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· **CASE FOR INVESTMENT (CFI):**
· **(NPR-000053) - PR745 –**
· **AUSTRAL PERMANENT ZS**
· **ESTABLISHMENT**

August 2022

Version Control and Approvals

Table 1 below is updated detailing key changes made between versions. The table is populated in descending order.

Table 1 – Version Control

Version #	Date of Issue	Description
1	8 August 2022	Initial Issue
0	26 November 21	First draft version.

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Investment Title	<< Capacity Increase for Austral Development Area >>
<< project # / code >>	PR745
Portfolio	Augex
CFI Date	08/08/2022
Pre RIT-D	<input type="checkbox"/>
Final CFI	<input type="checkbox"/>
Other	<input checked="" type="checkbox"/> Early Phase CFI (Documentation of need, scope and expenditure forecast for inclusion in IDST)

1. Executive Summary

This Executive Summary sets out an overview of the proposed investment including the underlying need, a discussion of the key drivers, the options considered to address the need and our recommended solution. These aspects are covered in detail in the body of the Case for Investment (CFI).

1.1 Need/ Background

The Austral precinct is part of the NSW Government's Western Sydney Priority Growth Area. The Austral precinct will deliver approximately 8,500 new dwellings, employment lands and two town centres. The development of this area has already begun, and new homeowners are now starting to occupy these new residential subdivisions.

The key drivers for this investment are the customer applications that Endeavour Energy have received and incorporated into the November 2021 Summer Demand forecast (SDF) along with updated information received from Liverpool and Camden council's Department of Planning.

This precinct is currently supplied by the Hinchinbrook and Kemps Creek Zone Substations (ZS). The growing demand in this area will exceed the capacity of Kemps Creek & Hinchinbrook ZS by FY28. The option of 'No proactive intervention' (BAU) will result in a large amount of load at risk and ultimately sustained involuntary load shedding, resulting in considerable unserved energy. This will result in customers not being able to connect to the network, which contravenes Endeavour Energy's obligation to provide connection services. A project is required to service future customers in the Austral Precinct and surrounding areas.

Figure 1 below depicts the decision rule from the growth servicing strategy. The identified need is such that it is sub-optimal for Endeavour Energy to do nothing because:

- Investment is classified as **greenfield**.
- Identified need based on consequence of no action for the greenfield development is **reliability corrective action**¹.

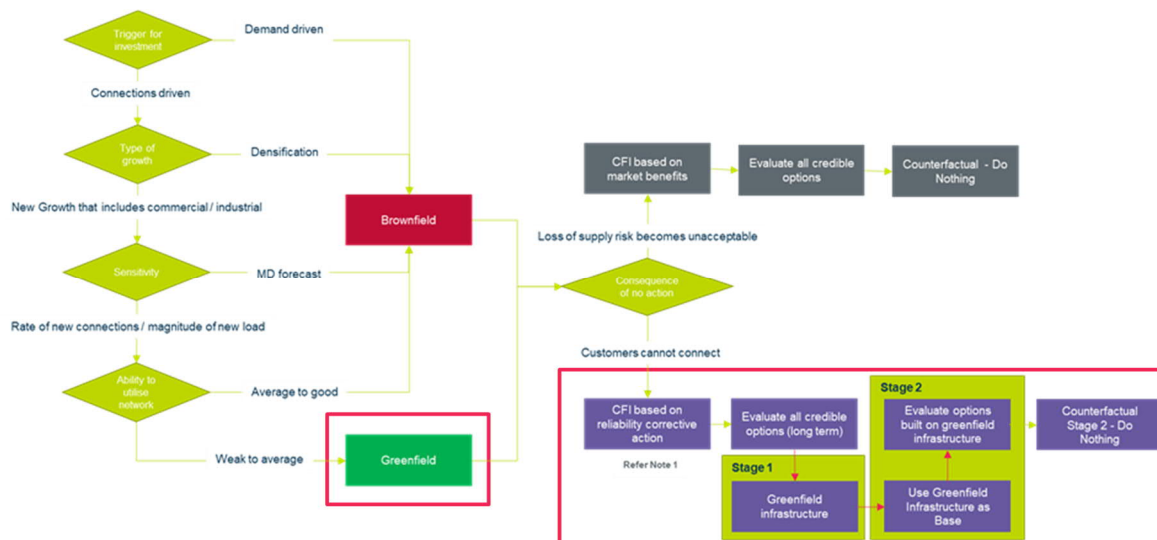


Figure 1: Decision Rule from Endeavour Energy's Growth Servicing Strategy

¹ Refer to Growth Servicing Strategy for definitions of greenfield and brownfield sites.

1.2 Options Considered

1.2.1 Long Term Network Options

Table 2 below outlines the long-term options to address the identified need of supplying the new connections in this area. The preferred option is **Option 1** as it has the most significant reduction in unserved energy, which will allow the greatest number of customers to connect within the Austral precinct, which aligns with NSW's Government's strategy for the Western Sydney Priority Growth Area. This option also has the greatest economic benefit being NPV positive **\$24.7 million**.

Table 2: Options for the Total Scope

Option	Description	Solution Type	NPV ¹ \$M	Rank	Comments
1	Establish Austral ZS 132/11kV with a firm capacity of 45MVA by 2028	Network solution	24.7	1	Best NPV, Preferred Long Term Network Option
2	Stage Austral ZS 132/11kV with a firm capacity of 45 MVA by 2031	Network solution	18.6	2	Technically feasible, lower net benefits

Notes:

1: The NPV is based on the central scenario.

1.2.2 Non-Network Options

The New Technology Master Plan (NTMP) tool was used to evaluate credible non-network options against the constraints in the existing distribution network. The NTMP tool and the subsequent qualitative analysis found that non-network options are not feasible. However, non-network may be feasible once the proposed network infrastructure has been commissioned to defer future network investment.

1.3 Recommendation

This CFI recommends the establishment of a 132/11kV outdoor 45MVA zone substation to supply the Austral development area (prior to 2028) . Austral ZS would be supplied by looping in and out of the existing 132kV feeder (93X), establishing two 132kV feeders supplying Austral ZS (one from Sydney West BSP and the other from North Leppington ZS). This option is NPV positive \$24.7 million with an estimated cost of 21.4 million with a contingency of 2.0 million. This cost is expected to be spread over three years, from FY25 to FY28.

It is recommended that the project value of \$23.4M be approved for consideration in the FY25-FY29 regulatory period.

Based on Endeavour Energy's RIT-D process (Figure 2), it is recommended that the next steps are:

- Endeavour Energy publish a screening report before progressing to a Draft Project Assessment Report (DPAR) as per the RIT-D process (Refer to Figure 2). The identified need for this investment is a reliability correction action to meet Endeavour Energy's connection obligations in the National Electricity Rules (NER). This requires the installation of greenfield infrastructure, which can only be addressed with a network only credible option.
- The project proceeds to preliminary release with preferred Option 1, which recommends capital expenditure to build Austral ZS with a firm capacity of 45 MVA by FY28. Preliminary release enables the development of project definitions, detailed design, environmental assessment, and preliminary market engagement activities according to Company Procedure GRM0051.

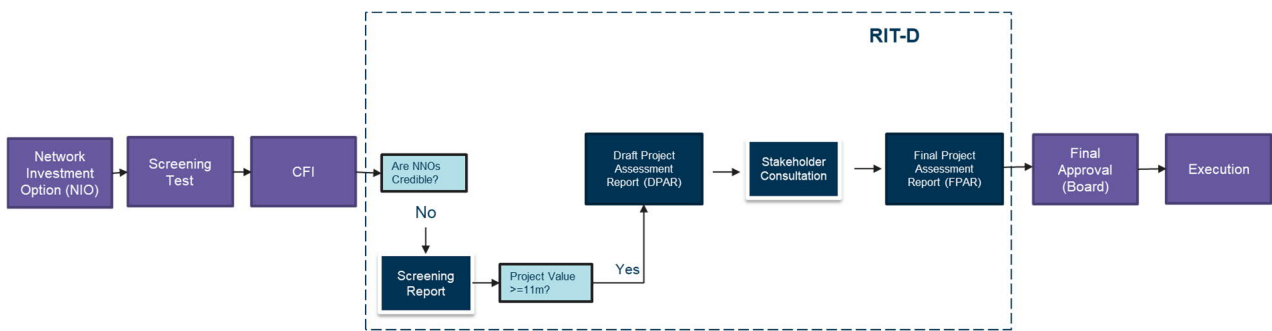


Figure 2: Endeavour Energy's RIT-D Process for this Project

2. Project Proposal

2.1 Identified Need or Opportunity

The Austral precinct is part of the NSW Government's Western Sydney Priority Growth Area and is currently supplied by the Hinchinbrook and Kemps Creek Zone substations. The Austral precinct will deliver approximately 8,500 new dwellings, employment lands and two town centres. The development of this area has already begun, and new homeowners are now starting to occupy these new residential subdivisions.

