EASTERN METROPOLITAN MELBOURNE THERMAL CAPACITY – PROJECT SPECIFICATION CONSULTATION REPORT

PREPARED BY:	AUSTRALIAN ENERGY MARKET OPERATOR
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Executive Summary

AEMO's 2011 Victorian Annual Planning Report (VAPR) and AEMO's 2010 National Transmission Network Development Plan (NTNDP) identified that action will be required to prevent loading a number of transmission elements beyond their thermal capability. This is due to continual demand growth in the Eastern Metropolitan Melbourne area. The VAPR studies highlighted the possibility of positive net market benefits by increasing the supply capability to the Eastern Metropolitan Melbourne area.

Following on from the VAPR studies, AEMO has decided to undertake a Regulatory Investment Test for Transmission (RIT-T) which will assess the technical and economic viability of increasing the thermal supply capability to Eastern Metropolitan Melbourne.

The RIT-T is an economic cost-benefit test which is used to assess and rank different electricity transmission investment options that address an identified need to invest. Its purpose is to identify the investment option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market.

This Project Specification Consultation Report (PSCR) is the first stage of the RIT-T process and shows:

- how demand growth in Eastern Metropolitan Melbourne will, without investment within the next five years, require involuntary load reduction to avoid loading transmission network assets beyond their thermal capability, with the specific transmission elements at risk being the:
  - Cranbourne A1 500/220 kV transformer.
  - Rowville A1 500/220 kV transformer.
  - Rowville A2 500/220 kV transformer.
  - East Rowville – Rowville 220 kV double circuit line.
- the network options being considered to overcome the network loading issues, specifically:
  - A new 500/220 kV transformer at Cranbourne Terminal Station.
  - A new 500/220 kV transformer at Rowville Terminal Station with upgrade of the existing circuits or installation a new circuit between East Rowville and Rowville terminal stations.
  - A new 500 kV terminal station, with a 500/220 kV transformer, at Ringwood or Templestowe terminal station.
- The technical characteristics and performance requirements that a non-network option would need to deliver to overcome the forecast network loading issues.
- Discusses specific categories of market benefit and their applicability to this RIT-T.

The second stage of the RIT-T process, full option analysis and publication of the Project Assessment Draft Report (PADR), is expected to be published by the end of May 2012.

AEMO welcomes written submissions on this PSCR, particularly in relation to the credible options presented and issues addressed in this report.

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1 Introduction

This Project Specification Consultation Report (PSCR) has been prepared by the Australian Energy Market Operator (AEMO) in accordance with the requirements of National Electricity Rules (NER) clause 5.6.6 and AEMO's capacity as the Transmission Network Service Provider (TNSP) responsible for planning and directing augmentations to the Victorian Declared Shared Network (DSN).

This PSCR represents stage one of the consultation process in relation to the Eastern Metropolitan Melbourne thermal capacity Regulatory Investment Test for Transmission (RIT-T).

This PSCR:

- Describes the need that AEMO is seeking to address and the assumptions used in identifying this need.
- Sets out the technical characteristics that a non-network option would need to deliver in order to address the identified need.
- Describes the credible options that AEMO currently considers may address the identified need.
- Discusses specific categories of market benefit which, in the case of this specific RIT-T assessment, are unlikely to be material.

1.1 Submissions

AEMO invites written submissions on this Project Specification Consultation Report from registered participants and interested parties. Submissions are particularly sought on the credible options presented and issues addressed in this report.

Submissions are due on or before 17 February 2012.

Submissions should be emailed to Planning@aemo.com.au.

Submissions will be published on the AEMO website. If you do not want your submission to be publicly available please clearly stipulate this at the time of lodgement.

The second stage of the RIT-T process, full option analysis and publication of the Project Assessment Draft Report (PADR), is expected to be published by the end of May 2012.

Further details in relation to this project can be obtained from:

Jason Pollock
Senior Engineer
Network Planning
AEMO

Phone: (03) 9609 8386
Email: Jason.Pollock@aemo.com.au

2 Identified Need

2.1 Background

In the 2011 Victorian Annual Planning Report (VAPR) and the 2010 National Transmission Network Development Plan (NTNDP), AEMO identified that due to continual demand growth in the Eastern Metropolitan Melbourne area, action will be required to prevent loading a number of transmission elements beyond their thermal capability. The VAPR studies suggested that there are potential economic benefits associated with increasing the thermal supply capability to Eastern Metropolitan Melbourne.[1,2]

The thermal network limitations expected to be reached as a result of demand growth in the Eastern Metropolitan Melbourne area, and that are identified for further assessment, include:

- Cranbourne A1 500/220 kV transformer loading.
- Rowville A1 500/220 kV transformer loading.
- Rowville A2 500/220 kV transformer loading.
- East Rowville – Rowville 220 kV double circuit line loading.

