RIT-D DRAFT PROJECT ASSESSMENT REPORT

PR292 South Marsden Park Stage 2

Endeavour Energy

January 2018

CONTENTS

1.0 EXECUTIVE SUMMARY

This Draft Project Assessment Report has been prepared by Endeavour Energy in accordance with the requirements of clauses 5.17.4(i) of the National Electricity Rules (NER).

The purpose of this report is to demonstrate the basis for the selected option to address the network limitations within the subject area(s). This report has been prepared following the publication of a Non-Network Options Report.

This Draft Project Assessment Report:

- Describes the network need which Endeavour Energy is seeking to address, together with the assumptions used in identifying that need.
- Describes the credible options that are considered in this RIT-D assessment
- Describes the methods used in quantifying each class of market benefit.
- Quantifies costs (with a breakdown of operating and capital expenditure) and classes of market benefits for each of the credible options
- Provides reasons why differences in changes in voluntary load curtailment, costs to other parties, option value and timing of other distribution investment do not apply to a credible option.
- Provides the results of NPV analysis of each credible option and accompanying explanatory statements regarding the results
- Identifies the preferred option.
- Seeks stakeholder input in consideration of the preferred option.
- Provides contact details for queries relating to this RIT-D project.

The Marsden Park Industrial precinct forms part of the programmed release areas of the North West Priority Growth Area.

The RIT-D application guidelines currently focus on monetising the risks of interruptions to supply to *connected* customers based on the value of customer reliability (VCR). The RIT-D guidelines currently do not have appropriate mechanisms for monetising the economic risks associated with deriving *unconnected* customers of supply. Endeavour Energy believes that this project belongs to the category of *unconnected* customers awaiting supply, as the investment is required in order to provide supply to customers who would otherwise remain unconnected (development would not proceed due to lack of power supply). As a proxy, therefore, Endeavour Energy has employed the same mechanism as provided in the RIT-D guidelines for the purpose of monetising the risks of non-supply to connected customers. One interpretation of this is that connection of new customers would continue regardless of available capacity and the ensuing risks of losing supply would be evaluated using Value of Customer Reliability (VCR).

Five options have been considered for evaluation in this report. All five options involve the establishment of a permanent zone substation on the same block as the existing temporary South Marsden Park zone substation. Option 1 involves completing the works in a single stage whereas the other options involve staging the works across two stages. The ultimate configuration of all five options is the same and will form a key link in the supply strategy for the North West Priority Growth Area.

Option 1 is the preferred option which maximizes the net market benefits and is expected to cost $24.6 Million excluding contingencies. This option establishes a permanent two transformer zone substation and a 132kV feeder between South Marsden Park ZS and Marsden Park ZS.

For the purpose of the RIT-D analysis, a number of scenarios have been considered for sensitivity analysis. These scenarios are based on higher and lower variations in the following factors: demand growth, VCR, capital cost, discount rate. For all of these scenarios, Option 1 remains the option that delivers the highest net market benefit.

2.0 INTRODUCTION

This Draft Project Assessment Report has been prepared by Endeavour Energy in accordance with the requirements of clauses 5.17.4(i) of the National Electricity Rules (NER).

This report describes the application of the Regulatory Investment Test for Distribution (RIT-D) for addressing supply to the South Marsden Park Industrial Precinct.

Endeavour Energy received no submission for non-network options to address supply constraints in the area. As a result, non-network options have not been considered to be feasible solutions for the analysis.

This Draft Project Assessment Report:

- Provides background information on the network limitations within the subject area.
- Describes the network need that Endeavour Energy is seeking to address, together with the assumptions used in identifying that need
- Describes the credible options that are considered in this RIT-D assessment
- Describes the methods used in quantifying each class of market benefit.
- Quantifies costs (with a breakdown of operating and capital expenditure) and classes of market benefits for each of the credible options
- Provides reasons why differences in changes in voluntary load curtailment, costs to other parties, option value and timing of other distribution investment do not apply to a credible option.
- Provides the results of NPV analysis of each credible option and accompanying explanatory statements regarding the results
- Identifies the preferred option
- Seeks stakeholder input in consideration of the preferred option.
- Provides contact details for queries relating to this RIT-D project.

Endeavour Energy adopts a process of exploring existing feasible methods of supply in assessing the ability to supply development applications. However, for greenfield sites, Endeavour Energy needs to determine the length of time that the existing network will be able to sustain the prevailing precinct development rate before further investment is required. Endeavour Energy needs to balance timely investment with the ramping up of demand as businesses and houses are built and occupied. It also needs to mitigate the risks of stalling developments due to delayed supply of power to developments resulting in adverse impacts on the supply of land for housing and employment needs.

3.0 CONSULTATION

3.1 SUBMISSIONS RECEIVED

Endeavour Energy has published a Non-Network Options Report together with a Request for Information in accordance with internal procurement processes. No submissions were received from registered participants and interested parties in relation to this document.

3.2 SUBMISSIONS REQUESTED

Endeavour Energy seeks written submissions from market participants and interested parties in relation to the preferred option outlined in this document. Submissions are due on or before 31 March 2018. Submissions may be published.

3.3 ENQURIES

All submissions and enquiries regarding this document should be directed to Endeavour Energy's Manager Asset Strategy and Planning at consultation@endeavourenergy.com.au

4.0 NETWORK NEED

4.1 EXISTING NETWORK OVERVIEW

The study area is supplied from a temporary 132/11kV zone substation with a single 15MVA power transformer. Supply to the zone substation is provided through a single 132kV transmission feeder from Schofields Zone Substation. Given that duplicate supply is not available to the 11kV busbar at the temporary zone substation, any load supplied from South Marsden Park Zone Substation (ZS) is considered to be “Load at Risk”, since the failure of a single network element would result in an outage to customers supplied from the zone substation.

In the event of an outage of the temporary zone substation, limited back-up capacity is available through surrounding 11kV feeder network ties to Rooty Hill ZS, Schofields ZS and Marsden Park ZS. However, the available capacity through these network links will diminish over time as these feeders are required to service growth closer to their respective zone substation’s catchment areas.

Additional feeder ties are anticipated to be developed between Marsden Park ZS and South Marsden Park ZS as part of the urban development of the area. However, staggered development, due to fragmented ownership of land could complicate the development of these ties. Therefore, any capacity provided through these potential network links cannot be relied upon and cannot be considered as part of the servicing strategy to the study area.