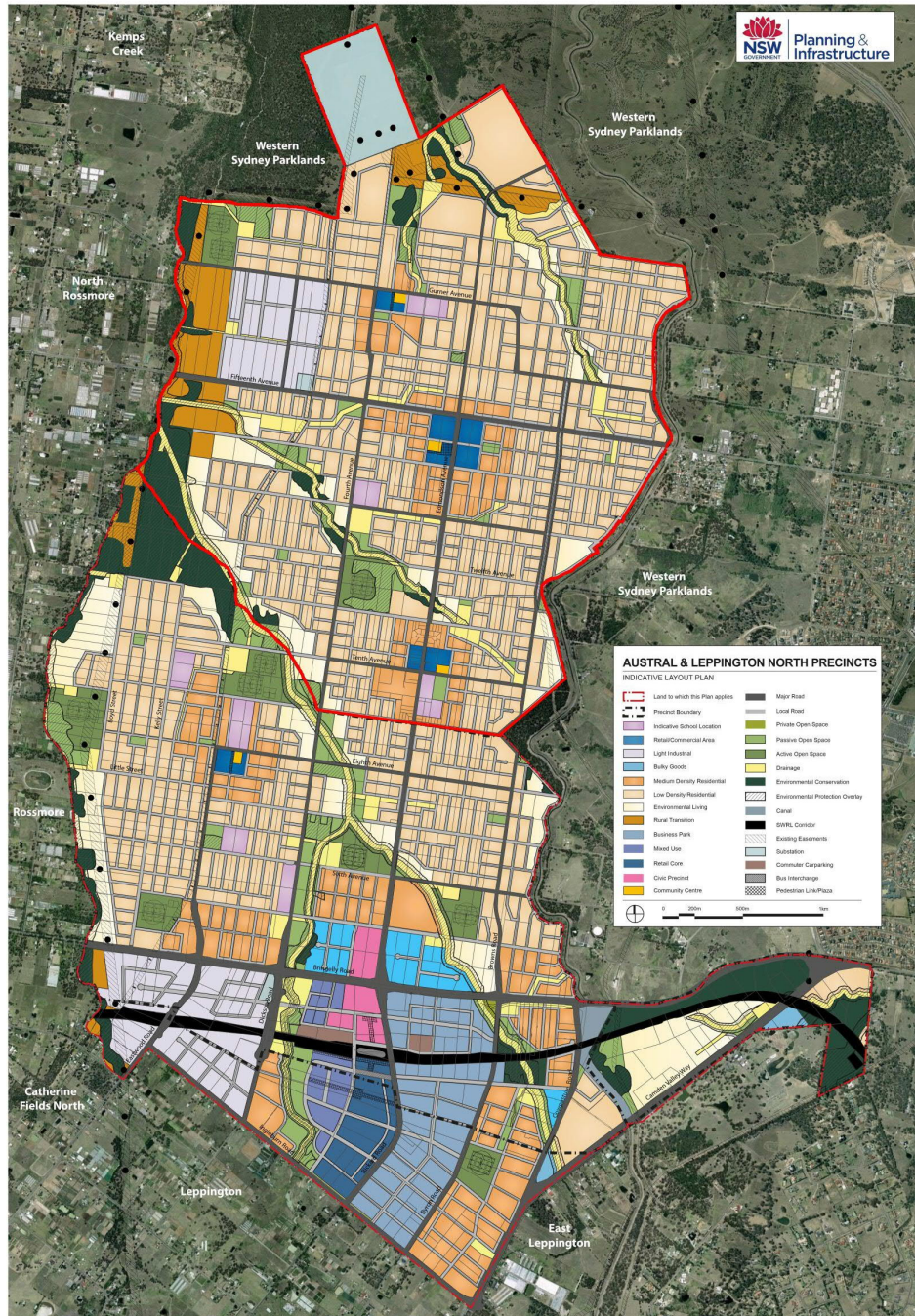


Figure 3: Austral development Area

2.2 Existing Infrastructure not capable of servicing the growth

2.2.1 Existing Infrastructure

The distribution network surrounding Austral precinct is supplied by a constrained 11kV network which is supplied by Kemps Creek ZS and Hinchinbrook ZS as shown in Figure 4. Additionally, a 132kV feeder (93X) runs through the proposed Austral precinct from Sydney West BSP to North Leppington ZS as shown in Figure 5. The available capacity to supply the new growth is limited to 29.6 MVA. Table 3 demonstrates that the current feeders are already exceeding their ratings or are committed to other projects/developments. Expansion of this network is not feasible as the surrounding 11kV feeders and substations are also constrained.

Table 3: Hinchinbrook ZS and Kemps Creek ZS Feeder Capacities

Feeder	Location	Zone Sub	Load	Comment
48198	McGuinness Ave	Hinchinbrook	254A	Feeder already exceeding rating
48185	Second Ave	Hinchinbrook	86A	Committed to Middle Grange
KC1284	Gurner Ave	Kemps Creek	105A	Will exceed with forecasted loads

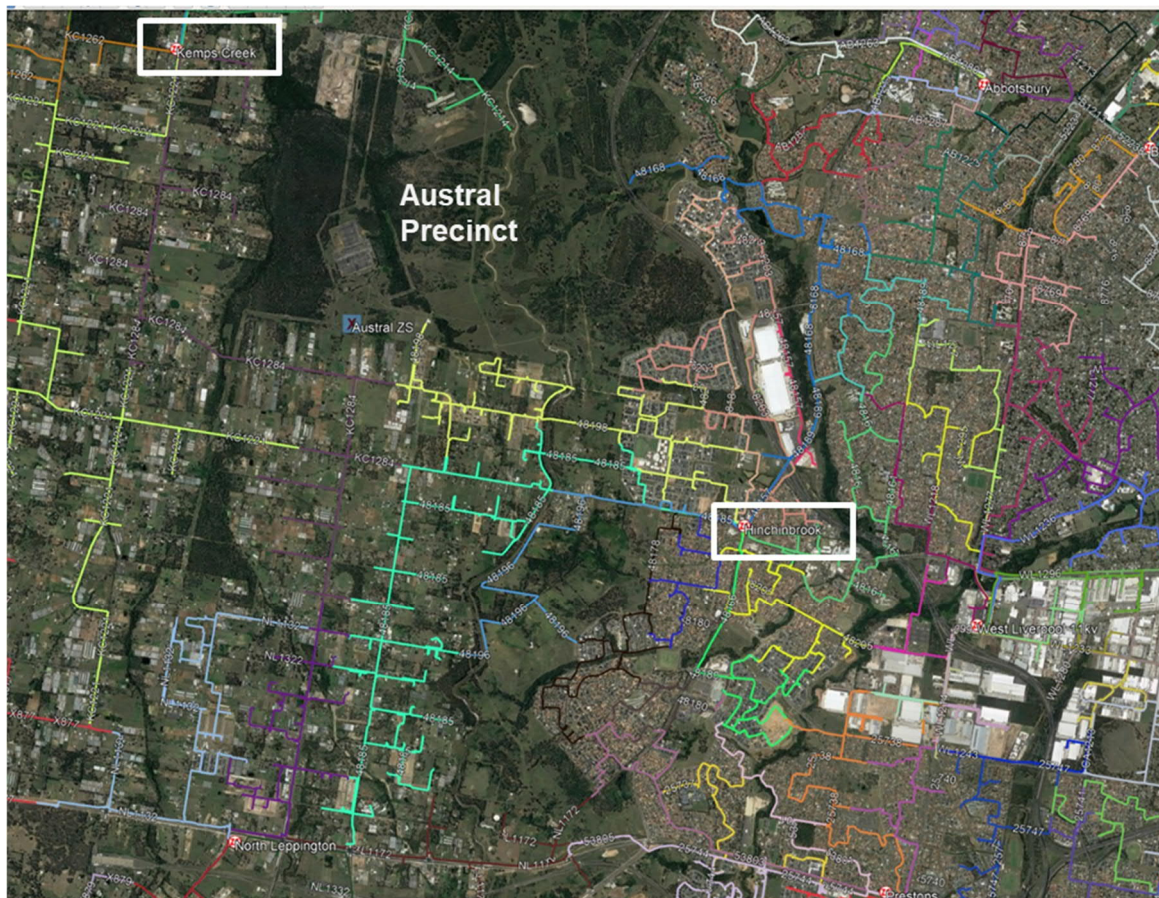


Figure 4: Existing 11kV Network (Kemps Creek ZS & Hinchinbrook ZS highlighted in white)