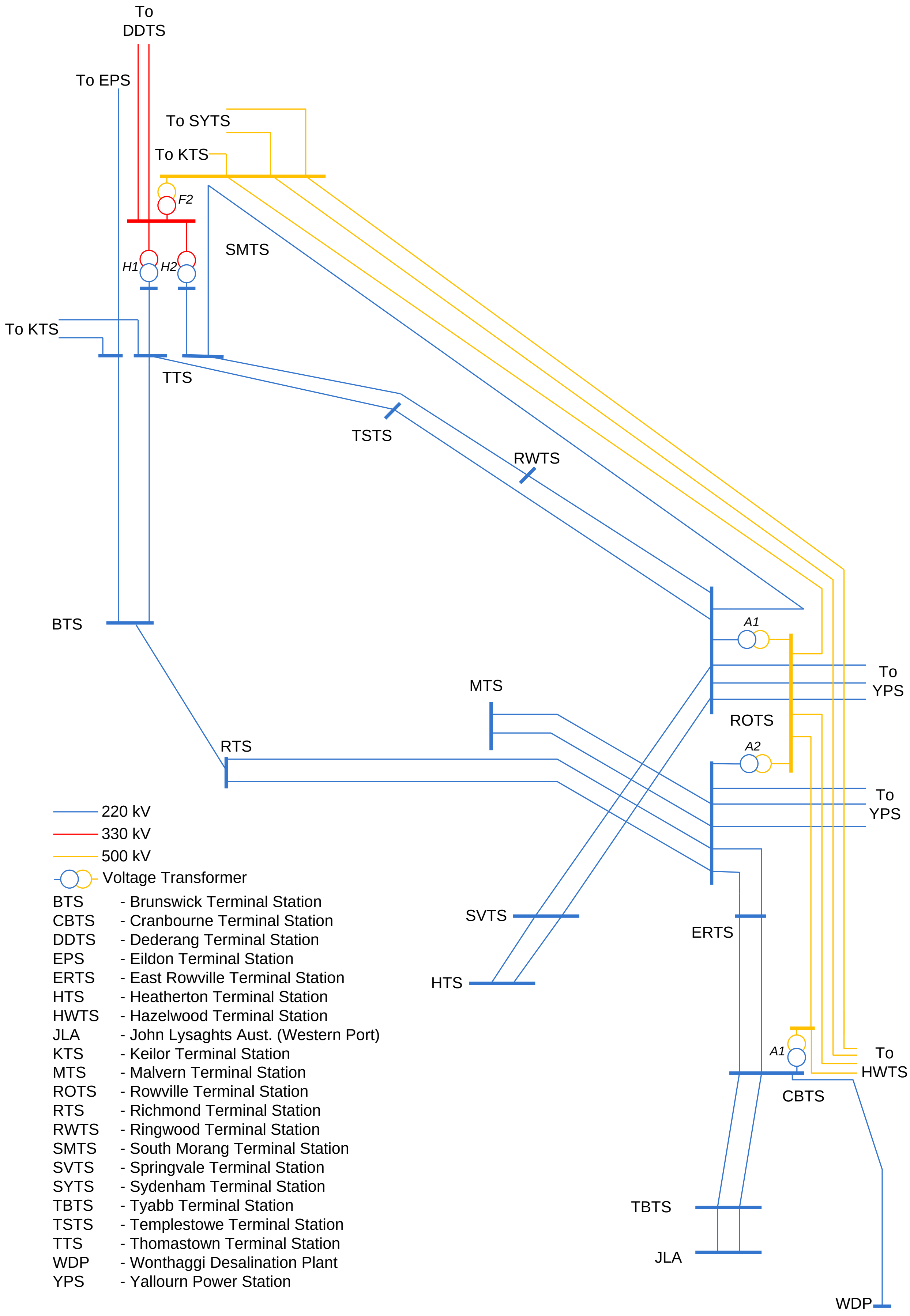
The three 1000 MVA 500/220 kV transformers at Rowville and Cranbourne are key components in supplying electricity from the 500 kV to the 220 kV transmission network in Melbourne's east. Rowville Terminal Station operates with a split bus arrangement. Due to this 220 kV split bus arrangement, the Rowville A2 500/220 kV transformer and the two 220 kV lines from Rowville to East Rowville work in parallel with the Cranbourne A1 500/220 kV transformer, to supply load connected to the terminal stations at East Rowville, Cranbourne, Tyabb, Western Port (JLA) and Richmond, as well as the Wonthaggi Desalination Plant.

The Rowville A1 500/220 kV transformer supplies load connected to the Heatherton, Malvern, Ringwood, Springvale and Templestowe terminal stations.

Figure 1 presents an approximate geographical schematic of the terminal stations affected by the forecast network limitations. During peak demand periods, electricity is generally supplied to Melbourne via the 500 kV lines from Hazelwood, the 220 kV lines from Yallourn and Eildon and the 330 kV lines from Dederang.

[1] AEMO. "Victorian Annual Planning Report 2011". Available http://www.aemo.com.au/planning/VAPR2011/vapr.html. Accessed November 2011.
[2] AEMO. "National Transmission Network Development Plan 2010". Available http://www.aemo.com.au/planning/ntndp.html. Accessed November 2011.

Figure 1 – Geographical representation of terminal stations affected by the forecast network limitations



2.2 Description of the identified need

Increasing electricity demand in Melbourne's east is increasing the loading on the Cranbourne and Rowville transformers and the East Rowville – Rowville 220 kV lines.

Without an increase in supply capacity, network security and asset protection requirements will result in load being constrained (involuntary load shedding) to ensure loading levels remain within asset limits. Involuntary load shedding is forecast to occur under system normal and N-1 conditions.[3,4]

The Cranbourne A1 500/220 kV transformer is forecast to be loaded above its continuous rating under system normal conditions as soon as 2013–14.

Similarly, the Rowville A1 500/220 kV transformer is forecast to be loaded above its continuous rating under system normal conditions by approximately 2014–15.

Load sharing between the Cranbourne A1 and Rowville A2 transformers is not exactly even with the Cranbourne transformer taking slightly more load than the Rowville A2 transformer. The Rowville A2 500/220 kV transformer is forecast to be loaded above its short-term rating following loss of the Cranbourne A1 transformer by approximately 2017–18.