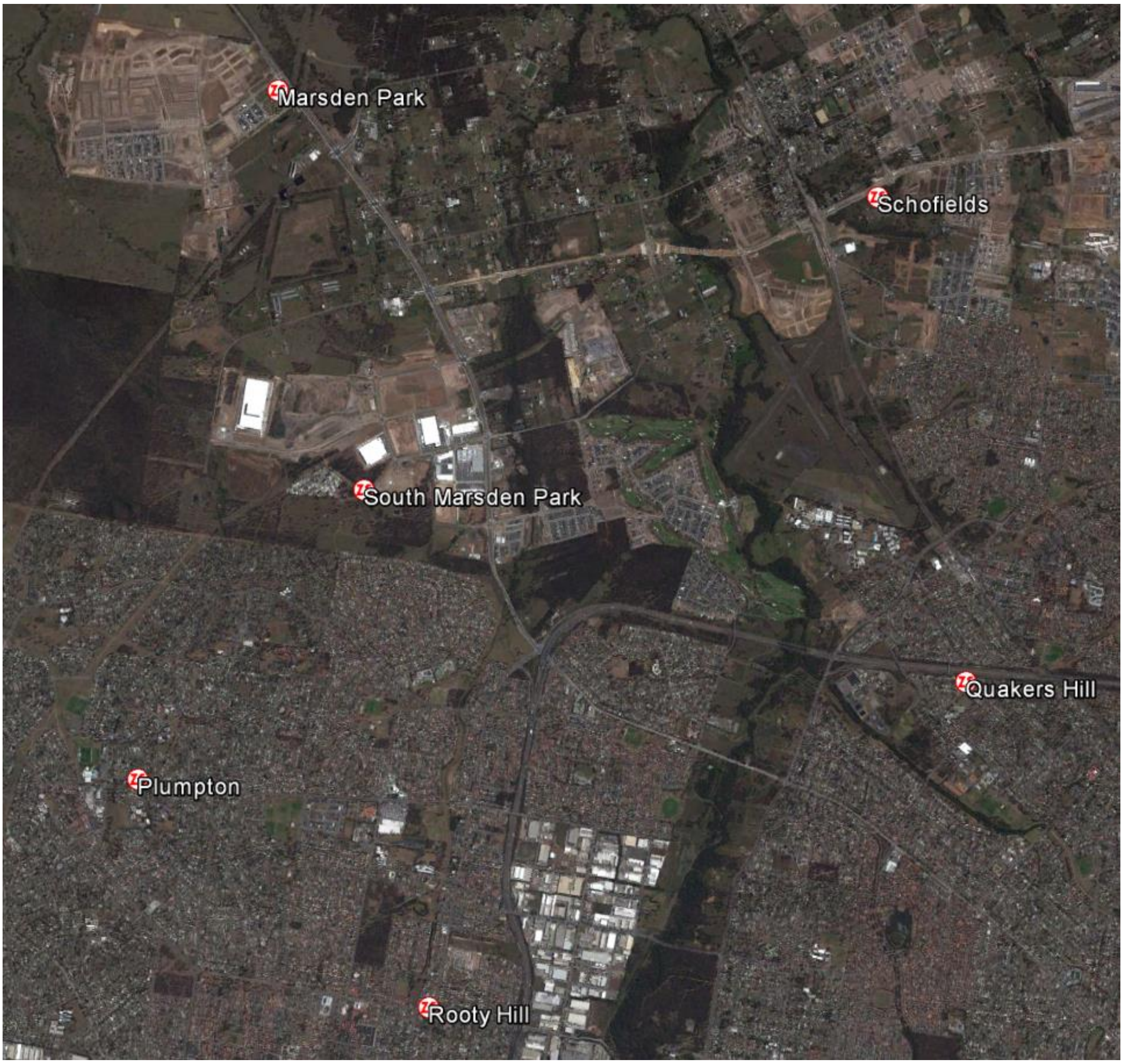

Figure 1 - Overview of Study Area November 2016

4.2 DESCRIPTION OF NETWORK NEED

Marsden Park Industrial precinct, shown in Figure 2 below, was rezoned by Planning NSW in 2010 under the Precinct Acceleration Protocol and subsequently included as part of the North-West Priority Growth Area. The precinct includes a total of 316 hectares of commercial, bulky good, retail and industrial land as well as 3,700 dwellings. Once fully developed, the precinct will create approximately 17,000 jobs and house 10,000 people requiring a diversified load demand of 55-60MVA.

The early stages of commercial and industrial development are underway in the Marsden Park Industrial precinct. Over 20 businesses have lodged applications for load and several applications have been submitted to supply residential developments. The diversified load estimate of received applications is over 15MVA, exceeding the capacity of the temporary zone substation. Nearby feeder ties will be relied upon to service anticipated load growth beyond the available capacity of the temporary zone substation and without further network investment, provision of supply to load growth exceeding the capacity of the existing network will not be possible.

Table 1 reflects a preliminary forecast based on submitted applications in the Marsden Park Industrial precinct combined with estimated development of the vacant sites zoned for development.

Table 1 – Summary of forecast load, available capacity and load at risk at South Marsden Park ZS

South Marsden Park ZS	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Forecast Load (MVA)	11.71	14.74	17.94	20.72	23.42	26.13	28.83	31.53	34.23	36.94
Total Available Capacity (MVA)	23.86	22.06	21.06	**19.76**	**19.05**	**19.05**	**19.05**	**19.05**	**19.05**	**19.05**
Capacity from Surrounding 11kV Network (MVA)	11.33	12.93	11.13	9.13	7.83	7.13	7.13	7.13	7.13	7.13
Maximum Load at Risk (MVA)	0.00	3.61	8.81	12.89	16.30	19.00	21.70	24.40	27.11	29.81

Establishment of a new permanent zone substation in the area is required to service the ongoing development of the precinct and provide suitable security of supply to the growth area.

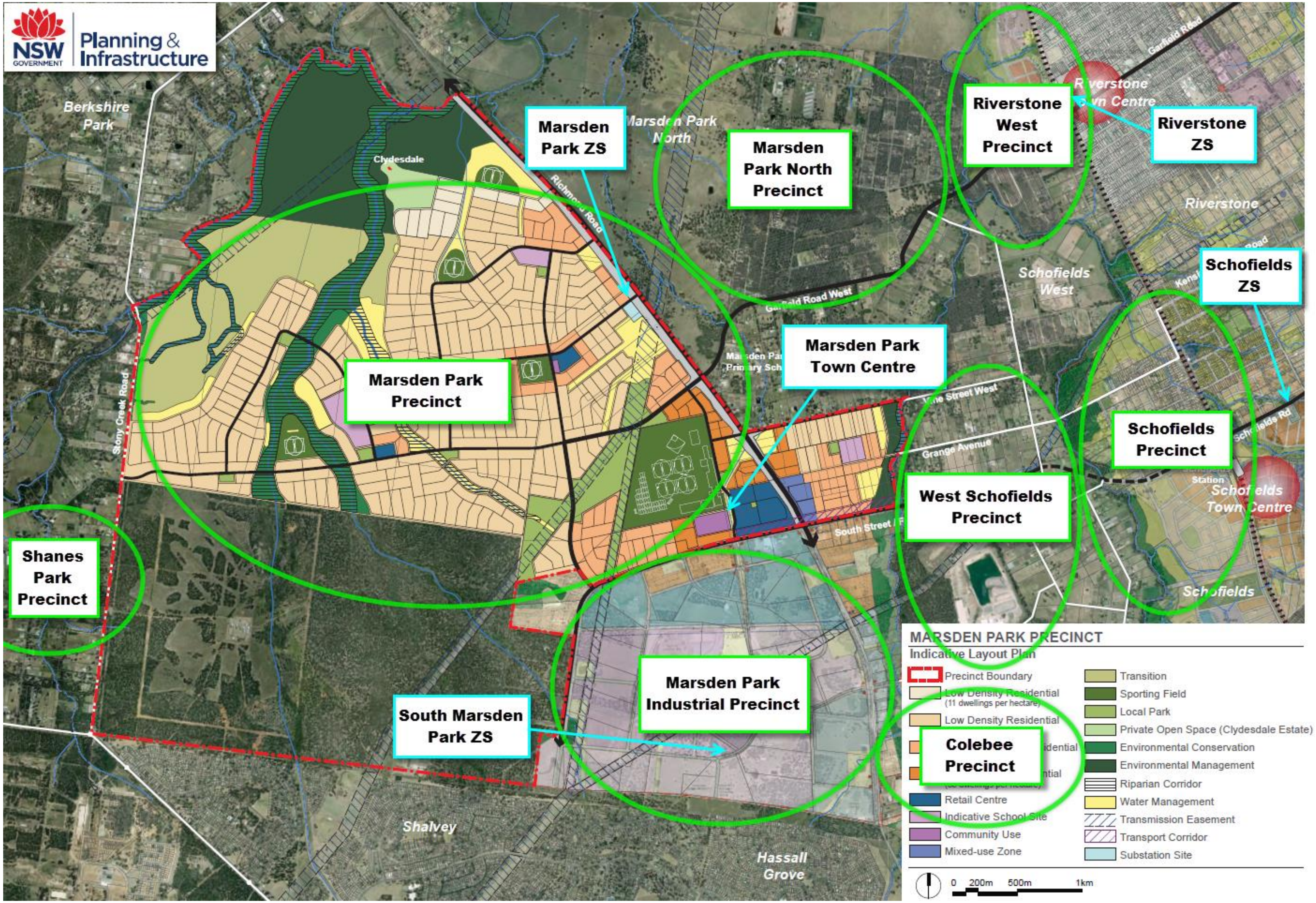

Figure 2 - Context Map

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4.3 QUANTIFICATION OF NETWORK NEED

The substantial commercial, industrial and residential development for Marsden Park Industrial precinct cannot be sustained without investment in additional capacity. A temporary zone substation has already been established in order to service the initial stages of development and defer the establishment of a permanent zone substation. For the purpose of quantifying the network need, it has been assumed that additional developments continue to connect to the existing network. In practice, it must be recognised that this will lead to deteriorating reliability and inability of the Network Service Provider to meet System Standards. Eventually this will necessitate "*reliability corrective action*".