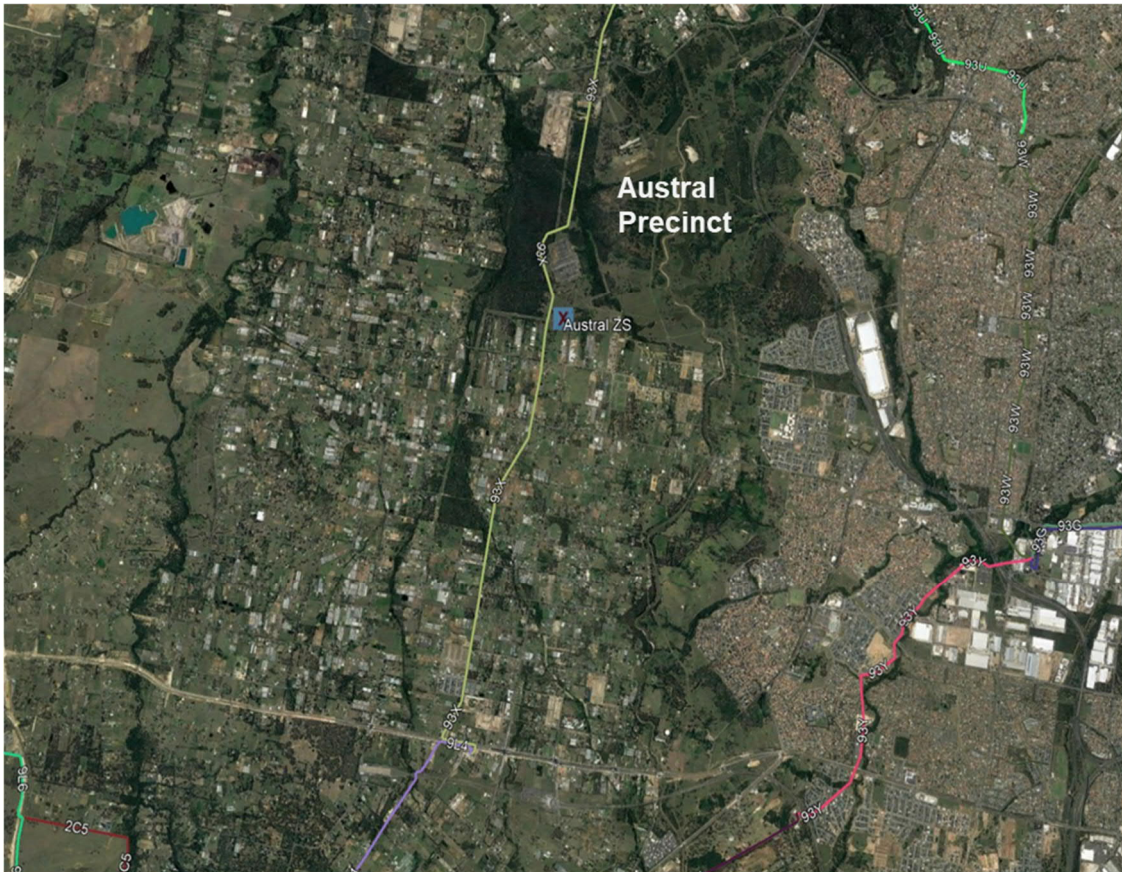


Figure 5: Existing sub transmission network in proximity of Austral precinct

2.2.1.1 Load Growth

There is an increase in the load growth due to connection requests in the Austral precinct which has been incorporated into the 2023 Summer Demand forecast (SDF). The SDF incorporates the following lot estimates for the Austral Precinct.

- 1,900 lots (Lots A) started development in 2019 and is expected to be completed over 5 years,
- 6,600 lots (Lots B) started in 2021 and is expected to be completed over 12 years.

In addition to the proposed lots, Endeavour Energy has estimated the following commercial & industrial loads commencing in 2025 and expected to be completed over 5 years:

- 10 hectare town centre with a load of 4.9 MVA,
- 40 hectare light industrial area with a load of 5.6 MVA.

This has been used to develop a residential lot forecast for the Austral Precinct detailed in Section 2.2.1.2. Additionally, Endeavour Energy has compared the proposed lot forecast in the SDF against connection applications received to date in Figure 6, which shows that developments are picking up and is heading towards lining up with Endeavour Energy's forecast. Endeavour Energy will continue to monitor the lot growth as it progresses through the RIT-D process for this project and future annual forecast reviews.

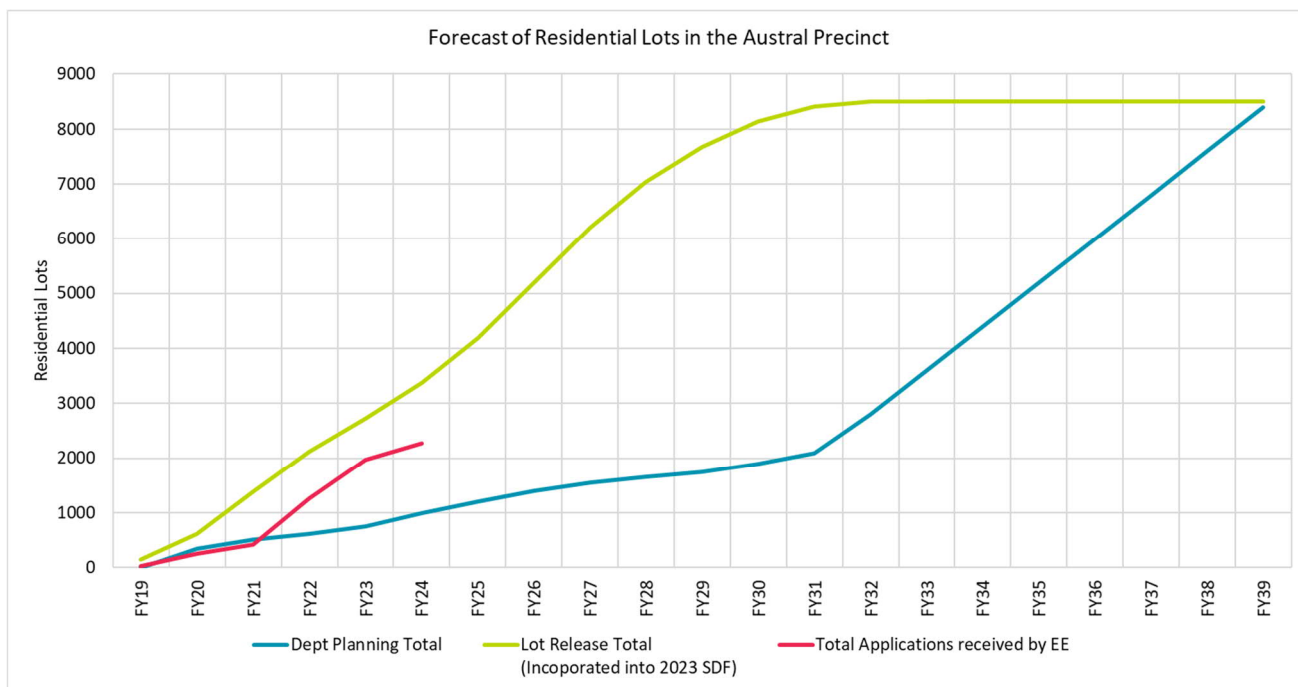


Figure 6: Residential Lot Forecast

2.2.1.2 Demand Forecast

The expected demand forecast for the Austral Precinct, considering the major new connections and network constraints listed above, is shown in Table 4 and Figure 7 and presents a central, high and low forecast cases. The high forecast case represents 110% of central forecast case while low forecast case represents 90% of central forecast case.

The network options considered in this CFI involve establishing a 132/11kV substation in 2028. All future Austral precinct load was assumed to be shifted to the new substation in 2028, while Hinchinbrook ZS will service the existing load in the region as shown in Figure 8. The load forecast that was used for the technical and economic assessment of the network options is listed in Table 5.