Under system normal conditions the East Rowville – Rowville 220 kV circuits remain well within their continuous ratings. However, from 2012–13 pre-contingent load reduction will be required due to the increased loading expected to occur on these circuits immediately following loss of the Cranbourne A1 500/220 kV transformer, at which stage the loading on this line is expected to exceed its short-term rating.

Table 1 shows the forecast loading of key transmission plant elements in the Eastern Metropolitan Melbourne area under system normal or N-1 conditions. The loading conditions are presented under Victorian peak demand conditions assuming an ambient temperature of 40°C. System normal loading is compared to the element's continuous rating, while N-1 loading levels have been compared to the element's short-term rating. Therefore, all forecast overloads reported are expected to result in pre-contingent action to manage system normal or post-contingent loading levels.

Table 1 – Transmission element loading under summer peak demand conditions

Transmission asset	Critical condition	2011–12	2012–13	2013–14	2014–15	2015–16
CBTS A1 500/220 kV	System normal	93%	97%	100%	102%	104%
ROTS A1 500/220 kV	System normal	87%	90%	96%	103%	105%
ROTS A2 500/220 kV	CBTS A1 outage	71%	73%	79%	84%	89%
ERTS-ROTS 220 kV line	CBTS A1 outage	92%	101%	104%	106%	109%

2.2.1 Market benefits

The purpose of the RIT-T is to identify the credible option that maximises the present value of net benefit to all those that produce, consume and transport electricity in the market.[5]

To measure the increase in net market benefit, AEMO will analyse the classes of market benefit required for consideration under the RIT-T, as set out in subparagraph 5 of the RIT-T.[6]

AEMO considers that the classes of market benefit that are most likely to change as a result of increasing the supply capability to Eastern Metropolitan Melbourne are:

[3] System normal is the condition where all transmission network elements are in service.
[4] N-1 is the condition following loss of the most critical network element.
[5] AEMC. "National Electricity Rules". Version 46, November 2011, Clause 5.6.5B (b). Available http://www.aemc.gov.au. Accessed November 2011.
[6] AER. "Final Regulatory Investment Test for Transmission". Version 1, June 2010, 4pp. Available http://www.aer.gov.au. Accessed November 2011.

- **Changes in involuntary load shedding**

  Increasing supply capability to Eastern Metropolitan Melbourne, or a reduction in demand in the area, will reduce the quantity and duration of load shedding required to ensure network loading remains within asset limits.

- **Changes in voluntary load curtailment**

  A demand-side reduction credible option may lead to an increase in the amount of voluntary load curtailment (and a decrease in involuntary load shedding).

- **Changes in costs for parties, other than the TNSP, due to differences in timing of new plant, capital and operating and maintenance costs**

  A non-network local generator credible option may reduce the requirement for future remote generation. Additionally, an embedded generator may lead to changes in distribution network investment requirements.

- **Changes in generator fuel consumption arising through different patterns of generation dispatch**

  The network limitations identified are predominantly driven by increasing demand; however, generation connected within the 220 kV network can offload the transmission assets of concern. In particular, Yallourn Power Station output significantly reduces loading on the Rowville and Cranbourne transformers, while Somerton, Newport and Laverton North power stations can also provide some loading relief to these assets.

  At times of high demand, local and 220 kV network connected generation, such as Yallourn Power Station, could potentially displace lower cost generation in the National Electricity Market (NEM) to minimise the amount of load shedding required during peak demand periods. Due to the very low fuel cost of operating Yallourn Power Station this is unlikely to have a significant market impact; however, due to the potential cost of a carbon price AEMO will assess the impact of variable operating costs under various carbon price trajectories.

- **Changes in network losses**

  Increasing supply to Eastern Metropolitan Melbourne may lead to a reduction in network losses as additional or alternative supply paths are established.

  Under the network options identified in Section 3, losses are expected to fall due to establishment of an additional supply path from the 500 kV network, to the 220 kV, in close proximity to the bulk demand area.

  Similarly, a non-network option such as new local generation would provide new supply in close proximity to the bulk demand area, could also be expected to reduce network losses.

It is expected that the market benefits arising from changes in dispatch costs and changes in network losses will be significantly less than market benefits arising from reductions in involuntary load shedding.

The market benefits that are not material to this RIT-T assessment are discussed in Section 4.

AEMO expects this project to be provided as a contestable service.

2.2.2 Assumptions made in relation to the identified need

The following key assumptions drive the market benefits expected from relieving the supply capability limitations to Eastern Metropolitan Melbourne:

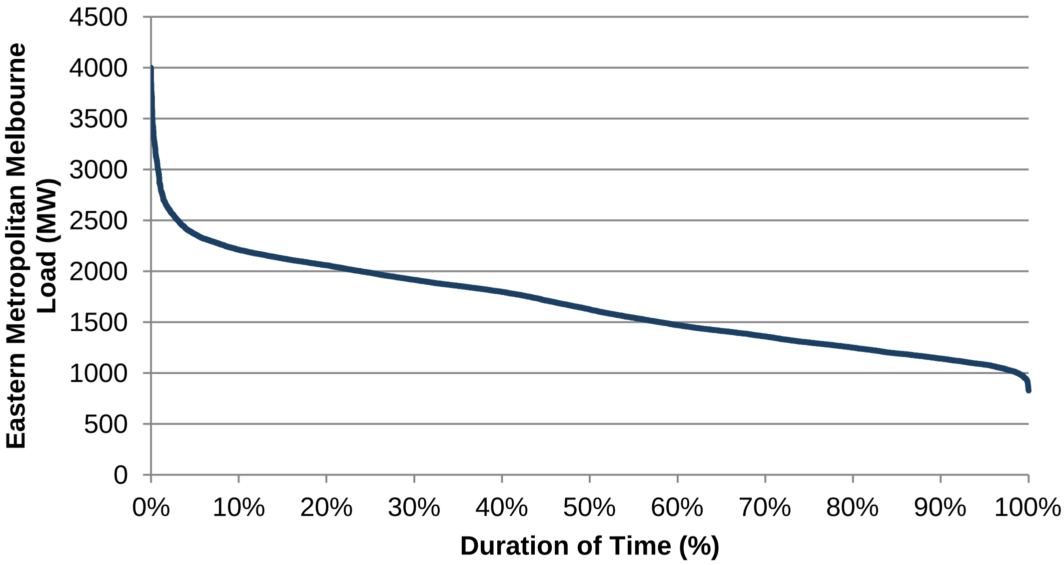
- Characteristics of the load profile.
- Forecast demand growth.
- Value of customer reliability (VCR).
- Generation re-dispatch cost.
- Network element outage rates.
- Network element asset ratings.
- Generator unit outage rates.
- Supply development scenarios.

Characteristics of the load profile

The Eastern Metropolitan Melbourne area predominantly supplies residential loads, along with the BlueScope steel works facility at Western Port. The annual peak demand for the Eastern Metropolitan Melbourne area occurs during summer, generally on hot afternoons due to increased residential air conditioner load.

The load duration characteristics of the area can vary significantly from year to year, depending largely on the diversity between terminal station peaks in the area. Figure 2 presents the load duration curve for the past year, 2010–11. The figure shows a very sharp peak of short duration, and average to low demand for most of the year.

Figure 2 – Eastern Metropolitan Melbourne historical load duration curves



As shown in Figure 2, demand can be expected to exceed around sixty percent of maximum demand approximately five percent of the time and seventy percent of maximum demand just one percent of the time. This implies that although the probability of reaching high demand levels is reasonably slim, the impact of not having sufficient capability, be it network capability or non-network support, can result in a significant amount of involuntary load shedding to maintain the network loading within transmission asset limits.

To account for uncertainty in the load duration characteristics, AEMO prepared terminal station demand traces based on the load shape of the six most recent historical base year traces from

2005–06 through to 2010–11. The expected unserved energy presented in Section 2.2.3 was calculated using each base year and then applying equal weighting across the six base years to calculate the overall expected unserved energy and generation dispatch variations.

Forecast demand growth

Electricity demand in the Metropolitan Melbourne area is continuing to grow rapidly, particularly due to the increase in housing developments in Melbourne's south-eastern suburbs around Cranbourne.

Figure 3 and Figure 4 show the forecast maximum demand growth of individual terminal stations in the Eastern Metropolitan Melbourne area. The forecasts are based on the medium economic growth scenario and represent the 10% probability of exceedence (POE) demand level.

Figure 3 – Demand growth of stations supplied via Rowville No.3–No.4 220 kV bus group

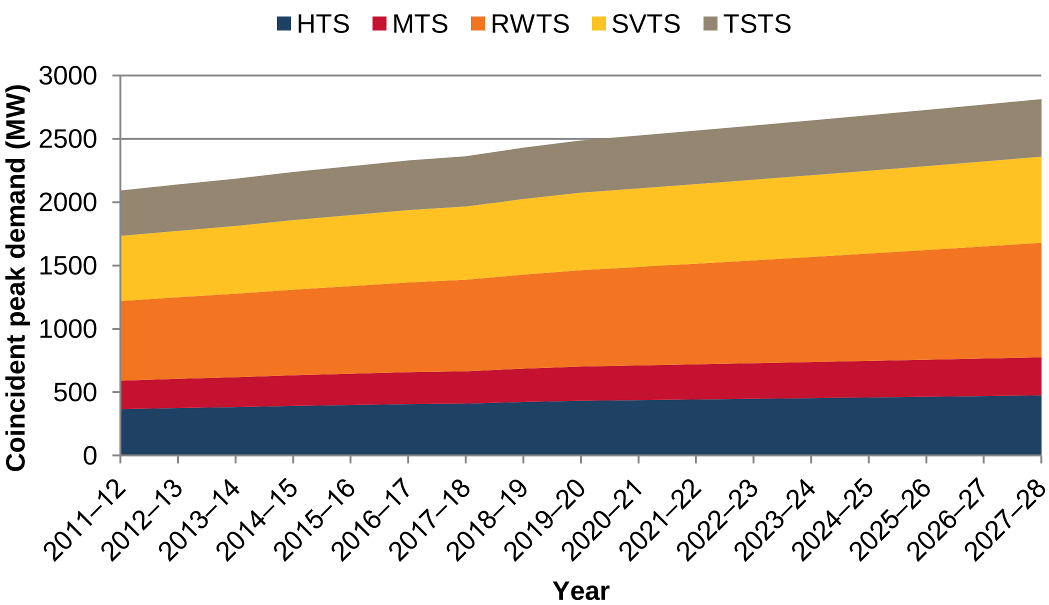
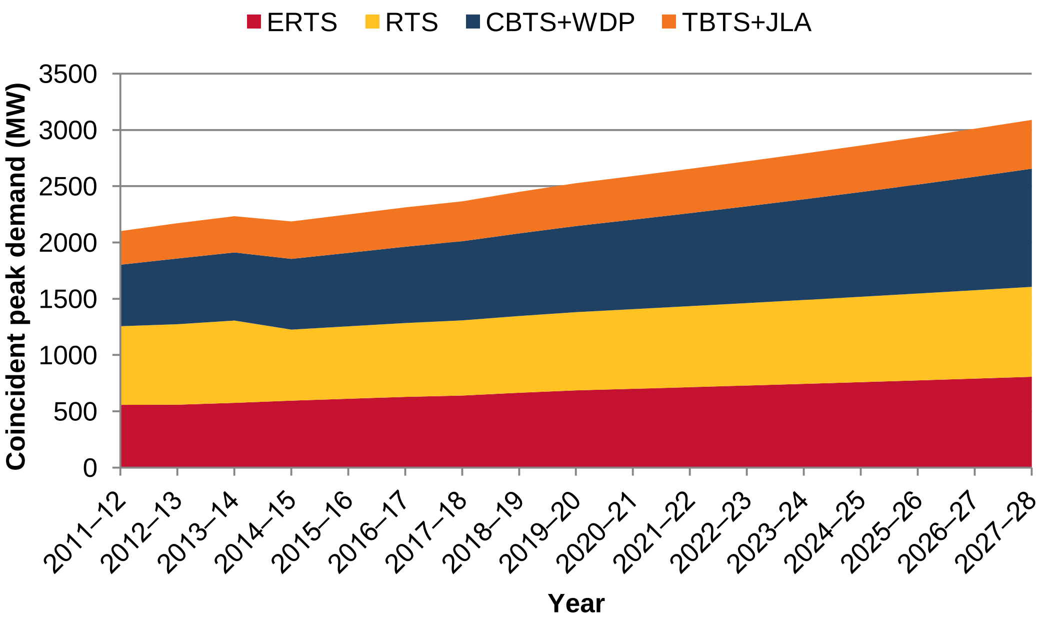