The forecast impact of the identified need discussed in Section 4.2 is presented in Table 2 below. It should be noted that the load at risk stated in the table below represents load that is yet to be connected to the network (or new connections in a greenfield area).

The table shows: Load at risk (MVA) – this is the MVA load that will not be supplied either in the event of a contingency or in the event of not augmenting the network in order to facilitate connections as is the case with Marsden Park Industrial precinct because of insufficient capacity in the network to sustain the level of expected growth. Expected unserved energy is capped at 360MWh as outlined in section 5.1.

Table 2 - Load at Risk and Value of Expected Unserved Energy

Year	Load At Risk (MVA)	Expected Unserved Energy (MWh)	Customer Value of Expected Unserved Energy ($,000)
2018	4.8	4.8	186
2019	7.9	15.7	610
2020	11.1	32.9	1,278
2021	13.8	153.3	5,957
2022	16.5	360.0	13,986
2023	19.2	360.0	13,986
2024	21.9	360.0	13,986
2025	24.6	360.0	13,986
2026	27.4	360.0	13,986
2027	30.1	360.0	13,986
2028	32.8	360.0	13,986

5.0 METHODOLOGY AND ASSUMPTIONS

5.1 METHODOLOGY

The assessment of this project is based on the RIT-D and the RIT-D application guidelines.

A baseline risk position has been established on the basis of a ‘Do-Nothing” option. The project involves the establishment of a permanent zone substation to service the 316 hectares of employment land and 3,700 dwellings. A do nothing approach means that supply for ongoing development in the precinct is required from the existing temporary 15MVA zone substation. Connection of these new developments in a business as usual scenario will result in Endeavour Energy being unable to meet its NER system standard obligations and hence result in ‘reliability corrective action’.

A core justification for this project is based on load at risk and energy not supplied to customers waiting to connect. This is different to a situation where already connected customers risk losing supply. Arguably, the value that connected customers place on continuity of supply is different to the value customers waiting to connect will place on having access to supply. However, neither the RIT-D application guidelines nor the AEMO VCR guidelines provide any guidance on procedures to follow in such greenfield development situations. Hence, the same VCR value has been applied as a default position to the energy at risk values established from the above proposition. For a greenfield situation such as this, where the forecast demand rapidly exceeds the available capacity in the network, the VCR benefits to be captured from formulating a project to address network shortfalls can quickly rise to extremely large sums. In order to derive meaningful results when comparing options against each other and consistent with industry practice elsewhere, the annual VCR benefits that can be captured in a project has been capped corresponding to an annual expected unserved energy value of 360MWh. This is reflected in Table 5 above.

Other market benefits have been addressed in the relevant sections of this document.

5.2 ENERGY AT RISK

The Energy at Risk (EAR) has been estimated from the annual peak demand forecasts and load duration curves. The energy at risk is considered to be the energy above firm capacity (or above “N-1” capacity). Two components of energy at risk are calculated:

a) Energy at risk above “N-1” capacity but below “N” capacity
b) Energy at risk above “N” capacity.

In the former case, the energy at risk is subject to the probability of an outage occurring. In the latter case, if new connections to the existing network continued to be made, the ‘energy at risk’ above N capacity simply refers to the energy that cannot be supplied at all due to insufficient capacity in the network. Hence in this situation, the expected unserved energy is the total energy at risk.

5.3 EXPECTED UNSERVED ENERGY

For the purpose of undertaking the RIT-D, the amount of expected unserved energy was estimated by taking 30% weighting of the unserved energy at 10% PoE maximum demand forecast and 70% weighting of the unserved energy at 50% PoE maximum demand forecast. This is to account for uncertainty in the demand forecast and is consistent with practices adopted by AEMO and other distribution network businesses in Australia.

As stated above, all of the energy at risk above “N” capacity is taken to be “Expected Unserved Energy” where the probability of element loss is used to reduce the “Expected Unserved Energy”. However, where loads are between “N-1” capacity and “N” capacity, the energy at risk is subject to a probability of an outage occurring to determine the “Expected Unserved Energy”.

5.4 LOAD PROFILE CHARACTERISTICS

The supply area forms a part of the rapidly growing North West Priority Growth Area. The existing network is still quite rural, as a result, the existing load profile is not representative of the load that will ultimately be services from the new zone substation. For the probabilistic planning purposes, it is considered that normalised characteristics of a similar mix of industrial, commercial and residential load would be an appropriate proxy to use in the absence of actual data. The load duration curves for Seven Hills Zone Substation which supplies an appropriate mix of the various load types has been used for the purpose of this RIT-D analysis.