While Kemps Creek ZS is expected to have load at risk, this CFI will only consider the load at risk at Hinchinbrook ZS as most of the forecasted Austral demand will be loaded on Hinchinbrook ZS in the summer period. As illustrated in Figure 7, Hinchinbrook ZS will have load at risk from 2023, with the total capacity of Hinchinbrook ZS exceeded in 2028, which will result in unserved energy without additional electrical capacity investment in the area. This will result in customers not being able to connect to the network, which contravenes Endeavour Energy's obligation to provide connection services. An investment into additional electrical capacity in this area is required to meet these requirements. Consequently, this investment is considered a reliability corrective action under Section 5.2.3(d) of the NER.

Table 4: Austral Precinct Load Forecast for BAU

Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Austral Load – Lots A	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Austral Load – Lots B	3.6	6.3	9.9	14.3	18.6	22.2	24.9	26.9	28.1	28.5	28.5	28.5
Austral Load – Commercial & Industrial	0.0	0.0	0.8	3.4	7.1	9.7	10.5	10.5	10.5	10.5	10.5	10.5
Total Austral Load - Central	11.8	14.5	18.9	25.8	34.0	40.0	43.7	45.6	46.8	47.2	47.2	47.2

Austral Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Austral Load Forecast - High	12.8	15.7	18.4	21.8	26.0	30.9	36.5	41.4	45.6	49.0	49.0	49.0
Austral Load Forecast - Central	10.7	13.2	15.4	18.2	21.7	25.8	30.4	34.5	38.0	40.9	45.9	45.9
Austral Load Forecast – Low	8.6	10.5	12.3	14.5	17.3	20.6	24.3	27.6	30.4	32.7	36.7	36.7
Hinchinbrook ZS SDF	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
High Forecast	41.1	42.3	45.0	46.1	46.5	46.3	46.5	46.6	46.9	47.2	47.2	47.2
Central Forecast	37.3	38.5	40.9	41.9	42.3	42.1	42.2	42.4	42.7	42.9	42.9	42.9
Low Forecast	33.6	34.6	36.8	37.7	38.1	37.9	38.0	38.1	38.4	38.6	38.6	38.6
BAU Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Total Demand Forecast - High	54.0	58.3	65.8	74.5	83.9	90.4	94.5	96.8	98.5	99.1	99.1	99.1
Total Demand Forecast - Central	49.1	53.0	59.8	67.8	76.2	82.2	85.9	88.0	89.5	90.1	90.1	90.1
Total Demand Forecast – Low	44.2	47.7	53.9	61.0	68.6	73.9	77.3	79.2	80.6	81.1	81.1	81.1
Capacity (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Hinchinbrook ZS (Total Capacity)	75	75	75	75	75	75	75	75	75	75	75	75
Hinchinbrook ZS + Supporting 11kV Network (Firm Capacity)	50	50	50	50	50	50	50	50	50	50	50	50
Load At Risk (Central Scenario)	0.0	3.0	9.8	17.8	26.2	32.2	35.9	38.0	39.5	40.1	40.1	40.1

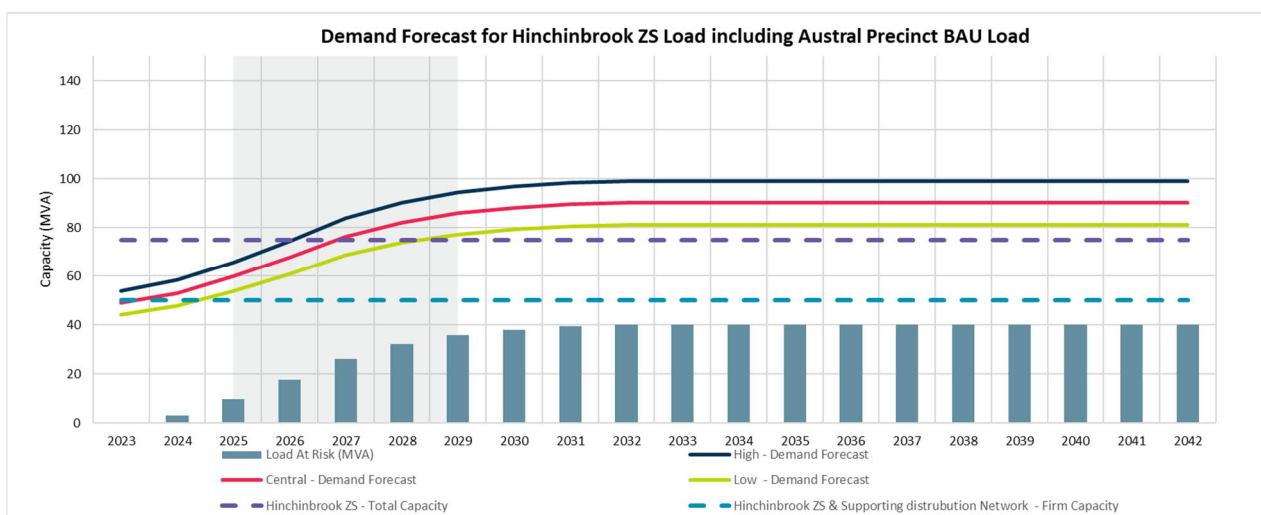


Figure 7: Hinchinbrook ZS Demand Forecast including Austral Precinct BAU Forecast

Table 5: Austral Precinct Load Forecast for Network Options

Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2037	2042
Austral Load – Lots A	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Austral Load – Lots B	3.6	6.3	9.9	14.3	18.6	22.2	24.9	26.9	28.1	28.5	28.5	28.5
Austral Load – Commercial & Industrial	0.0	0.0	0.8	3.4	7.1	9.7	10.5	10.5	10.5	10.5	10.5	10.5
Total Austral Load - Central	11.8	14.5	18.9	25.8	34.0	40.0	43.7	45.6	46.8	47.2	47.2	47.2
Austral ZS Demand Forecast (MVA)	2023	2024	2025	2026	2027	2028 ¹	2029	2030	2031	2032	2037	2042

Austral Load Forecast - High	-	-	-	-	-	44.0	48.0	50.2	51.5	51.9	51.9	51.9
Austral Load Forecast - Central	-	-	-	-	-	40.0	43.7	45.6	46.8	47.2	47.2	47.2
Austral Load Forecast – Low	-	-	-	-	-	36.0	39.3	41.1	42.1	42.5	42.5	42.5
Hinchinbrook ZS SDF	2023	2024	2025	2026	2027	2028¹	2029	2030	2031	2032	2037	2042
High Forecast	54.0	58.3	65.8	74.5	83.9	46.3	46.5	46.6	46.9	47.2	47.2	47.2
Central Forecast	49.1	53.0	59.8	67.8	76.2	42.1	42.2	42.4	42.7	42.9	42.9	42.9
Low Forecast	44.2	47.7	53.9	61.0	68.6	37.9	38.0	38.1	38.4	38.6	38.6	38.6

Notes:

1: Prior to 2028, the Austral precinct will be supplied by the existing Hinchinbrook ZS

2: The reduction in load at Hinchinbrook ZS between 2027-2028 is due to the proposed commissioning of Austral ZS. The proposed Austral precinct load will be shifted from Hinchinbrook ZS to the new Austral ZS.

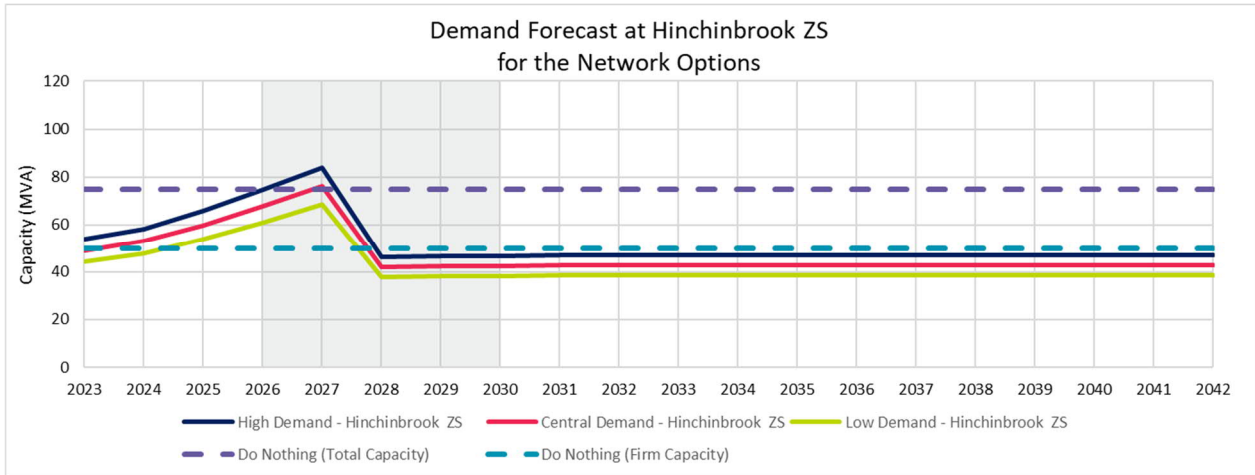


Figure 8: Hinchinbrook ZS Load Forecast for Network Options

2.2.2 Investment Timing

To demonstrate the appropriate and optimal timing of the investment an analysis was conducted on key criteria. The criteria examined were:

- Zoning of the area by Government.
- Development status observed in the area from planning, design and construction activity.
- Progress in development of supporting infrastructure in the area.