Figure 4 – Demand growth of stations supplied via Rowville No.1–No.2 220 kV bus group and Cranbourne



Uncertainty in the demand forecasts are accounted for by applying a 10% POE demand forecast and a 50% POE demand forecast and weighting them 30% and 70% respectively to calculate the expected unserved energy and generation dispatch variations presented in Section 2.2.3.

Value of customer reliability

The cost of unserved energy is calculated using the value of customer reliability (VCR), which is an estimate of the value electricity consumers place on a reliable electricity supply. This value is equivalent to the cost to consumers of having their electricity supply interrupted for a short time.

The Victorian VCR is currently $57,877/MWh (in 2011–12 Australian dollars), and has been used by AEMO to calculate the cost of expected unserved energy for this RIT-T.

Generation re-dispatch cost

Re-dispatch of generation is valued using the short run marginal cost (SRMC) of generation, including any price on carbon. The SRMC of generation used in this RIT-T derives from the 2010 NTNDP database.[7]

Network element outage rates

Expected outage rates for individual transformers have been calculated by SP AusNet. These expected outage rates are derived from the individual transformer's age and condition, based on a range of oil and electrical integrity tests performed as part of SP AusNet's asset maintenance program. The tests produce condition scores for the transformer's bushings, core, oil and online tap changer to derive an outage probability for each transformer. The outage rates represent prolonged outages due to transformer failures, thereby excluding short outages that don't result in prolonged outage durations.

The expected transformer unavailability rate derived by SP AusNet and applied for this RIT-T is 0.3% per transformer for the Rowville A1 500/220 kV, Rowville A2 500/220 kV and Cranbourne A1 500/220 kV transformers.

Network element ratings

Supply from the 500 kV network is limited by the thermal capacity of the Cranbourne A1 transformer and the Rowville A1 and A2 transformers. Each of the three transformers have a continuous rating of 1,000 MVA, a two hour rating of 1,250 MVA and a thirty minute rating of 1,500 MVA. Supply throughout the 220 kV network supplying Eastern Metropolitan Melbourne is limited by the thermal capacity of the two East Rowville – Rowville 220 kV circuits, where each have a continuous rating of 750 MVA at 40°C.

The transformer limits are constant in that they don't vary with generation or demand and are assumed unchanged irrespective of ambient temperature. The East Rowville – Rowville line rating varies with ambient temperature and also has a fifteen minute contingency rating that varies depending on each circuit's pre-contingent loading level.

Generator unit outage rates

The generator unit outage rates used for this RIT-T are assumed to vary based on generator technology and are derived from the 2010 NTNDP database.

Supply development scenarios

Eastern Metropolitan Melbourne thermal loading is primarily dependent on demand growth in Melbourne and its surrounding suburbs. AEMO considers that the number of generation expansion scenarios can therefore be limited without significantly impacting the investment decisions of this RIT-T.

[7] AEMO. "National Transmission Network Development Plan 2010". Available http://www.aemo.com.au/planning/2010ntndp_cd/html/NTNDPdatabase.htm. Accessed November 2011.

The NTNDP scenario considered most appropriate to assess the Eastern Metropolitan Melbourne thermal capacity is the Decentralised World scenario, as detailed in AEMO's 2010 NTNDP. The Decentralised World scenario describes a world where moderate emissions targets are coupled with medium economic and population growth. For the purpose of this RIT-T, the Decentralised World scenario is assessed with two different carbon price trajectories: a low carbon price sensitivity (DW-Low) and a medium carbon price sensitivity (DW-Medium). The low carbon price trajectory is the most similar to the Australian Government's carbon price modelling.[8]

The base scenario, and that considered the most likely to occur, is the Decentralised World with a low carbon price (DW-Low). The Decentralised World with a medium carbon price (DW-Medium) has been considered as a sensitivity study.

