Jemena Electricity Networks (Vic) Ltd

2016-20 Electricity Distribution Price Review Regulatory Proposal

Revocation and substitution submission

Attachment 7-20 Addendum to Preston network development strategy

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Preston Area Conversion

Network Development Strategy (Addendum)

ELE PL 0029 (A)

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EXECUTIVE SUMMARY

Purpose

This documents serves as an addendum to the Preston area conversion network development strategy[1] (April 2015 Preston network development strategy) submitted with Jemena Electricity Network's (Vic) Ltd (JEN) April 2015 proposal[2] and seeks to respond to concerns raised in the preliminary decision that JEN's recommended option to upgrade the existing 6.6kV network in the area to 22kV was not supported by probabilistic planning and our approach to forecast required capital expenditure (capex) for this project is based on the physical condition of the assets instead of reliability performance[3].

JEN's April 2015 proposal included $25.8 million (direct un-escalated $2015) for the Preston Conversion project for the 2016 regulatory period and identified that a further $19.4 million (direct un-escalated $2015) will be required in the 2021 regulatory period to complete the project by 2022.

JEN categorised this expenditure as augmentation capital expenditure (augex) for the purposes of its April 2015 proposal. The primary investment drivers for the Preston area network development strategy are forecast demand increases and the need to maintain the zone substation supply reliability with increased demand. JEN submitted a network development strategy with its April 2015 proposal which served as the primary document justifying the upgrade to the Preston area, however Attachment 7-3 also included summarised details of the drivers for this investment. The document presented Jemena's long term supply requirements for the Preston area, and outlined the proposed network development plan that will maximise the net market benefits to customers in the supply area.

The preliminary decision did not provide any allowance to continue augmenting the Preston area. JEN considers this amount to be insufficient to alleviate the demand constraints, asset condition and age-related issues and will result in further decline in customer supply reliability in the Preston area over the forthcoming regulatory control period. This outcome will not enable JEN to maintain network reliability, security, safety or quality of supply in Preston's supply area and does not satisfy the capex objectives. Therefore JEN provides additional material in this addendum to the Preston area conversion network development strategy submitted as a supporting capex document with JEN's April 2015 proposal which responds to issues raised in the preliminary decision[4].

To do this, this paper provides the following additional supporting material:

- Updated Category Analysis Regulatory Information Notice (CA RIN) and Electricity Distribution Price Review RIN (EDPR RIN) templates 2.2 which have been amended to transfer both historical and forecast expenditure for this project from augex to repex; and
- Independent expert report prepared by Parsons Brinckerhoff '2265052A-RPT-003 JEN Preston Area Network Development Strategy' which provides an independent assessment of the Preston conversion project and advises an investment recommendation which maximises the net present value of net market benefits to JEN's customers.

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1 ELE PL 0029 Preston Area Network Development Strategy, 25 February 2015, submitted as an augex supporting document with JEN's response to the EDPR RIN, 30 April 2015

2 Jemena Electricity Networks (Vic) Ltd, *Regulatory proposal 1 January 2016 – 31 December 2020,* 30 April 2015

3 AER, *Preliminary Decision Jemena distribution determination 2016 to 2020*, Attachment 6 – Capital expenditure, October 2015, page 6-44. 6-44, 6-53 and 6-54

4 Ibid, pages 6-44, 6-53 and 6-54

JEN has also reclassified the expenditure associated with this project for the 2016 regulatory period as replacement capital expenditure (repex) in recognition that the timing of the projects required during the 2016-20 regulatory period are driven by asset condition.

Background

The Preston area distribution network has a primary voltage level of 6.6 kV. The area is supplied from two 66/6.6 kV zone substations, Preston (P) and Preston East (EP), with the surrounding zone substations Coburg North (CN), Coburg South (CS) and North Heidelberg (NH) operating at 22 kV. The Preston Conversion program, started in 2008, aims to address the deteriorating condition of assets at P and EP and efficiently meet customer demands in the area in terms of minimising the whole life cycle cost to JEN customers.

Two credible options (Option A – convert the 6.6kV network to 22kV and Option B – replace the 6.6kV distribution assets) were presented in detail in the Preston network development strategy submitted in April 2015, and included the following economic analysis shown in Table 1 below.