Table 6 below shows results of the investment timing analysis for the Austral Precinct and the network option investments evaluated. The analysis shows that moderate growth is expected in the short term.

Table 6: Investment Timing Analysis

Criteria	Low or later growth time frame	Moderate growth in medium term expected	High growth likely in shorter term
Zoning status	Not part of any official release area and not rezoned	Part of official release area but not rezoned yet	Yes rezoned
Development status	No current activity	First stages already planned /committed to	Construction commenced for initial stages of the development. Connection applications received by Endeavour
Supporting infrastructure (water/sewer, roads, transport)	Lack of other infrastructure commitment	Planned/committed initial stages of other infrastructure	Significant progress on roads and transport and water/sewer infrastructure already

2.3 Related Projects

No current projects related to this Austral Permanent ZS Establishment.

3. Options Considered

Based on the decision rule outlined in the Growth Servicing Strategy, the following are the characteristics of the area:

- Investment is classified as **greenfield**.
- Identified need based on consequence of no action for the greenfield development is **reliability corrective action**².

Figure 9 below (subset of the decision rule included in the Growth Servicing Strategy) has been utilised to outline the options.

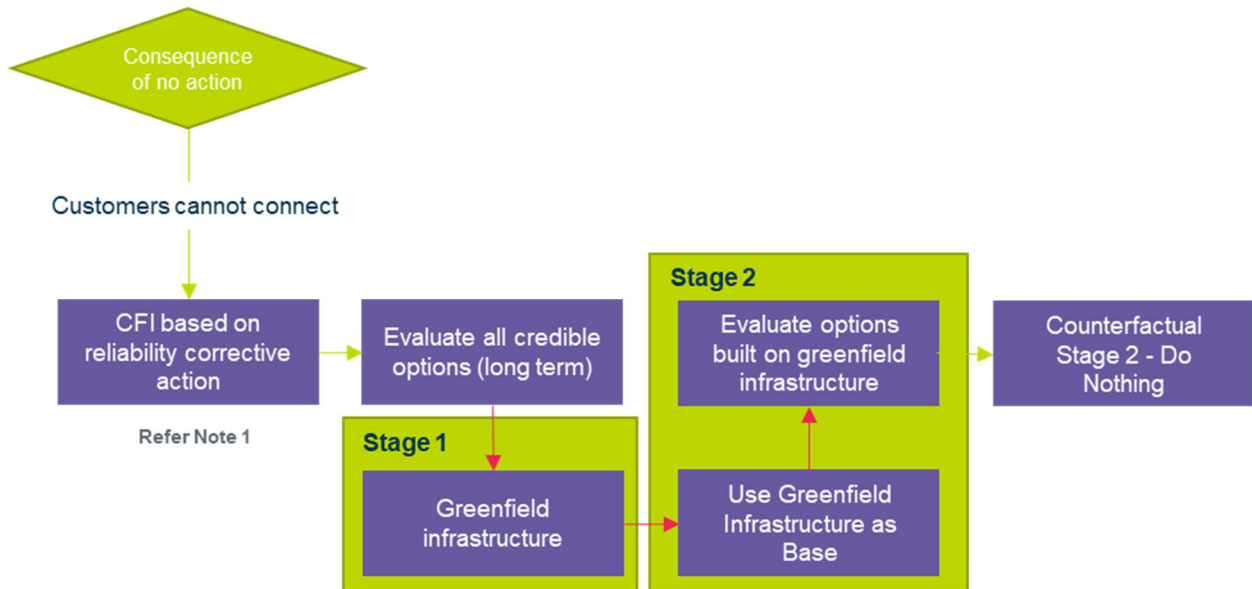


Figure 9: Decision Rule from Endeavour Energy's Growth Servicing Strategy

3.1 BAU Base Case - 'No proactive intervention'

The consequence of not proceeding with the investment in a network option for the Austral precinct results in significant unserved energy due to the existing supply network being constrained and incapable of supplying the forecast demand for the area. The BAU option will lead to the total capacity of Hinchinbrook ZS capacity being exceeded by 2028, resulting in significant unserved energy (Refer to Figure 10). There are also substantial reputational risks of negative media coverage and NSW Government dissatisfaction if Endeavour Energy cannot meet supply requirements for this area.

For the BAU option to be credible, Endeavour Energy has considered the additional cost for 11kV distribution feeders to supply the Austral precinct from Hinchinbrook ZS, which has a PV cost of \$6.7 million.

In terms of Risk Cost assessment, the "No Proactive Intervention" option provides a base case where the risks are valued by applying a Value of Customer Reliability (VCR) to the forecast expected unserved energy. The VCR values used by Endeavour Energy in its modelling are the same as those published by AER. The AER endorsed this approach during the determination process

² Refer to Growth Servicing Strategy for definitions of greenfield and brownfield sites

For a 30-year review period, no proactive intervention equates to a total PV cost of \$40.9M, which is a very high and unacceptable high-risk position and is therefore non-preferred.

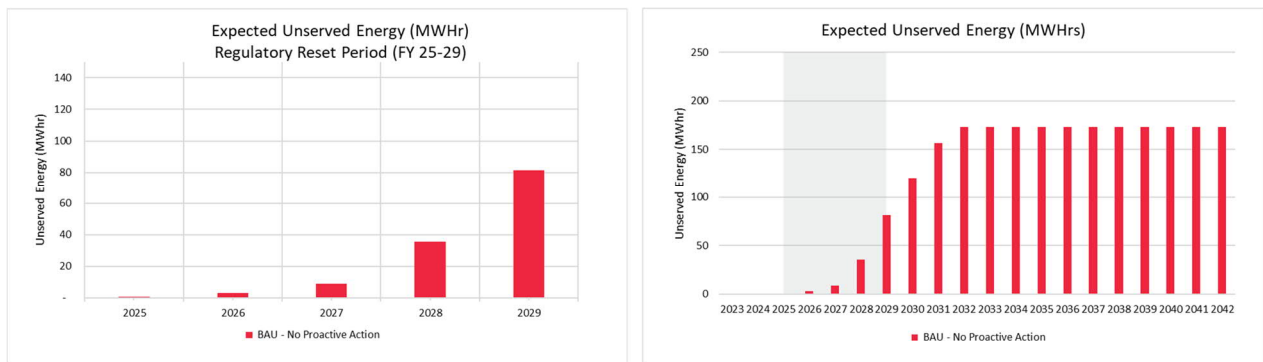


Figure 10: Expected Unserved Energy as a result of “no proactive intervention” based on Central Demand

Table 7: Value of Expected Unserved Energy as a result of “no proactive intervention”

	2025	2026	2027	2028	2029	2030	2031	2036	2041
Expected Unserved Energy (MWh)	1	3	9	35	82	120	157	173	173
Value of Unserved Energy (\$M)	0.0	0.1	0.2	0.9	2.1	3.1	4.1	4.5	4.5

3.2 Credible Network Options (Long Term)

The National Electricity Objectives (NEO) as stated in the National Electricity Law (NEL) require Endeavour Energy to operate the networks in the long-term interests of consumers. The options in this section sets out the **credible options** that were considered, together with a counterfactual option: “*BAU Base Case*” to assist the overall comparison. These include all substantially differing commercially and technically credible options, including non-network solutions. Credible options (or a group of options) are those that meet the following criteria:

- addresses the identified need
- is (or are) commercially and technically feasible
- can be implemented in sufficient time to meet the identified need

For this CFI, only one long-term credible network option is feasible which is the implementation of a 132/11kV Austral ZS providing N-1 security with a firm capacity of 45MVA. Other network options such as a 33/11kV Austral ZS was considered but were found to be not feasible.