2.2.3 Expected cost of the limitation

The forecast market impact of each network limitation is presented in Table 2 to Table 5.

The tables show:

- Load and energy at risk, which is the MW load shedding required to avoid the network limitation, and the resulting unserved energy under 10% POE demand conditions.
- Expected unserved energy, which is a portion of the energy at risk after taking into account the probability of the limitation occurring, including the probability of the demand conditions occurring.
- Limitation cost, which is the cost of the expected unserved energy, obtained by multiplying the expected unserved energy by the VCR.

Table 2 – Forecast market impact of Cranbourne A1 500/220 kV transformer limitation

Year	Load at risk (MW)	Energy at risk (MWh)	Expected unserved energy (MWh)	Limitation cost ($ million)
2011–12	-	-	-	-
2012–13	-	-	-	-
2013–14	40	70	9	0.5
2014–15	175	1,960	260	15
2015–16	240	3,375	585	35
2016–17	305	5,060	1,255	75
2017–18	370	8,140	2,255	130
2018–19	455	14,280	4,210	245
2019–20	540	23,975	7,185	415
2020–21	610	35,050	10,930	635
2021–22	690	49,060	16,075	930
2022–23	770	66,805	23,130	1,340
2023–24	850	88,715	32,350	1,870
2024–25	940	114,950	44,465	2,575
2025–26	1,030	150,005	60,480	3,500

[8] Australian Government. "Clean Energy Future"'. Available http://www.cleanenergyfuture.gov.au. Accessed November 2011.

Table 3 – Forecast market impact of Rowville A1 500/220 kV transformer limitation

Year	Load at risk (MW)	Energy at risk (MWh)	Expected unserved energy (MWh)	Limitation cost ($ million)
2011–12	-	-	-	-
2012–13	-	-	-	-
2013–14	-	-	-	-
2014–15	100	330	50	5
2015–16	160	950	160	10
2016–17	220	1,910	340	20
2017–18	275	2,865	555	30
2018–19	360	4,645	1,105	65
2019–20	435	7,435	2,005	115
2020–21	495	10,525	3,075	180
2021–22	555	15,085	4,545	265
2022–23	620	21,555	6,545	380
2023–24	685	29,695	9,150	530
2024–25	750	39,595	12,550	725
2025–26	820	51,550	17,015	985

Table 4 – Forecast market impact of Rowville A2 500/220 kV transformer limitation

Year	Load at risk (MW)	Energy at risk (MWh)	Expected unserved energy (MWh)	Limitation cost ($ million)
2011–12	-	-	-	-
2012–13	-	-	-	-
2013–14	-	-	-	-
2014–15	-	-	-	-
2015–16	-	-	-	-
2016–17	-	-	-	-
2017–18	5	5	-	-
2018–19	130	610	60	5
2019–20	250	2,230	280	15
2020–21	355	4,240	635	35
2021–22	460	6,600	1,310	75
2022–23	575	9,300	2,590	150
2023–24	695	15,145	4,685	270
2024–25	815	25,015	7,865	455
2025–26	945	39,805	12,545	725

Table 5 – Forecast market impact of East Rowville – Rowville 220 kV line limitation

Year	Load at risk (MW)	Energy at risk (MWh)	Expected unserved energy (MWh)	Limitation cost ($ million)
2011–12	-	-	-	-
2012–13	55	275	20	1
2013–14	100	890	80	5
2014–15	155	1,800	195	10
2015–16	200	2,835	370	20
2016–17	250	4,030	695	40
2017–18	290	5,150	1,095	65
2018–19	360	7,235	1,960	115
2019–20	425	10,590	3,215	185
2020–21	475	14,050	4,600	265
2021–22	525	18,270	6,445	375
2022–23	580	23,400	8,890	515
2023–24	635	29,855	12,070	700
2024–25	690	38,945	16,150	935
2025–26	750	50,090	21,310	1,235

2.3 Required technical characteristics for a non-network option

This section describes the technical characteristics of the identified need that a non-network option would be required to deliver.

The primary market benefits associated with the identified need relate to reducing the expected amount of involuntary load shedding that is forecast to occur during pre-contingent peak demand conditions, to ensure network loading remains within transmission asset limitations. To achieve similar levels of market benefits, it is expected that a non-network option would also need to be able to reduce the amount of involuntary load shedding required to maintain transmission network loading within transmission asset limits during peak demand times.

Table 6 and Table 7 indicate the estimated load reduction, or additional generation required, by location and the number of hours in each year that would likely be required.

Because the network limitations are based on pre-contingent network conditions, a non-network option would be required to operate within the fifteen minute response time required operationally.

Table 6 - Load reduction or additional generation requirements by location for stations supplied via Rowville No.3–No.4 220 kV bus group

Year	Heatherton and Springvale Terminal Stations under 10% POE conditions (MW)[9]	Hours under 10% POE conditions	Heatherton and Springvale Terminal Stations under 50% POE conditions (MW)[9]	Hours under 50% POE conditions
2011–12	-	-	-	-
2012–13	-	-	-	-
2013–14	-	-	-	-
2014–15	100	10	-	-
2015–16	160	15	-	-
2016–17	220	20	-	-
2017–18	275	25	30	2
2018–19	360	35	85	5
2019–20	435	50	160	15
2020–21	495	70	220	20
2021–22	555	100	290	25
2022–23	620	130	355	35
2023–24	685	160	425	50
2024–25	750	190	500	70
2025–26	820	220	575	110

[9] Non-network support at Heatherton Terminal Station and Springvale Terminal Station is best for offloading the Rowville A1 transformer due to additional network losses in servicing these locations, however support at Malvern, Templestowe or Ringwood terminal stations will also significantly offload these network limitations.