Table 1: Summary of JEN's economic analysis ($'000s, real $2014 with overheads)

	Option A	Option B
Total Capital Expenditure[5]	$72,456	$100,240
Present Value at 6.24% discount rate	$56,427	$62,239

Consistent with JEN's network augmentation planning criteria, the option which maximises the Net Present Value (NPV) of the net market benefits is the preferred option. The two options A and B presented above have the same net benefit to consumers, however Option A has a lower present value cost. Therefore Option A maximises the net market benefits to consumers, compared to option B, and is the option recommended in this submission. This recommendation is also consistent with the option in JEN's April 2015 proposal.

Independent Review

In addition to JEN's April 2015 proposal we have recently engaged a consultant WSP | Parsons Brinckerhoff (WSPPB) to provide an independent assessment of JEN's proposed Preston Conversion project to independently assess that JEN conducted economic analysis consistent with its network augmentation planning criteria[6] and also that JEN's recommended option maximises the net market benefits to customers. WSPPB reviewed and developed options that also consider the whole of life cycle costs of future replacements and the potential impact of asset failures. The WSPPB independent review report is provided at Attachment 7-15. Their report identified four main credible network options, that are reproduced below:

- Option 2: Replacement of 6.6 kV distribution assets[7]
- Option 3: Conversion of the 6.6 kV network to 22 kV using standard design substations[8]
- Option 4: Conversion of the 6.6 kV network to 22 kV using non-standard design substations
- Option 5: Conversion of the 6.6 kV network to 22 kV using standard design substations, with load transfers.

[5] The total capital expenditure represents the total program fully loaded cost (i.e. capex including real 2014 cost and capitalised overheads).

[6] JEN PR 007 Network Augmentation Planning Criteria, submitted as a supporting document with JEN's response to the EDPR RIN

[7] This is the same as Option B in JEN's Preston Area Conversion Network Development Strategy (ELE PL 0029).

[8] This is the same as Option A in JEN's Preston Area Conversion Network Development Strategy (ELE PL 0029).

WSPPB's market benefit analysis of the options (i.e. using the VCR approach[9]) clearly shows that the greatest benefit will be realised by continuing with the Preston Conversion area from 6.6kV to 22kV using standard design substations (Option 3). This option has a net present value (NPV) of $206 million consisting of $45.2 million[10] (direct un-escalated $2015) augmentation costs.

WSPPB's analysis also shows that there is currently substantial load at risk which exceeds the present value cost of the preferred option. The customer benefit in terms of avoided cost of expected unserved energy greatly exceeds the net cost of the preferred option showing that the works should be undertaken as soon as practical to reduce the risk and realise these benefits. The preferred and recommended option identified by WSPPB reaffirms JEN's proposal which maximizes the net market benefit compared to other options.

Coburg South (CS) Zone Substation Supply Risk

As previously highlighted in JEN's Preston network development strategy submitted in April 2015, predominately due to the Preston conversion program, the CS zone substation is now heavily loaded as it is currently supplying a significant amount of load within the Preston area. CS zone substation is currently operating well above its station N-1 rating and is forecast to exceed its N rating[11] over the 2016 regulatory period based on a 10% Probability of Exceedance (POE). The Preston conversion program, and its options, account for the current and future capacity constraints that need to be addressed to minimise the whole life cycle cost to consumers.

As implied in the preliminary decision, if the current Preston Conversion program did not continue as planned or was deferred (i.e. meaning the existing P zone substation from 66/6.6 kV to 66/22 kV station called 'PTN[12]' was not rebuilt by 2018), then JEN would need to install a third 66/22 kV 30/33 MVA transformer at CS zone substation by November 2018. The estimated cost for this project is $10M[13] which would be required to address the significant load at risk and to avoid load shedding customers under system-normal and credible single contingency outage conditions.

This additional augmentation expenditure is not required if some of the load currently supplied out of CS zone substation is transferred to the newly built PTN zone substation by November 2018 (P Stage 6).

9 By calculating expected unserved energy (EUE), which is defined in terms of megawatt hours (MWh) per annum, and expresses this economically by applying a value of customer reliability ($/MWh).