3.2.1 Option 1 – Firm Austral ZS 132/11kV 45MVA Build

3.2.1.1 Scope

Option 1 is the complete implementation of Austral ZS, providing N-1 security with a firm capacity of 45MVA to be commissioned by FY28. The proposed commissioning date is based on load forecasts to avoid exceeding maximum capacity at Hinchinbrook ZS. Option 1 includes the following:

- 2 x 132/11kV 45MVA power transformer
- 132kV bus bar with a minimum of 2 x 132kV outdoor Circuit Breaker (CB), 2x 132kV feeder bays and 2x 132kV transformer bays

- 11kV indoor switchgear and switchboard with 14 CB's
- Looping in and out of the existing 132kV feeder (93X) which will establish two 132kV feeders supplying Austral ZS (One from Sydney West BSP and the other from North Leppington ZS.

This option results in a firm capacity of 45 MVA by 2028. The expected unserved energy consists of the following categories:

- Unserved Energy due to load at risk at Hinchinbrook ZS based on the demand forecast provided in Table 4,
- Unserved Energy due to precinct load at Austral ZS based on the demand forecast in Table 5.

There is minimal expected unserved energy to 2041 with the central scenario for both Austral ZS and Hinchinbrook ZS³. The split of unserved energy between the different substations can be found in Figure 12 and Table 8. A high level SLD can be found in Figure 13 along with a proposed line route for the proposed transmission feeders.

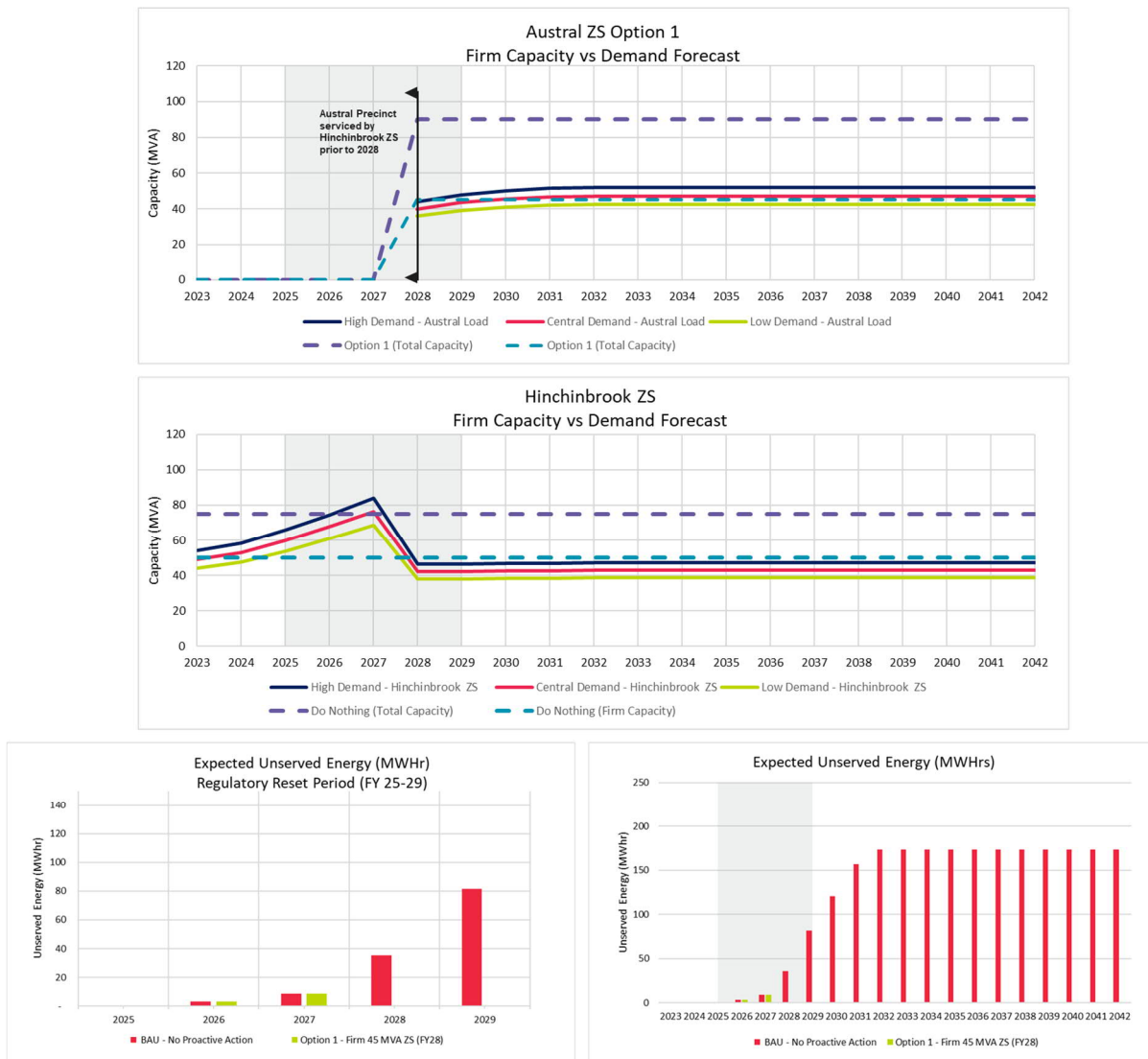


Figure 11: Summary of Option 1. Expected Unserved Energy based on “central” demand

³ Austral ZS allows load to be shifted from the existing Hinchinbrook ZS, which reduces the load at risk at Hinchinbrook ZS resulting in minimal unserved energy.

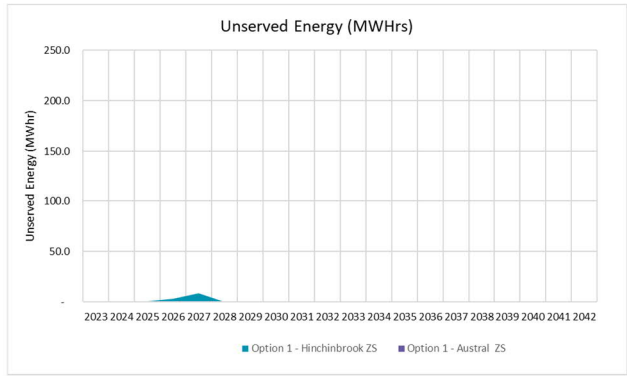
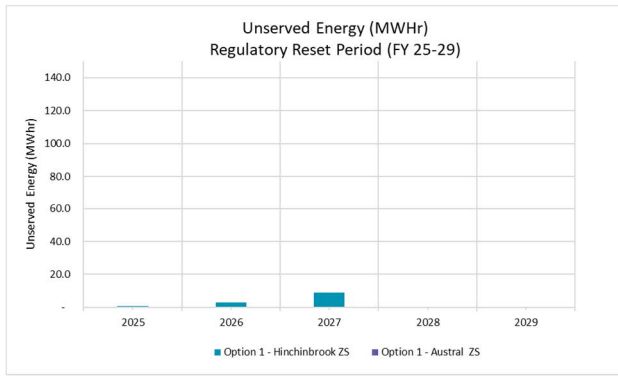


Figure 12 - Breakdown of Expected Unserved Energy for Option 1 based on the central case demand forecast

Table 8 - Breakdown of Expected Unserved Energy for Option 1

Expected Unserved Energy (MWh)	2025	2026	2027	2028	2029	2030	2031	2036	2041
Existing Hinchinbrook ZS	0.6	3	9	0	0	0	0	0	0
Austral ZS	0	0	0	0	0	0	0	0	0