Table 7 – Load reduction or additional generation requirements by location for stations supplied by Rowville No.1–No.2 220 kV bus group and Cranbourne

Year	Tyabb Terminal Station and Western Port under 10% POE conditions (MW)[10]	Hours under 10% POE conditions	Tyabb Terminal Station and Western Port under 50% POE conditions (MW)[10]	Hours under 50% POE conditions
2011–12	-	-	-	-
2012–13	55	10	-	-
2013–14	100	15	-	-
2014–15	175	20	-	-
2015–16	240	30	50	10
2016–17	305	50	115	15
2017–18	370	75	175	20
2018–19	455	115	245	35
2019–20	540	165	325	55
2020–21	610	205	395	85
2021–22	690	255	470	125
2022–23	770	310	550	170
2023–24	850	375	635	215
2024–25	940	525	720	275
2025–26	1,030	785	810	340

[10] Non-network support at Tyabb Terminal Station and Western Port is best for offloading the Cranbourne A1 transformer, Rowville A2 transformer and East Rowville – Rowville 220 kV line due to additional network losses in servicing these locations, however support at Cranbourne or East Rowville terminal stations will also significantly offload these network limitations

3 Potential credible options to address the identified need

This section summarises the credible network and non-network options of which AEMO is currently aware.

None of these credible options are likely to have a material inter-regional impact.

3.1 Description of credible network options

The network options relate to increasing the capability of transmission network supply to Eastern Metropolitan Melbourne.

Option 1 – New 500/220 kV transformer at CBTS

The proposed scope of works for Option 1 involves the installation of a new 1000 MVA A2 500/220 kV transformer at Cranbourne Terminal Station. This option may also require the switching in of the Hazelwood – Rowville No.3 500 kV line at Cranbourne Terminal Station.

This option will provide a second 500/220 kV connection at Cranbourne, which will:

- Offload the Cranbourne A1 500/220 kV transformer.
- Prevent the East Rowville – Rowville 220 kV line being overloaded following loss of the Cranbourne A1 500/220 kV transformer.
- Pffload the Rowville A2 500/220 kV transformer or enable it to be switched across to the Rowville No. 3-4 220 kV bus to offload the Rowville A1 500/220 kV transformer.
- Provide diversified transmission assets to supply Metropolitan Melbourne.

Including the cost of switching in the Hazelwood – Rowville No.3 500 kV line at Cranbourne Terminal Station, the estimated cost of this option is $66 million (±30%). The estimated construction lead time is three years.

Option 2a – New 500/220 kV transformer at ROTS and upgrade of the existing ERTS–ROTS double circuit line

The proposed scope of works for Option 2a involves the installation of a new 1000 MVA A3 500/220 kV transformer at Rowville Terminal Station and upgrade of the existing line between East Rowville and Rowville terminal stations to a continuous rating of 1180 MVA at 40°C by replacing the existing twin Finch conductors with higher capacity quad Mango conductors.

This option will provide a second 500/220 kV connection at Rowville and higher capacity circuits between East Rowville and Rowville, which will:

- Offload the Rowville A2 500/220 kV transformer or enable it to be switched across to the Rowville No. 3-4 220 kV bus to offload the Rowville A1 500/220 kV transformer.
- Prevent the East Rowville – Rowville 220 kV line being overloaded following loss of the Cranbourne A1 500/220 kV transformer.
- Offload the Cranbourne A1 500/220 kV transformer.

The estimated cost of this option is $67 million (±30%). The estimated construction lead time is three years.

Option 2b – New 500/220 kV transformer at ROTS and installation of an underground ERTS–ROTS circuit

The proposed scope of works for Option 2b involves the installation of a new 1000 MVA A3 500/220 kV transformer at Rowville Terminal Station along with installation of an underground 220 kV circuit, with a continuous rating of 953 MVA, between East Rowville and Rowville terminal stations.

This option will provide a second 500/220 kV connection at Rowville and a third circuit between East Rowville and Rowville, which will:

- Offload the Rowville A2 500/220 kV transformer or enable it to be switched across to the Rowville No. 3-4 220 kV bus to offload the Rowville A1 500/220 kV transformer.
- Prevent the East Rowville – Rowville 220 kV line being overloaded following loss of the Cranbourne A1 500/220 kV transformer.
- Offload the Cranbourne A1 500/220 kV transformer.

The estimated cost of this option is $87 million (±30%). The estimated construction lead time is three years.

Option 3 – New 500 kV switchyard and 500/220 kV transformer at RWTS

The proposed scope of works for Option 3 involves the development of a new 500 kV switchyard and switching of a new 1000 MVA A1 500/220 kV transformer at Ringwood Terminal Station. This option will also require switching in of the Rowville – South Morang No.3 500 kV line at Ringwood Terminal Station.

This option will provide a new 500 kV switchyard and 500/200 kV transformation at Ringwood, which will:

- Offload the Rowville A1 500/220 kV transformer.
- Offload the South Morang H1 and H2 330/220 kV transformers.

The estimated cost of this option is $84 million (±30%). The estimated construction lead time is four years.

Option 4 – New 500 kV switchyard and 500/220 kV transformer at TSTS

The proposed scope of works for Option 4 involves the development of a new 500 kV switchyard and switching of a new 1000 MVA A1 500/220 kV transformer at Templestowe Terminal Station. This option will also require switching in of the Rowville – South Morang No.3 500 kV line at Templestowe Terminal Station.