10 Not including the sunk cost completed to date for the project.

11 "N" Rating is with all plant in service (e.g. all transformers in service)

12 As part of the Preston 6.6 kV to 22 kV conversion project, PTN would allow for significant amount of load from CS within the Preston area to be transferred to PTN.

13 Fully loaded cost real $2015 includes third 22kV bus at CS.

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GLOSSARY

Amperes (A)	Refers to a unit of measurement for the current flowing through an electrical circuit. Also referred to as Amps.
Constraint	Refers to a constraint on network power transfers that affects customer service.
Jemena Electricity Networks (JEN)	One of five licensed electricity distribution networks in Victoria, the JEN is 100% owned by Jemena and services over 320,000 customers via an 11,000 kilometre distribution system covering north-west greater Melbourne.
Maximum demand (MD)	The highest amount of electrical power delivered (or forecast to be delivered) for a particular season (summer and/or winter) and year.
Megavolt ampere (MVA)	Refers to a unit of measurement for the apparent power in an electrical circuit. Also million volt-amperes.
Network	Refers to the physical assets required to transfer electricity to customers.
Network augmentation	An investment that increases network capacity to prudently and efficiently manage customer service levels and power quality requirements. Augmentation usually results from growing customer demand.
Network capacity	Refers to the network's ability to transfer electricity to customers.
Non-network alternative	An alternative solution to growing customer demand, which does not involve augmenting physical network assets.
Planning criteria	The methodologies, inputs and assumptions that must be followed when undertaking technical and economic analysis to predict emerging power transfer limitations.
Present Value Ratio (PVR)	PVR index calculates a measure of investment efficiency. It is determined by the present value of benefit divided by the present value of cost.
Probability of exceedance (POE)	The likelihood that a given level of maximum demand forecast will be met or exceeded in any given year:
Reliability of supply	The measure of the ability of the distribution system to provide supply to customers.
10% POE condition (summer)	Refers to an average daily ambient temperature of 32.9ºC derived by NIEIR and adopted by JEN, with a typical maximum ambient temperature of 42ºC and an overnight ambient temperature of 23.8ºC.
50% POE condition (summer)	Refers to an average daily ambient temperature of 29.4ºC derived by NIEIR and adopted by JEN, with a typical maximum ambient temperature of 38.0ºC and an overnight ambient temperature of 20.8ºC.
50% POE and 10% POE condition (winter)	50% POE and 10% POE condition (winter) are treated the same, referring to an average daily ambient temperature of 7ºC, with a typical maximum ambient temperature of 10ºC and an overnight ambient temperature of 4ºC.
CBRM	Condition Based Risk Management

ABBREVIATIONS

ACS	Asset Class Strategy
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CBRM	Condition Based Risk Management
CN	Coburg North Zone Substation
CS	Coburg South Zone Substation
DDF	Degree of Polymerisation
EP	East Preston Zone Substation
EPN	East Preston Zone Substation (new 66/22kV station)
EOL	End of Life
FF	Fairfield Zone Substation
HB	Heidelberg Zone Substation
JEN	Jemena Electricity Network
MD	Maximum Demand
NEM	National Electricity Market
NER	Neutral Earthing Resistor
NH	North Heidelberg Zone Substation
NPV	Net Present Value
NS	North Essendon Zone Substation
OH&S	Operational Health and Safety
OLTC	On Load Tap Changer
P	Preston Zone Substation
PD	Partial Discharge
POE	Probability of Exceedance
PTN	New Preston Zone Substation (proposed)
PV	Pascoe Vale Zone Substation
TTS	Thomastown Terminal Station
VCR	Value of Customer Reliability
WACC	Weighted Average Cost of Capital

1. JEN'S RESPONSE TO AER PRELIMINARY DETERMINATION

As part of JEN's April 2015 proposal, we proposed $25.8 million (direct un-escalated $2015) for the Preston Conversion project under the 'augex' category. The justification for the Preston conversion project was provided in the April 2015 Preston network development strategy[14]. The document presents JEN's long term supply requirements for the Preston area, and it demonstrated that converting the Preston (P) and East Preston (EP) networks from 6.6 kV to 22 kV resulted in the most favourable net present value in terms of whole life cycle cost whilst maximising the net economic benefits to consumers.