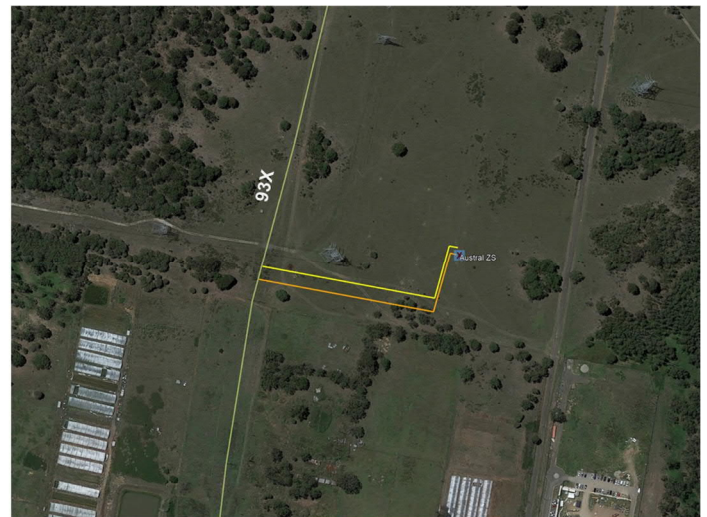
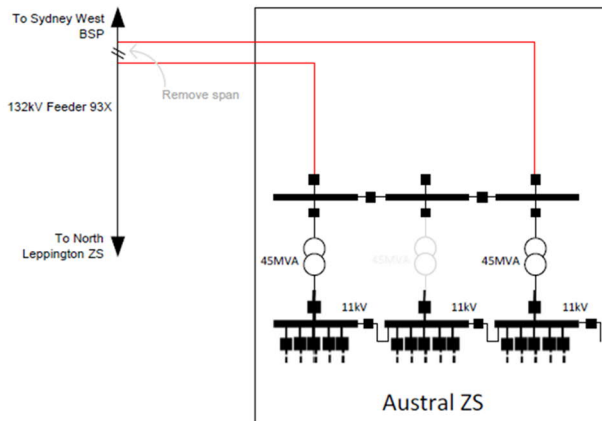


Figure 13: High Level SLD (Left) and Proposed 132kV Transmission Line Loop In & Out (Right)

3.2.1.2 Cost

Total estimated capital cost of Option 1 is \$21.4 M. The cost is spread over three years to align with construction timelines, and it is based on estimates provided by Endeavour Energy's estimating team. Commissioning of Option 1 is planned for FY28. A summary of the capital cost can be found in Table 9.

The total present value of costs for Option 1 is \$9.6M.

Table 9: Option 1 - Capital cost summary

Option	2025	2026	2027
1	\$3.21M	\$9.63M	\$8.56M

3.2.2 Benefits & NPV

The NER states that quantifiable economic market benefits (needs) include changes in involuntary load shedding. The costs and benefits analysis described in the following section included this benefit in determining the best option. Endeavour Energy's Unserved Energy Template was used to estimate the involuntary load shedding that can be prevented as a result of proactive action. The HK model utilised the involuntary load shedding along with a Value of Customer Reliability to calculate a market benefit. There were no other identified risks that were included in the costs and benefits analysis.

The assumptions used in the HK model are stated below, and the NPV summary is provided in Table 10.

- A study period of 30 years;
- The commercial discount rate was set to 3.26% based on the pre-tax real WACC for the 2025-29 determination period and $\pm 1.04\%$ for low and high sensitivities.
- A VCR of \$27,945/MWh based on Oran Park VCR which has a similar load type as the Austral area.
- A maintenance cost estimate based on 0.4% of the project cost; and
- The benefits of options are based on the avoided unserved energy.
- NPV based on the central scenario

Table 10: NPV Summary - Option 1 (Central Scenario)

Option	PV "Market Benefits" (\$M)	PV Costs (\$M)	NPV (\$M)
1	\$65.1	\$9.6	\$55.4

3.2.3 Option 2 – Staged Austral ZS 132/11kV 45MVA Build

3.2.3.1 Scope

Option 2 is the staged implementation of Austral ZS, providing N-1 security with firm capacity of 45MVA by FY31.

The first stage of this implementation to be completed by FY28 includes the following:

- 1 x 132/11kV 45MVA power transformer
- 132kV bus bar with a minimum of 2 x 132kV outdoor Circuit Breaker (CB), 2x 132kV feeder bays and 2x 132kV transformer bays
- 11kV indoor switchgear and switchboard with 14 CB's
- Looping in and out of the existing 132kV feeder (93X), which will establish two 132kV feeders supplying Austral ZS (One from Sydney West BSP and the other from North Leppington ZS).

The second stage of the implementation to be commissioned by FY33 includes the following:

- 1 x 132/11kV 45MVA power transformer

This option results in a total capacity of 45 MVA and 6.3 MVA firm capacity from FY28 to FY33. From FY33 onwards, Austral ZS has a total capacity of 90 MVA with 45 MVA firm capacity (same as in Option 1). The expected unserved energy consists of the following categories:

- Unserved Energy due to load at risk at Hinchinbrook ZS based on the demand forecast in Table 4,
- Unserved Energy due to precinct load at Austral ZS based on the demand forecast in Table 5.

The split of unserved energy between the different substations can be found in Figure 15 and Table 11, which shows that the expected unserved energy (EUE) between FY27 to FY29 is greater than the base case option ("no proactive intervention"). This is because Austral ZS only has a firm capacity of 6.3 MVA

- compared to 50 MVA for Hinchinbrook ZS. From FY31 onwards, the EUE is the same as in Option 1 and there is minimal expected unserved energy to 2041 with the central scenario.
- A high level SLD can be found in Figure 13 along with a proposed line route for the proposed transmission feeders.

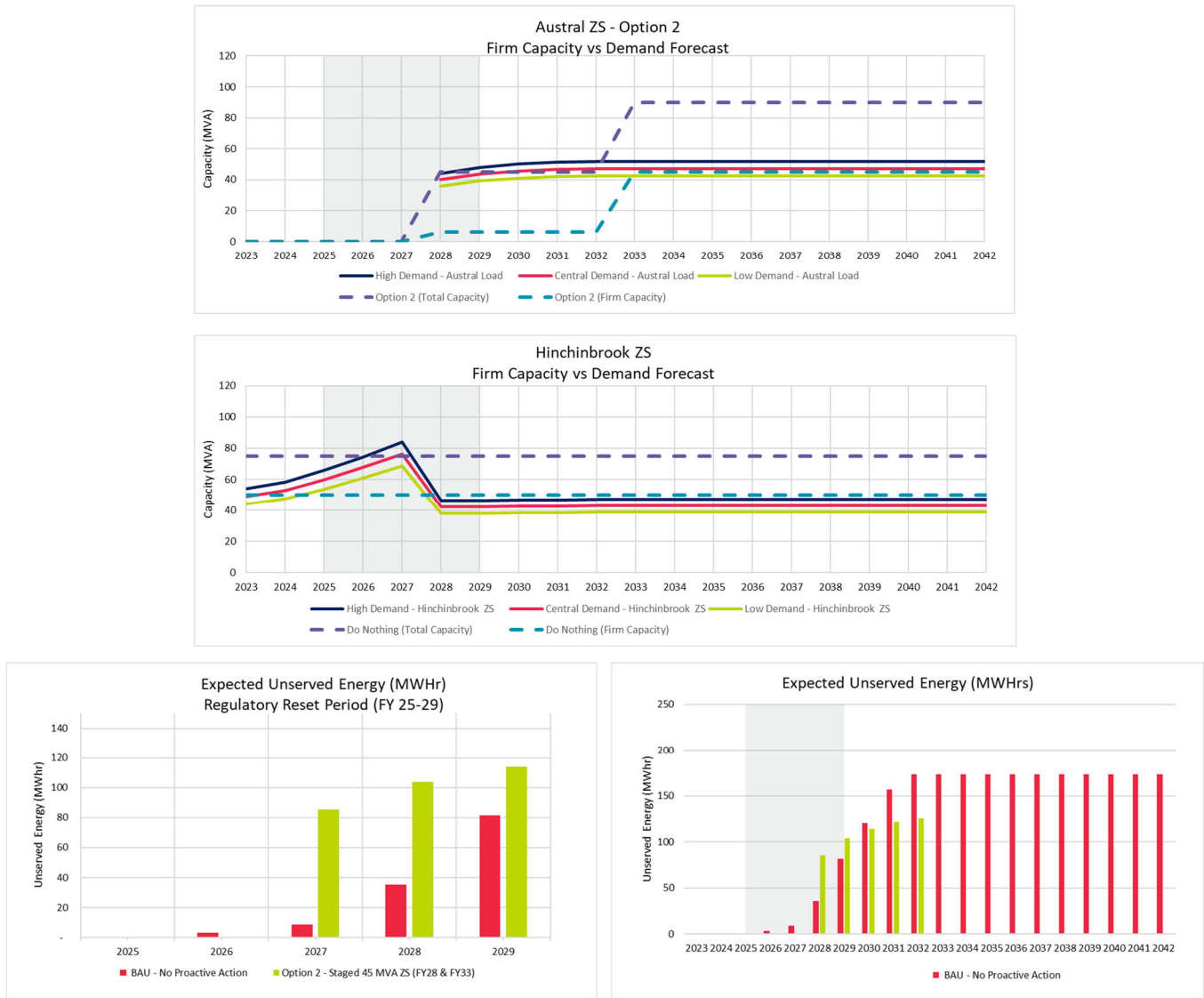


Figure 14: Summary of Option 2 . Expected Unserved Energy based on “central” demand