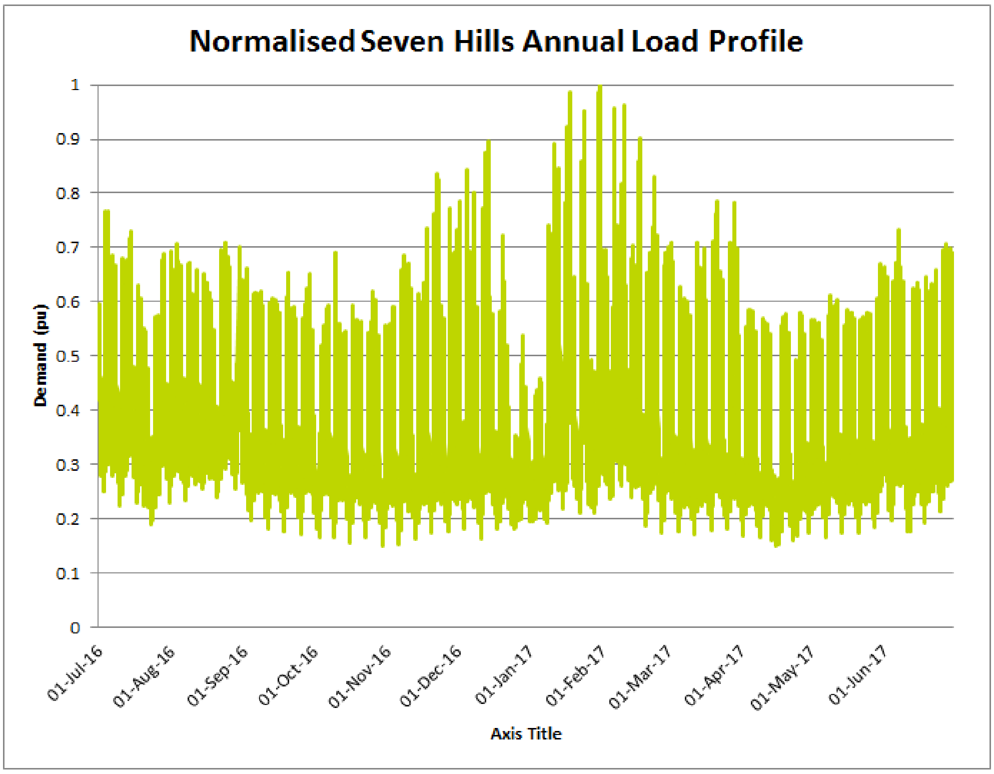

Figure 3 - Normalised Annual Load Profile

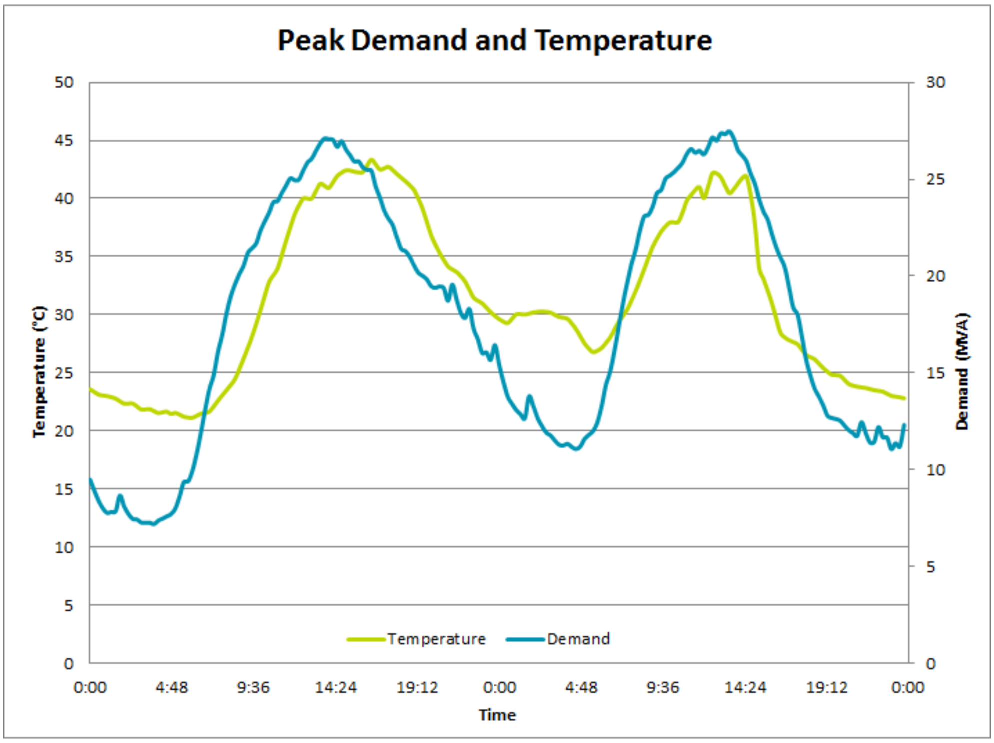

Figure 4- Summer Peak Day Profiles

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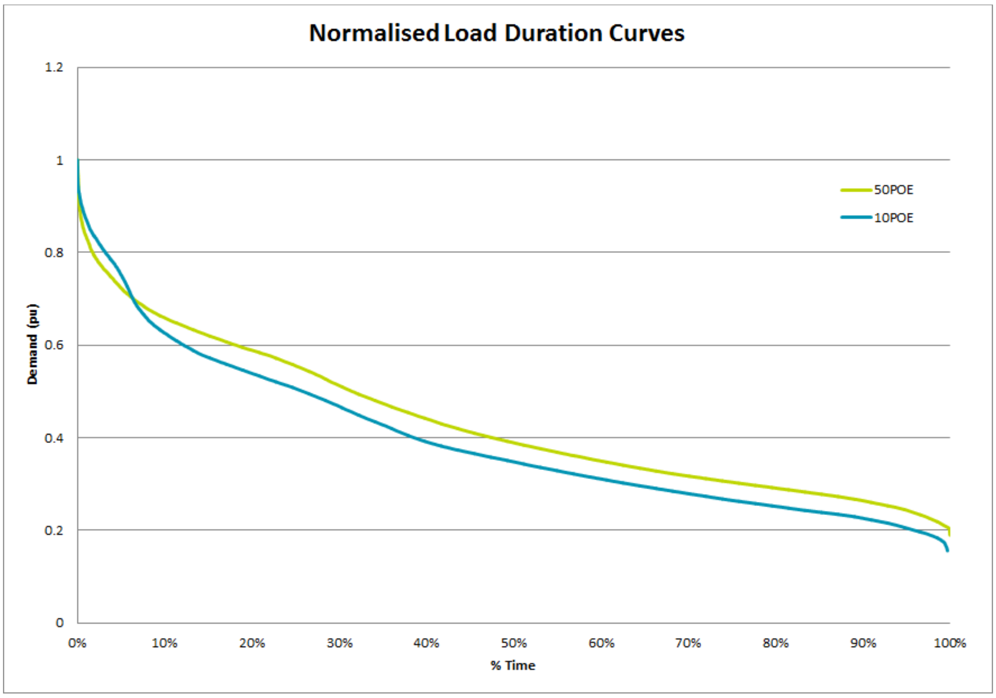


Figure 5 - Load Duration Curves

5.5 LOAD TRANSFER CAPACITY AND SUPPLY RESTORATION TIMES

The Marsden Park Industrial precinct is expected to grow rapidly. The opportunities for load transfers to adjoining areas are extremely limited due to the sparse existing network and the pace of growth in the area.

If connections to the existing network continued without further investment, the opportunities for load transfer would be further reduced, resulting in long supply restoration times. This will result in significant organisational, economic and local government risks that are not otherwise captured in the RIT-D analysis.

5.6 PLANT FAILURE RATES

The most significant risk of loss of supply to the Marsden Park Industrial precinct is the loss of a single network element at the temporary South Marsden Park Zone Substation. There is limited backup capacity in the region to service the current loads, and any further connections will be subject to the risk of extended outages in the event of failure of the South Marsden Park ZS transformer/132kV feeder. Hence it has been considered appropriate to use the transformer failure scenario as the most significant risk against which to evaluate this project.

Table 3 - Transformer Failure Rates

Major Plant Item: Transformer		Interpretation
Transformer failure rate per 100 transformers per year (major fault)	1 failure per 100 transformers per annum	A major failure is expected to occur once per 100-transformer years
Duration of outage (major fault)	2.6 months	A total of 2.6 months is required to repair/replace the transformer, during which time the transformer is not available for service.

5.7 DISCOUNT RATES

The choice of discount rate will impact on the estimated present value of net market benefits, and may affect the ranking of alternative options.

The RIT-D recommends the use of the regulated weighted average cost of capital (WACC) as the lower bound in RIT-D analysis. A real, pre-tax discount rate of 6.76% (WACC + 2%) has been adopted in this assessment. The lower bound has been selected as the current real WACC of 4.76%. An upper bound for sensitivity analysis has been selected as 8.76 (or WACC plus 4%).

5.8 PLANT RATINGS

Endeavour Energy has assumed a 10% increase above nameplate rating for emergency purposes for the temporary power transformer at the temporary South Marsden Park ZS. An emergency 11kV feeder rating of 320A has been used to determine the available back-up capacity. The standard design rating of 240A per 11kV feeder has been used to determine available base capacity.

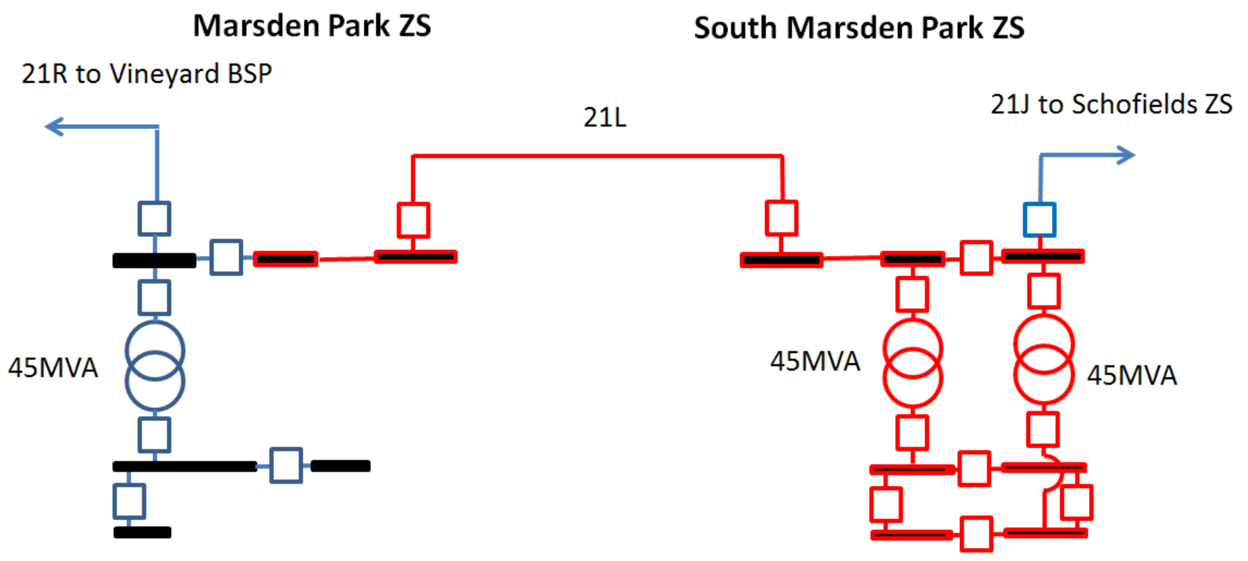
5.9 VALUE OF CUSTOMER RELIABILITY

A volume weighted value of customer reliability (VCR) value has been used for the evaluation. This is based on AEMO published VCR values for residential, commercial, industrial, agricultural sectors.