1.1 SUMMARY OF AER PRELIMINARY DETERMINATION FOR PRESTON

In summary, the Australian Energy Regulator (AER) stated the following key findings in its 2016 to 2020 Preliminary Decision in October 2015[15] for the Preston project:

- Jemena did not engage in probabilistic planning approach;
- The AER was not satisfied that this project is justified by the need to expand the capacity or capability of the network. It is not clear that Jemena would have proposed this augmentation project if it were not for its assessment of the condition of the relevant assets (therefore the AER have not included this project within its alternative estimate of 'augex');
- If Jemena is of the view that, given the condition of the assets, it requires more than business as usual repex to meet the capex objectives, then it should provide supporting information to this effect in its revised proposal;
- Jemena dismissed other potential credible options that will alleviate capacity concerns in 6.6kV feeders and ease pressure of ageing assets.

The following sections of this report aim to respond to the AER's preliminary determination findings.

1.2 IDENTIFIED NEED

Supply to the Preston and East Preston area is inadequate because:

- Major primary and secondary plant assets such as transformers, switchgear and relays at P and EP zone substations are either at or approaching their end of life, are in generally poor condition and therefore require replacement;
- The 6.6 kV switchboards at P and EP zone substations are not built to current safety standards for arc fault containment and present an unacceptably high OH&S risk to personnel performing work in the nearby vicinity in the event of asset failure;
- There is significant load at risk at the adjacent CS zone substation with the maximum load demand projected to exceed its station N rating over the next 5 years;

[14] ELE PL 0029 Preston Area Conversion Network Development Strategy, submitted as a supporting document with JEN's response to the EDPR RIN

[15] AER Preliminary Decision Jemena distribution determination 2016 to 2020, Attachment 6 – Capital expenditure, October 2015, pages 6-44, 6-53 and 6-54.

- The 6.6 kV system (a legacy of early 1920's) is inefficient and inadequate to accommodate expected new customer connections due to its low capacity; and
- There is insufficient feeder capacity to cover emergency outage conditions in surrounding areas.

In the context of the above primary drivers, there is significant evidence[16] supporting the need for this project to continue as planned in order to maintain customer and network supply, reliability, security and safety in accordance with the NER requirements.

However, given that the timing of the projects during the 2016 regulatory period is driven primarily by the replacement needs of P and EP zone substations (with P zone substation assets requiring replacement as soon as practical closely followed by assets at EP zone substation), we have reclassified this project as repex (rather than augex). JEN note the acknowledgment in the preliminary decision that its assessment of the condition of the relevant assets is the primary driver for the project over the 2016 regulatory period. Accordingly, JEN has updated its CA RIN and EDPR RIN templates 2.2 (see Attachment 7-21) to reflect this reclassification.

1.3 OPTIONS ANALYSIS

A number of credible options to alleviate the risks and constraints in the Preston area were investigated in the April 2015 Preston network development strategy, with the focus on the long term development plans for the area. Recently, JEN has engaged WSP |Parsons Brinckerhoff (WSPPB) to provide an independent assessment of JEN's proposal including the options reviewed for this project.

The outcome of WSPPB's review provided the following options:

- Option 1: Do nothing;
- Option 2: Replacement of 6.6 kV distribution assets[17];
- Option 3: Conversion of the 6.6 kV network to 22 kV using standard design substations[18];
- Option 4: Conversion of the 6.6 kV network to 22 kV using non-standard design substations;
- Option 5: Conversion of the 6.6 kV network to 22 kV using standard design substations, with load transfers; and
- Option 6: Non-network solutions.

Options 4 and 5 are new options assessed by WSPPB. Please refer to the WSPPB's Preston Area Network Development Strategy Report at Attachment 7-15 for details on the options evaluations, including the options scope and cost.

1.4 COST BENEFIT ANALYSIS

JEN's April 2015 Preston network development strategy demonstrated that converting the P and EP networks from 6.6 kV to 22 kV option resulted in the most favourable net present value in terms of whole life cycle cost to

16 Detailed justification for the replacement needs is provided in JEN's Preston Area Conversion Network Development Strategy (ELE PL 0029) and JEN's Asset Class Strategies (ELE PL 21, 39 and 42).