This option will provide a new 500 kV switchyard and 500/200 kV transformation at Templestowe, which will:

- Offload the Rowville A1 500/220 kV transformer.
- Offload the South Morang H1 and H2 330/220 kV transformers.

The estimated cost of this option is $145 million (±30%). The estimated construction lead time is four years.

3.2 Non-network options

AEMO has identified two potential non-network options that may create market benefits similar to those of the network options.

Subject to costs and the magnitude of the benefits associated with these non-network options, these options may present competitive alternatives to the network options. At this stage AEMO has not determined whether these options are commercially and technically feasible at the scale required, or whether they could be available in a similar timeframe to the network options.

However, AEMO proposes to undertake indicative modelling for these options to identify the potential magnitude of market benefits, notwithstanding the current lack of identified proponents for these options.

Given the long construction lead times associated with the identified network options, a non-network option with a short lead time could result in additional benefits in the next one to three years prior to a network option being able to be established.

Non-network Option 1: Demand management

Demand management, in the form of voluntary load curtailment, has the potential to decrease the involuntary load shedding that would otherwise be required during peak demand periods.

As outlined in Section 2.3, AEMO has calculated the expected unserved energy and location of any involuntary load shedding that would be required to maintain network loading within asset limits. This information can be used as an indication for demand management providers to propose specific demand management options.

Non-network Option 2: Local generation development

Development of new or expanded generation capacity close to high demand locations within the Metropolitan Melbourne area has the potential to reduce network asset loading during peak demand periods under system normal and outage conditions.

The reduction of network asset loading can create positive market benefits by reducing the amount of expected unserved energy that would otherwise be required to maintain network loading within asset limits.

As outlined in Section 2.3, AEMO has calculated the expected unserved energy and location of any local generation development that would be required to maintain network loading within asset limits. This information can be used as an indication for generation developers to propose specific generation development options.

3.2.1 Information to be provided by proponents of a non-network option

Proponents of non-network options are invited to lodge a submission to AEMO, as indicated in Section 1.1 of this report, and should include the following details:

- Proponent name and contact details.
- A detailed description of the proposal.
- A nominated site.
- The capacity to be provided.
- A commissioning date with contingency specified.
- Availability and reliability performance benchmarks.
- Proposed contract period.
- Evidence of a planning application having been lodged, where appropriate.

All proposals must satisfy the requirements of any applicable laws and the requirements of any relevant regulatory authority.

Any network reinforcement costs required to accommodate the non-network solution will typically be borne by the proponent(s) of the non-network options. For example, some non-network alternatives such as embedded generation may require fault level mitigation measures; and any associated costs would be borne by proponents.

4 Materiality of market benefits

AEMO notes the NER requirement that all categories of market benefit identified in relation to the RIT-T are included in the RIT-T assessment, unless the TNSP can demonstrate that:

- A specific class (or classes) of market benefit are unlikely to be material in relation to the RIT-T assessment for a specific option, or
- the cost of undertaking the analysis to quantify that benefit would likely be disproportionate to the "scale, size and potential benefits of each credible option being considered in the report".[11]

At this stage of the consultation, AEMO considers that the following classes of market benefits are not material for this RIT-T assessment for any of the credible options:

- **Differences in the timing of transmission investment**

  The credible options to address the identified need are not expected to change the timing of any other transmission investment currently being considered. AEMO therefore does not propose to estimate any additional transmission investment market benefit for this RIT-T assessment.

- **Changes in ancillary services costs**

  There is no expected change to the costs of Frequency Control Ancillary Services (FCAS), Network Control Ancillary Services (NCAS) or System Restart Ancillary Services (SRAS) as a result of the options being considered. These costs are therefore not material to the outcome of the RIT-T assessment.

- **Option value**

  AEMO notes the AER's view that option value is likely to arise where there is uncertainty regarding future outcomes, the information that is available in the future is likely to change and the credible options considered by the TNSP are sufficiently flexible to respond to that change.[12]

  AEMO also notes the AER's view that appropriate identification of credible options and reasonable scenarios capture any option value, thereby meeting the NER requirement to consider option value as a class of market benefit under the RIT-T.

  For this RIT-T assessment, the estimation of any option value benefit over and above that already captured via the scenario analysis in the RIT-T would require a significant modelling assessment, which would be disproportionate to any additional option value benefit that may be identified for this specific RIT-T assessment. AEMO therefore does not propose to estimate any additional option value market benefit for this RIT-T assessment.

- **Competition benefits**

  Increasing the supply capability to Eastern Metropolitan Melbourne will reduce the reliance on local generation and increase the ability of generation from the rest of the NEM to supply the bulk demand areas around Metropolitan Melbourne. The extent that this increase in competition results in a different dispatch pattern over and above that associated with a variation in fuel costs, as described in Section 2.2.1, is expected to be negligible.

  Assessment of competition benefits would also require additional modelling, such as the inclusion of game theory bidding or similar, which would lead to substantial increases in the complexity and cost of the RIT-T assessment. Such increased complexity is not warranted given the negligible market benefits expected from any additional market competition realised.

[11] AEMC. "National Electricity Rules". Version 46, November 2011, Clause NER 5.6.6(c)(6)(iii). Available http://www.aemc.gov.au. Accessed November 2011.

[12] AER. "Final Regulatory Investment Test for Transmission Application Guidelines", p.39 and p.75. Available http://www.aer.gov.au. Accessed November 2011.

AEMO therefore does not propose to estimate any additional market competition benefit for this RIT-T assessment.

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