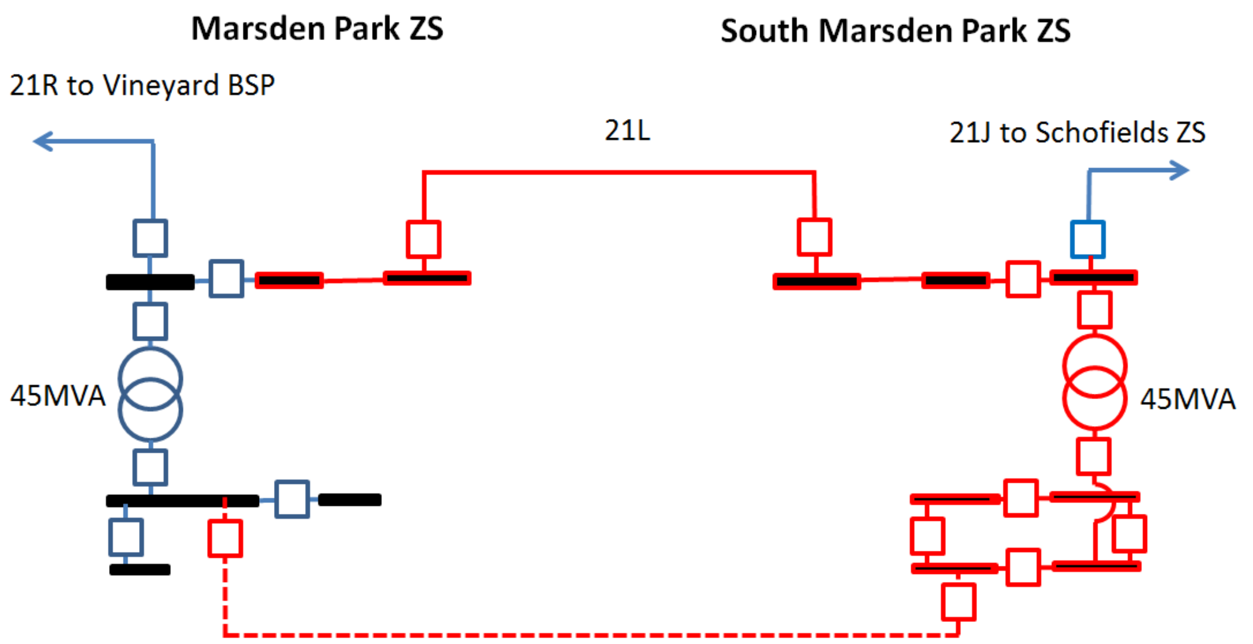
6.0 CREDIBLE OPTIONS CONSIDERED

Five credible options were considered. All options include the ultimate establishment of the permanent South Marsden Park ZS with 2 x 45MVA transformers and a 132kV feeder between South Marsden Park ZS and Marsden Park ZS (Feeder 21L). The difference between options is how the development is staged.

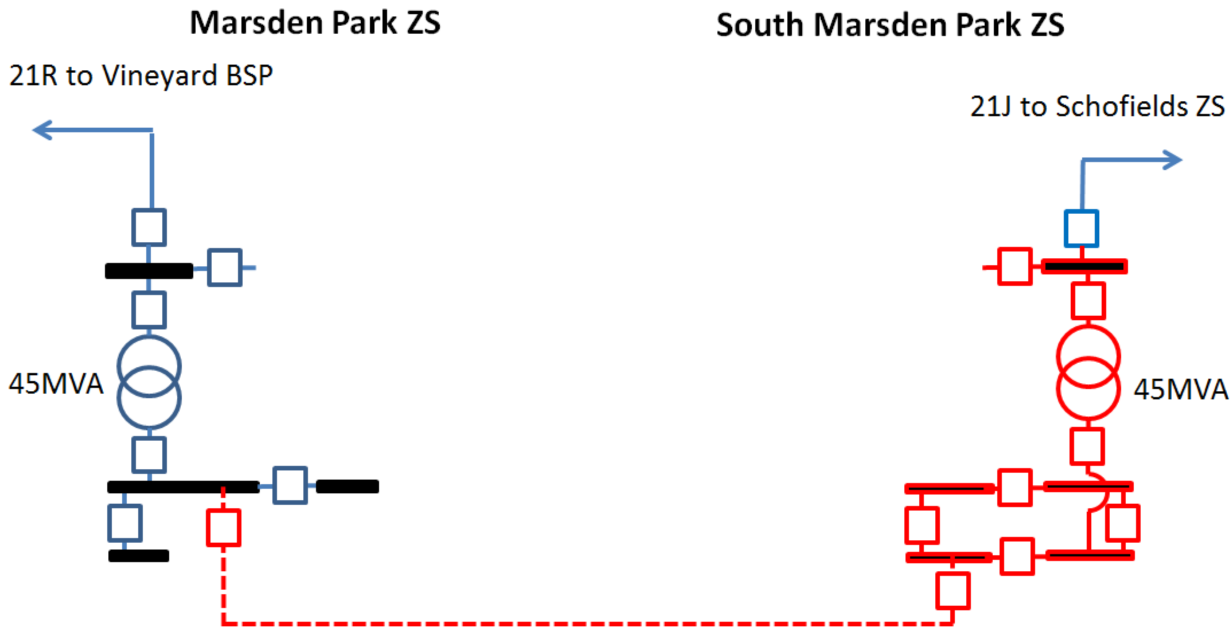
Option 1 includes the completing the works in a single stage.



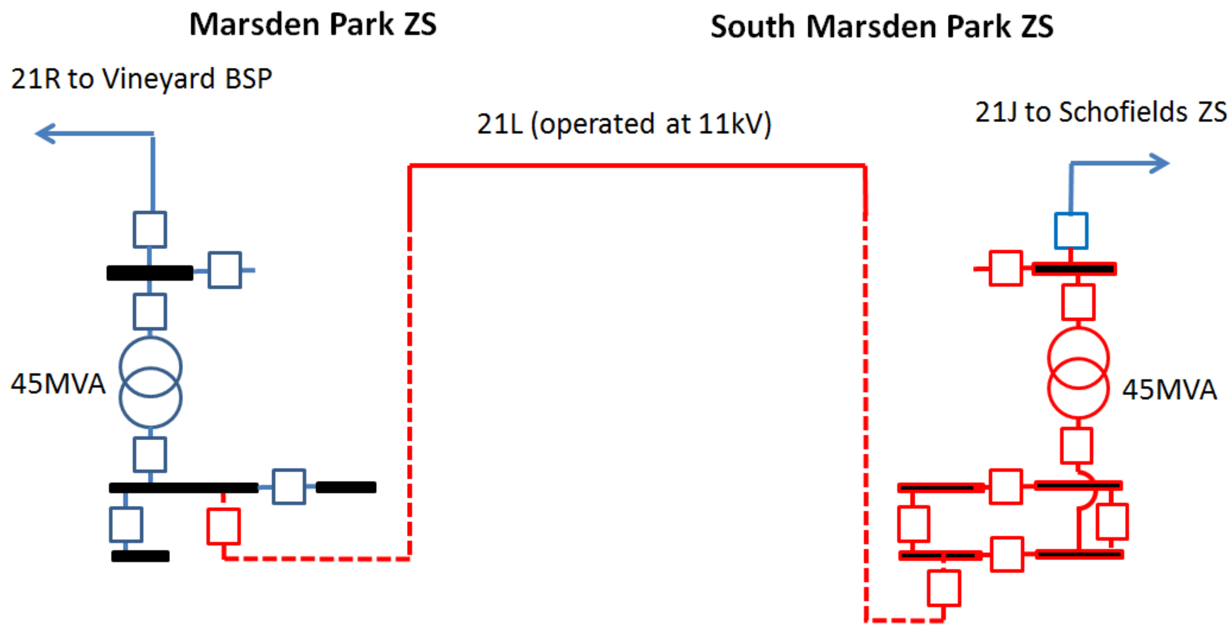
Option 2a includes the establishment of a single 45MVA transformer and 132kV Feeder 21L in the first stage. Additional 11kV feeder ties would also be developed between South Marsden Park ZS and Marsden Park ZS to provide additional back-up capacity between the two zone substations. The second stage would then establish the second 45MVA transformer.