17 This is the same as Option B in JEN's Preston Area Conversion Network Development Strategy (ELE PL 0029).

18 This is the same as Option A in JEN's Preston Area Conversion Network Development Strategy (ELE PL 0029).

consumers whilst maximising the net economic benefits to consumers. The paper also demonstrated that the overall total present value cost would be higher if the proposed Preston conversion works program was to be deferred.

In response to the preliminary decision relating to criticism that JEN did not use probabilistic planning and consider the cost of reliability to consumers, JEN engaged PB to independently undertake cost benefit analysis of the options using the reliability impact to consumers (i.e. VCR approach). The cost benefit analysis results for the viable options (detailed above in Section 1.3) is summarised in the table below.

Table 1–1: Summary of WSPPB identified viable options and market economic analysis

	Cost [19]	NPV	Ranking
Option 1: Do nothing	$0	($2,517M)	5
Option 2: Replacement of 6.6 kV distribution assets	$73.8M	($242M)	3
Option 3: Conversion of the 6.6 kV network to 22 kV using standard design substations	$45.2M	($206M)	1
Option 4: Conversion of the 6.6 kV network to 22 kV using non-standard design substations	$46.9M	($207M)	2
Option 5: Conversion of the 6.6 kV network to 22 kV using standard design substations, with load transfers	$49.5M	($410M)	4

Please refer to Section 4.2 of Attachment 7-15 for details on the cost benefit analysis and addressing the optimal timing for the proposed program of works.

Although it was not included in the analysis undertaken by PB, it should also be noted that by not continuing with the Preston conversion program, specifically building PTN zone substation by 2018, JEN would need to install a third 66/22 kV 30/33 MVA transformer at Coburg South (CS) Zone Substation prior to summer 2018. This would be required to address the significant load at risk with the station well exceeding its N-1 rating and reaching it N rating (the amount of unserved energy at risk is provided in JEN's April 2015 Preston network development strategy). JEN has recently performed a cost benefit analysis for this as a stand-alone project, which demonstrated that installing a third transformer at CS zone substation would be economically justified, based on the value of customer load at risk, should the Preston conversion project not proceed as planned.

Based on an annual discount rate of 6.24%, value of customer reliability (VCR) of $38.40 per kWh and a planning horizon of 10 years, Table 1–2 presents a summary of the economic analysis for CS 3rd transformer project, with a Present Value Ratio (PVR) of 1.2, which shows this project would be economically viable.

Table 1–2: Summary JEN's economic analysis for CS 3rd Transformer

	Total
Cost	$10,000k[20]
Present value of costs	$8,339k
Present value of benefits	$9,575k
NPV	$1,235k
PVR	1.2

[19] Direct un-escalated real 2015 dollars.

[20] Fully loaded cost in real $2015 includes third 22kV bus at CS.

1.5 PREFERRED OPTION AND CONCLUSION

In alignment with the National Electricity Objective (NEO), the preferred and recommended strategy is the option that maximises the net economic benefits whilst maintaining a safe and reliable supply to customers. Option 3, converting of P and EP network from 6.6 kV to 22 kV using standard design substations, is shown to maximise the net economic benefit, and is therefore the preferred option for implementation.

This analysis has reaffirmed JEN's proposal presented in the April 2015 Preston network development strategy to continue with the Preston area conversion program which was started in 2008. Jemena accepts that this work could be reclassified as 'repex' rather than 'augex' and has updated the CA RIN and EDPR RIN template 2.2 to reflect this reclassification.

The Preston area conversion program proposed completion timing and cost is again presented in Table 1.3 and Table 1.4 below.

Table 1–3: Preston conversion program 2016-2020 Period

Stage	Timing	Cost (direct un-escalated real 2015)
P & EP Stage 4	Nov 2016	$4.85M
P Stage 5	Aug 2017	$3.74M
P Stage 6	Nov 2018	$12.19M
EP Stage 5	Nov 2019	$5.02M

Table 1–4: Preston conversion program 2021-2025 Period

Stage	Timing	Cost (direct un-escalated real 2015)
EP Stage 6	Nov 2021	$7.05M
EP Stage 7	Jun 2022	$8.94M
EP Stage 8	Dec 2022	$3.41M