VAPR) possible locations for multi-connection terminal stations
- AEMO informs prospective applicant of preferred location for connection and refers applicant to VAPR where applicable.

ii. Connection Enquiry

- AEMO informs prospective applicant of preferred location for connection and refers applicant to VAPR where applicable.

iii. Connection Application

- AEMO defines the following in collaboration with the applicant:
  - Location of connecting station
  - Initial switching arrangement required to connect the applicant
  - "Standalone" station arrangement
  - The standalone station arrangement forms the basis for determining the cost of negotiated services to be paid by the applicant and for AEMO to identify the required expansion provisions.
- AEMO defines the following:
  - Possible ultimate terminal station configuration
  - Modifications to the standalone arrangement (identified above) required to facilitate expansion to possible ultimate arrangement
- AEMO incorporates expansion capability into scope of works for new terminal station.
- AEMO obtains a cost estimate (nominally +/-30% accuracy) for contestable and non-contestable works with expansion capability separately itemised.
- As the expansion capability is not required to provide the agreed level of shared transmission service to the applicant, the associated costs are not incurred in providing a negotiated transmission service.

[1] Connection Process Map For Augmenting The Declared Shared Network
New Generator Transmission Connection in Victoria (refer AEMO website)

- If the estimated cost of works to facilitate expansion is less than $5M, then AEMO performs cost-benefit analysis on these works. If the works pass the cost-benefit test then:
    - AEMO publishes a consultation report for the new terminal station including scope and costing information on the prescribed component.
    - The consultation report is made available to NEM registered participants and other interested parties for a consultation period of 30 days.
    - Following the public consultation, AEMO obtains board approval for expansion works.
- If the estimated cost of works to facilitate expansion is greater than $5M, then AEMO performs a RIT-T on these works. If the works pass the RIT-T then:
    - AEMO completes the RIT-T process as defined in section 4.
    - AEMO obtains board approval for expansion works.
- Subject to passing the RIT-T or cost-benefit analysis, AEMO incorporates expansion capability into scope of works for the new terminal station. The scope of works is then used in the tender process.

iv. Contracts

If applicable, AEMO incorporates expansion capability into project agreements for the new terminal station.

v. Construction

AEMO arranges for expansion capability works to be carried out and the costs recovered through charges for prescribed transmission services.

Attachment 1: Application of Cost Allocation Policy for Victorian Terminal Stations – Prescribed Transmission Services to Scenario 1

The following example sets out the allocation of costs to three applicants that connect as outlined in Scenario 1. The example covers a ten-year term and shows how costs are apportioned between the applicants over the course of the term, as each new applicant connects to the terminal station. The allocations are based on AEMO's Cost Allocation Policy for Victorian Terminal Stations – Prescribed Transmission Services.

The input costs provided in Table A1 have been extracted from Tables 3 to 5 in Section 3.2.

Table A1 Input costs

Input cost item	Capital Cost ($M)	Notes
(1) Stand-alone connection cost for each generating plant	100	Includes a bay (item 3) that is solely utilised to connect the generating plant into the terminal station (Connection Bay), which is not shared with other generating plant
(2) Upfront work to create multi-connection terminal station for G1	10	
(3) Connection at multi-connection terminal station per generating plant (that is, Connection Bay)	10	Connection assets
(4) Transmission line G1 - additional costs to get to multi-connection terminal station	10	
(5) Transmission line G2 - additional costs to get to multi-connection terminal station	20	
(6) Transmission line G3 - additional costs to get to multi-connection terminal station	40	
(7) Costs justified under the RIT-T	20	

Table A2 calculates the value of the initial terminal station costs that will be shared by future applicants.

Table A2 Initial terminal station costs

	Capital cost ($M)	Notes
Total costs to establish the terminal station and connect G1:	120	
less costs to be borne by G1 and not subject to cost sharing:	20	G1 will pay $10M for a Connection Bay; and $10M for the transmission line
less costs to be borne by customers through Transmission Use of System (TUoS) charges:	20	
Value of initial terminal station costs to be allocated to future applicants:	80[2]	This represents the negotiated shared network charges paid by G1

Costs on an annual basis are then allocated between the applicants as per Table A3:

[2]These costs are allocated according to AEMO's Cost Allocation Policy for Victorian Terminal Stations – Negotiated Transmission Service.

Table A3 Allocation of costs ($M)

	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10
G1 costs	100	100	100	60	60	60	60	60	47	47	47
G2 costs				70	70	70	70	70	57	57	57
G3 costs									77	77	77
TUoS costs	20	20	20	20	20	20	20	20	20	20	20
Total Costs	**120**	**120**	**120**	**150**	**150**	**150**	**150**	**150**	**200**	**200**	**200**

Table A3 is based on capital costs only. Actual costs paid by applicants or allocated to TUoS would reflect an annualised amount based on the applicant's capital cost.