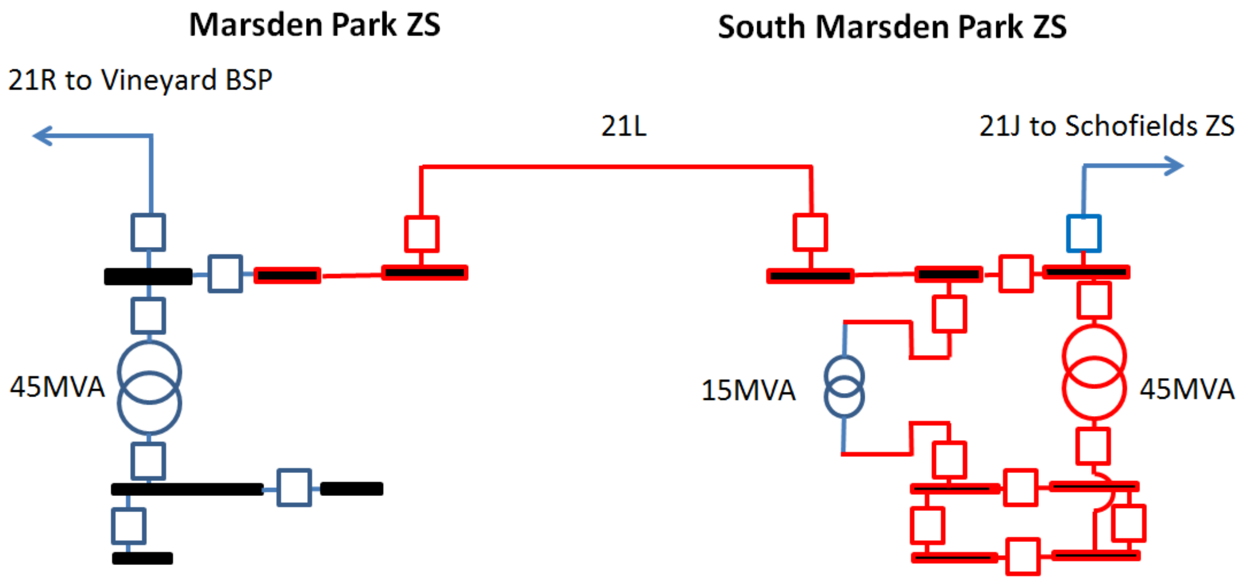
Option 2b includes the establishment of a single 45MVA transformer in the first stage. Additional 11kV feeder ties would also be developed between South Marsden Park ZS and Marsden Park ZS to provide additional back-up capacity between the two zone substations. The second stage would then establish the second 45MVA transformer and 132kV Feeder 21L.



Option 2c includes the establishment of a single 45MVA transformer and 132kV Feeder 21L in the first stage. Feeder 21L would be operated at 11kV initially to provide 11kV back-up capacity between the two zone substations. The feeder would then be converted to 132kV operation in the subsequent stage along with the establishment of the second 45MVA transformer.



Option 3 includes retaining the temporary 15MVA transformer, establishing a new 45MVA transformer and establishing 132kV Feeder 21L in the first stage. The temporary 15MVA transformer would then be replaced with a new 45MVA transformer in the second stage.



7.0 MARKET MODELLING

The RIT-D states that the preferred option is the credible option that maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the NEM.

The market benefit of a credible option is calculated by comparing the state of the world with the credible option in place with the state of the world in the base case.

In order to calculate the outcomes in the relevant 'state of the world', Endeavour Energy has developed a model which incorporates the key variables that drive market benefits, with particular emphasis on evaluating risks of involuntary load shedding.

The market benefits that can be considered under the National Electricity Rules are:

- Changes in voluntary load curtailment (considered a negative benefit)
- Changes in involuntary load shedding and customer interruptions caused by network outages
- Changes in costs to other parties (timing of new plant, capital costs, operating and maintenance costs)
- Differences in timing of expenditure
- Changes in load transfer capacity and the capacity of embedded generators to take up load
- Option value
- Changes in electrical energy losses
- Any other class of market benefit determined to be relevant by the AER

7.1 CLASSES OF MARKET BENEFIT CONSIDERED

The classes of market benefits that are considered material and have been quantified in this RIT-D assessment are:

- Changes in involuntary load shedding and customer interruptions caused by network outages
- Differences in timing of expenditure
- Option value

7.1.1 CHANGES IN INVOLUNTARY LOAD SHEDDING

Increasing the supply capability in Marsden Park Industrial supply area increases the supply available to meet the growth in demand within these areas. This will provide a greater reliability for this region by reducing potential supply interruptions and consequent risk of involuntary load shedding. The present rules only allow for consideration of changes in involuntary load shedding for connected customers. The establishment of supply in a greenfield housing development where potential customers would otherwise have to go without supply is therefore captured using changes in involuntary load shedding.

7.1.2 DIFFERENCES IN TIMING OF EXPENDITURE

A fundamental difference between the two groups of options considered is whether to build the zone substation in full configuration up front or to carry out the first stage works first and wait for the capacity provided by these works to be exhausted before a second stage is planned to be brought on line.

The NPV calculation intrinsically takes into account the savings from deferring the second stage of the zone substation.

7.1.3 OPTION VALUE

Endeavour Energy notes that the AER's view is 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 RIT-D proponent are sufficiently flexible to respond to that change.

Endeavour Energy also notes the AER's view that appropriate identification of the credible option and reasonable scenarios captures any option value as a class of market benefit under the RIT-D.

Endeavour Energy has already staged the construction of the South Marsden Park Zone Substation with the establishment of a temporary single transformer substation and now has an established history of significant growth in connections and demand growth in this area.

Significant additional enquiries from high energy customers requiring high reliability seeking to establish in the area have been received. The availability of firm substation capacity with suitably zoned and appropriately serviced industrial land close by is very likely to attract such customers to the area.

The net market benefits delivered by further staged options is extremely close to the net market benefits delivered by the full zone substation due to the high rate of growth in the area. Further staging is therefore not attractive. The availability of a full zone substation in this area has the added option value of allowing Endeavour Energy to respond quickly and favourably to high value customers seeking connection.

7.2 CLASSES OF MARKET BENEFIT NOT CONSIDERED TO BE MATERIAL

The classes of market benefits that are not considered material are listed below:

- Changes in voluntary load curtailment
- Changes in load transfer capacity and the capacity of embedded generators to take up load
- Changes in costs to other parties
- Changes in electrical energy losses

7.2.1 CHANGES IN VOLUNTARY LOAD CURTAILMENT

Voluntary load curtailment is when customers agree to reduce their load to address a network limitation in return for a payment. A credible demand side option to enlist such customers could lead to a reduction in involuntary load shedding, that is, increase in voluntary load reduction.

A Non-network Options Report and associated Request for Information did not attract any submissions.

In the absence of any credible demand side options, Endeavour Energy has not estimated any market benefits associated with changes in voluntary load curtailment as there is insufficient capacity in the existing customer base to deliver sufficient voluntary demand reduction.

7.2.2 CHANGES IN LOAD TRANSFER CAPABILITY

The opportunities for further load transfers in relation to the existing supply into the area are limited as the adjacent network supplies other growth areas from other zone substations. There is a need to extend the existing network to provide for additional connections from new customers from new residential, commercial and industrial development in the area. Due to the small rural nature of the existing load in the area, and nearby areas growing at significant rates simultaneously, load transfers cannot be considered in a meaningful way.

7.2.3 CHANGES IN COSTS TO OTHER PARTIES

In this instance, Endeavour Energy has not identified any changes in costs to other parties from developing the credible options identified in this document.

7.2.4 CHANGES IN ELECTRICAL LOSSES

Endeavour Energy recognises that there would be small changes in the loss profile for customers serviced out via the two groups of options considered – particularly where there is a difference in the timing of the second transformer and 132kV Feeder 21L. As the majority of the customers to be connected will be general customers (rather than site specific customers), the impact of the small change from one to two transformers is unlikely to have a significant impact on the network wide distribution loss factors which would be applicable to these and other customers. Hence changes in electrical losses have not been modelled.

7.3 OPTION COSTS

The capital and operating cost assumptions for each credible option, based on standard planning estimates, are summarised in Table 4. Given that establishment of the temporary zone substation has been referred to as Stage 1 of the South Marsden Park ZS Establishment, the first stage of the project considered in this report will be Stage 2, followed by Stage 3, if required.

Table 4 - Option Costs

Option	Capital Cost	O&M Cost
Baseline Risk	$0M	$0 incremental
Option 1 – Permanent 45MVA firm zone substation + Feeder 21L	$22.7M	2.5% of capital cost p.a.
Option 2a – Single 45MVA zone substation + Feeder 21L + Stage 3 later	$23.1M	2.5% of capital cost p.a.
Option 2b – Single 45MVA zone substation + Stage 3 later	$22.3M	2.5% of capital cost p.a.
Option 2c – Single 45MVA zone substation + Feeder 21L (11kV) + Stage 3 later	$22.2M	2.5% of capital cost p.a.
Option 3 – Single 45MVA zone substation + 15MVA temporary transformer + Feeder 21L + Stage 3 later	$22.3M	2.5% of capital cost p.a.

7.4 SCENARIOS AND SENSITIVITIES

The capital and operating cost assumptions for each credible option are summarised in Table 5.

Table 5 - Capital and Operating Cost Assumptions

Variables	Values
Maximum demand forecasts	Base (expected) growth scenario presented in section 4.2
Capital costs	Base estimates provided in Table 11
O&M costs	2.5% of the capital costs
Value of customer reliability	Base estimates provided in section 7.4.3
Discount Rate	6.76%

7.4.1 DEMAND FORECASTS

The maximum demand forecasts have been derived from a projection of the take up of residential lots released by developers. Notionally, this is on a 50% probability of exceedance basis. For sensitivity analysis, this base forecast has been varied by ± 10%.

7.4.2 CAPITAL COSTS

Capital cost estimates have been based on standard planning cost estimates of the detailed scope of work including a high level scope of work for the zone substation construction. For sensitivity analysis, these estimates have been varied by ± 10%.

7.4.3 VALUE OF CUSTOMER RELIABILITY

This analysis adopts the value of customer reliability values published by AEMO to calculate the expected unserved energy. The ratio of load types has been estimated and used to calculate the weighted aggregate VCR value and then applied to the energy at risk. As the values published by AEMO vary quite significantly from data previously published, it was not considered appropriate to use a percentage variation in VCR values for the purpose of sensitivity testing. Based on the estimated load composition of the subject area, a volume weighted VCR value of $38.85 per kWh has been derived and used in the RIT-D analysis. A variation of ±$10 has been used for sensitivity testing.

7.4.4 DISCOUNT RATES

The RIT-D guidelines suggest the use of a commercial discount rate appropriate for the analysis of a private enterprise investment in the electricity sector. For historical internal governance purposes, Endeavour Energy has employed the regulated WACC in all its project evaluations. For these historical reasons it has been deemed appropriate to use a base case discount rate referenced to the prevailing regulated WACC. A base case discount rate of 6.76% has been used (WACC+2%). For sensitivity analysis, a lower bound discount rate of the WACC (4.76%) and a higher bound of 8.76% have been used.

7.4.5 SUMMARY OF SENSITIVITIES

Table 6 below describes the variations in input parameters used for the purpose of defining various scenarios.

Table 6 - Variables for Sensitivity Testing

Variable for Sensitivity Testing	Lower Bound	Base Case	Upper Bound
Maximum Demand	Low (Base estimates minus 10%)	Base estimates	High (Base estimates plus 10%)
Capital expenditure	Low (Base estimates minus 10%)	Base estimates	High (Base estimates plus 10%)
Value of Customer Reliability	Low (Base estimates minus $10)	Base estimates	High (Base estimates plus $10)
Discount Rate	4.76%	6.76%	8.76%

8.0 RESULTS OF ANALYSIS

This section describes the results of the RIT-D modelling for each of the options considered in this RIT-D assessment.

8.1 GROSS MARKET BENEFITS

The table below summarises the gross market benefits for each option in present value terms. Since the ultimate network arrangement of all options is the same, the difference in market benefits captured reflects the additional reliability option during the staging of works.

Table 7 - Gross Market Benefits

Options	Base Case (PV)
Option 1 – Permanent 45MVA firm zone substation + Feeder 21L	$169.8M
Option 2a – Single 45MVA zone substation + Feeder 21L + Stage 3 later	$169.8M
Option 2b – Single 45MVA zone substation + Stage 3 later	$169.7M
Option 2c – Single 45MVA zone substation + Feeder 21L (11kV) + Stage 3 later	$168.4M
Option 3 – Single 45MVA zone substation + 15MVA temporary transformer + Feeder 21L + Stage 3 later	$166.0M

8.2 NET MARKET BENEFITS

The table below summarises the net market benefit in NPV terms for each credible option. The net market benefit is the gross market benefit minus the present value of total costs for each option. The difference in NPV demonstrates the value of deferring the zone substation construction.

Some additional market benefits have also been considered that could not be captured through the standard process. These include:

- Risk of loss of supply during establishment of Stage 3 for options 2c and 3
- The benefit of releasing mobile assets for use elsewhere in the network
- The benefit of deferring the additional 45MVA power transformer and the associated 132kV equipment at Marsden Park in options 2a, 2b and 2c
- The benefit of increased probability of securing large energy demand customers as a result of increased energy security provided by options 1, 2a and 3

These costs are summarised according to their total market benefit and are presented in the “Additional Market Benefits” column below. The table outlines the ranking of each option. Costs and market benefits from involuntary load shedding are close for all options but considering the additional market benefits, Option 1 delivers the maximum net market benefit.

Table 8 - Net Market Benefits

Options	Total Costs (PV)	Market Benefits from involuntary load shedding (PV)	Additional Market Benefits (PV)	Gross Market Benefits (PV)	Net Market Benefits	Ranking under RIT-D
Baseline Risk	$0M	$0M	$0M	$0M	$0M	6
Option 1 – Permanent 45MVA firm zone substation + Feeder 21L	$30.9M	$160.9M	$8.9M	$169.8M	$138.9M	1
Option 2a – Single 45MVA zone substation + Feeder 21L + Stage 3 later	$31.4M	$160.5M	$9.3M	$169.8M	$138.3M	3
Option 2b – Single 45MVA zone substation + Stage 3 later	$30.3M	$160.5M	$8.2M	$168.7M	$138.4M	2
Option 2c – Single 45MVA zone substation + Feeder 21L (11kV) + Stage 3 later	$30.7M	$160.9M	$7.5M	$168.4M	$138.2M	4
Option 3 – Single 45MVA zone substation + 15MVA temporary transformer + Feeder 21L + Stage 3 later	$30.4M	$160.5M	$5.5M	$166.0M	$135.6M	5

The RIT-D assessment demonstrates that Option 1 has the highest net market benefit under the base case reasonable scenario.

8.3 SENSITIVITY AND SCENARIO ASSESSMENT

Endeavour Energy has carried out sensitivity analysis on the RIT-D assessment based on variations of key parameters. Specifically, Endeavour Energy has investigated changes in relation to:

- Maximum demand
- Value of Customer reliability
- Investment cost
- Discount Rate

Table 9 describes the results of the sensitivity analysis.

Table 9 - Sensitivity and Scenario Assessment

Scenario	NPV ($M)				
	Option 1	Option 2a	Option 2b	Option 2c	Option 3
Base case	138.9	138.3	138.4	138.2	135.6
Forecast Low	129.9	129.6	129.7	129.2	126.9
Forecast High	147.3	146.3	146.3	146.6	143.5
Cost of Investment Low	142.0	141.5	141.4	141.2	138.6
Cost of Investment High	135.8	135.2	135.3	135.2	132.5
VCR Low	97.5	97.0	97.1	96.8	94.3
VCR High	180.3	179.6	179.7	179.6	176.9
Discount Rate Low	192.6	191.5	191.5	191.6	188.7
Discount Rate High	103.3	103.0	103.2	102.7	100.4

Table 10 describes the scenarios used to test the robustness of this RIT-D assessment.

Table 10 - Scenarios Used

Scenario	Demand Forecast	VCR	Investment Cost	Discount Rate
Base Case	Base	Base	Base	Base
Scenario 1	High	Base	Base	Base
Scenario 2	Low	Base	Base	Base
Scenario 3	Base	Base	High	Base
Scenario 4	Base	Base	Low	Base
Scenario 5	Base	High	Base	Base
Scenario 6	Base	Low	Base	Base
Scenario 7	Base	Base	Base	High
Scenario 8	Base	Base	Base	Low
Scenario 9	High	High	Base	Base
Scenario 10	Low	Low	Base	Base

Table 11 sets out the net market benefits (NPV) for each option across all reasonable scenarios considered. The shaded cells indicate the option that maximises the net market benefit under each scenario.

Table 11 - Net Market Benefits (NPV) for all scenarios

Scenario	Do Nothing		Option 1		Option 2a		Option 2b		Option 2c		Option 3	
	Net Market Benefit	Rank	Net Market Benefit	Rank	Net Market Benefit	Rank	Net Market Benefit	Rank	Net Market Benefit	Rank	Net Market Benefit	Rank
Base	$0	6	138.9	1	138.3	3	138.4	2	138.2	4	135.6	5
1	$0	6	147.3	1	146.3	3	146.3	3	146.6	2	143.5	5
2	$0	6	129.9	1	129.6	3	129.7	2	129.2	4	126.9	5
3	$0	6	135.8	1	135.2	3	135.3	2	135.2	3	132.5	5
4	$0	6	142.0	1	141.5	2	141.4	3	141.2	4	138.6	5
5	$0	6	180.3	1	179.6	3	179.7	2	179.6	3	176.9	5
6	$0	6	97.5	1	97.0	3	97.1	2	96.8	4	94.3	5
7	$0	6	103.3	1	103.0	3	103.2	2	102.7	4	100.4	5
8	$0	6	192.6	1	191.5	3	191.5	3	191.6	2	188.7	5
9	$0	6	190.9	1	189.6	4	189.7	3	190.2	2	186.8	5
10	$0	6	90.8	1	90.5	3	90.6	2	90.1	4	87.8	5

The results show that Option 1 maximises the net market benefit in the base case as well as all scenarios considered for sensitivity analysis.

8.4 ECONOMIC TIMING

The economic timing of the proposed preferred option is taken to be the point when the cost of lost load (or VCR benefits that can be attributed to the project) exceeds the annualised cost of the preferred option. However, using this methodology, the cost of the whole project, including the construction of the zone substation gets annualised and hence indicates a later optimum timing than if only the cost of the first stage of the preferred option were used. Given the pace of development of the Marsden Park Industrial Precinct, it is imperative that capacity be made available as soon as the existing available capacity in the network is exhausted. On the basis of current forecasts, this is expected to occur in 2020.

The resolution of the modelling is not intended to provide a finer resolution than one year. Modelling indicates that the solution will become economically viable in 2021.

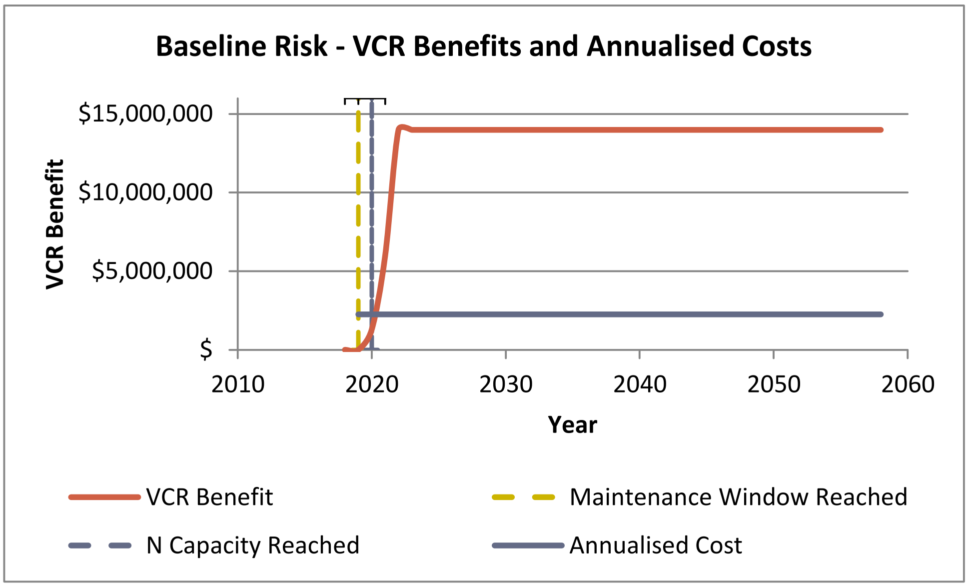


Figure 6 - VCR Benefits (based on value of lost load) and Annualised costs

Table 12 - Scenario Timings

Scenario	Demand Forecast	VCR	Investment Cost	Discount Rate	Timing
Base Case	Base	Base	Base	Base	2021
Scenario 1	High	Base	Base	Base	2020
Scenario 2	Low	Base	Base	Base	2022
Scenario 3	Base	Base	High	Base	2021
Scenario 4	Base	Base	Low	Base	2021
Scenario 5	Base	High	Base	Base	2021
Scenario 6	Base	Low	Base	Base	2021
Scenario 7	Base	Base	Base	High	2021
Scenario 8	Base	Base	Base	Low	2021
Scenario 9	High	High	Base	Base	2020
Scenario 10	Low	Low	Base	Base	2022

The above results indicate that the preferred option becomes viable between 2020-2022 and there is no scope for deferring the solution under the scenarios considered. Commissioning dates are likely to be driven by actual supply requirements of high demand industrial customers.

9.0 PREFERRED OPTION

The option that presents the greatest net market benefit is Option 1. The difference in net market benefits across all options considered is marginal. Option 1 involves the establishment of a permanent two transformer zone substation and a 132kV feeder between South Marsden Park ZS and Marsden Park ZS, constructed in a single stage, at a cost of $24.6M (excluding contingencies).

The technical characteristics of project PR292 for Option 1 are as follows:

- Establish a permanent 2 x 45MVA transformer zone substation with a standard control building;
- Establish 132kV Feeder 21L from South Marsden Park ZS to Marsden Park ZS
- Distribution works
- Communication links
- Decommission the temporary substation on the site