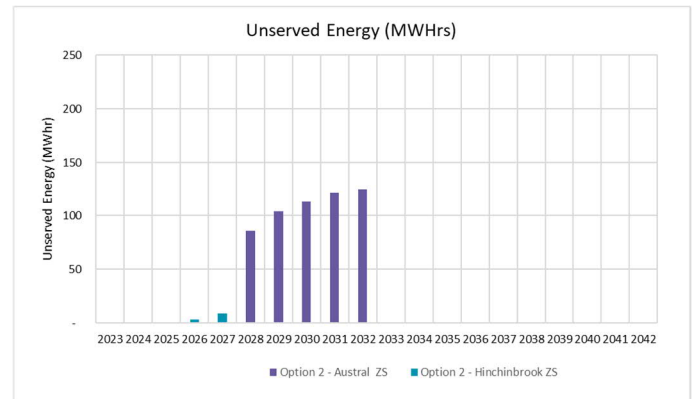
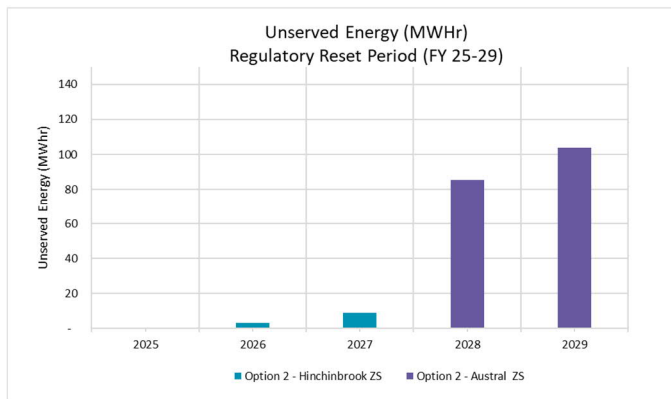


Figure 15 - Breakdown of Expected Unserved Energy for Option 2 based on the central case demand forecast

Table 11 - Breakdown of Expected Unserved Energy for Option 2

Expected Unserved Energy (MWh)	2025	2026	2027	2028	2029	2030	2031	2032	2033	2036	2041
BAU Base Case	1	3	9	35	82	120	157	173	173	173	173
Option 2 - Existing Hinchinbrook ZS	1	3	9	0	0	0	0	0	0	0	0
Option 2 - Austral ZS	-	-	-	85	104	113	114	122	125	0	0

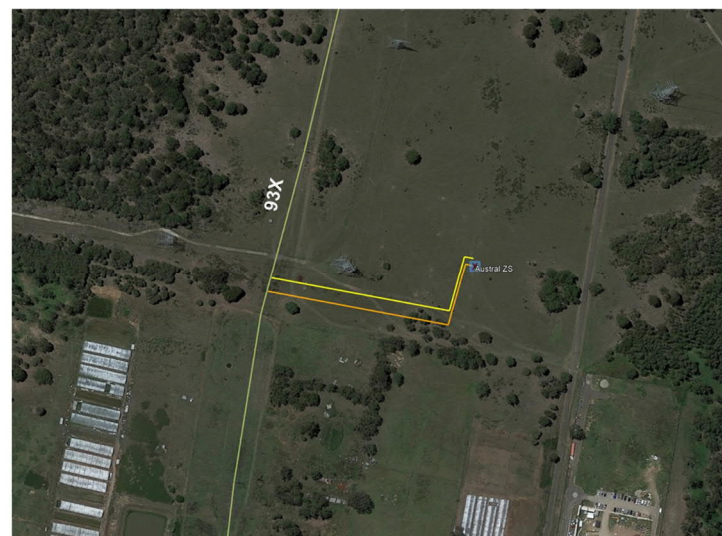
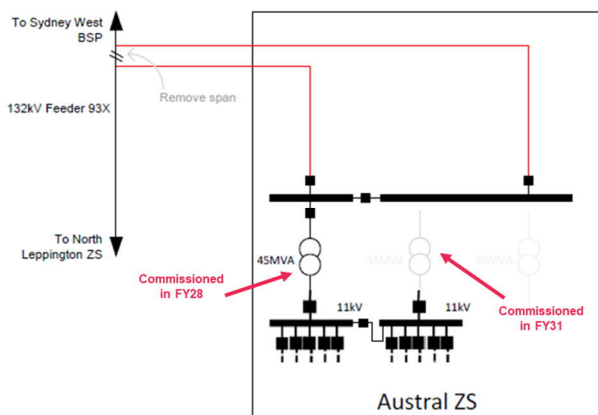


Figure 16: High Level SLD (Left) and Proposed 132kV Transmission Line Loop In & Out (Right)

3.2.3.2 Cost

Total estimated capital cost of Option 2 including both stages is \$21.7 M. The cost is spread over five years to align with construction timelines of both stages, and it is based on estimates provided by Endeavour Energy's estimating team. Commissioning of Stage 1 is planned for FY28 while commission of Stage 2 is planned for FY33. A summary of the capital cost can be found in Table 12.

The total present value of costs for Option 2 is \$9.3M.

Table 12: Option 2 - Capital cost summary

Option	2025	2026	2027	2031	2032
Option 2: Phase 1	\$2.85M	\$8.55M	\$7.59M	-	-
Option 2: Phase 2	-	-	-	\$1.49M	\$1.22M

3.2.3.3 Benefits & NPV

The NER states that quantifiable economic market benefits (needs) include changes in involuntary load shedding. The costs and benefits analysis described in the following section included this benefit in determining the best option. Endeavour Energy's Unserved Energy Template was used to estimate the involuntary load shedding that can be prevented as a result of proactive action. The HK model utilised the involuntary load shedding along with a Value of Customer Reliability to calculate a market benefit. There were no other identified risks that were included in the costs and benefits analysis.

The assumptions used in the HK model were the same as those stated in Section 3.2.2. The NPV summary is provided in the table below.

Table 13: NPV Summary - Option 2A & 2B (Central Scenario)

Option	PV "Market Benefits" (\$M)	PV Costs (\$M)	NPV (\$M)
2	\$55.4	\$9.3	\$46.1

3.2.4 Other Options Considered but not Progressed

3.2.5 Option A – Establish 33/11kV Austral ZS supplied by 2x 33kV feeders from West Liverpool TS

One option that was considered was to establish a 33kV/11kV Austral ZS consisting of 3x 33/11kV 35 MVA transformers which would be required to provide at least 45MVA of firm capacity that is required for the ultimate load. To supply the substation at 33kV with N-1 transmission reliability, two 33kV feeders would be required from West Liverpool TS which is the closest 33kV substation approximately 8.0km away.

Budget pricing indicates that the 33kV feeders would cost approximately **30 Million** with the substation costing approximately **15 Million**. Additionally, there are significant route challenges that exist for the 33kV feeders which may increase the cost and duration of the project.

This option did not progress at the budget pricing shows that this option costs twice as much as establishing a 132kV/11kV Austral ZS (Option 1 & 2) and has considerable practical constraints and long term limitations.

3.3 Recommended Network Option

The options table below sets out the **long-term credible options** considered together with the option: **BAU Base Case** - “no proactive intervention” to assist the overall comparison. Table 14 shows that Option 1 represents the highest value (economic benefit), being NPV positive of \$24.7 Million compared to Option 2, even with the sensitivity & scenarios considered in Section 3.4. Additionally, it has the greatest reduction in unserved energy, allowing the greatest number of customers to connect. This aligns with NSW's Government's strategy for the Western Sydney Priority Growth Area. Hence, **Option 1** is the preferred long-term credible network configuration for the project's overall scope.

Table 14 – Options' summary table

Option	Description	Solution Type	PV residual risk ¹ \$M	PV Cost ² \$M	PV Benefits ³	NPV ⁴⁵ \$M	Rank	Assessment Description
N/A	BAU Base Case - No proactive intervention	Base case / counterfactual	-65.3	6.7 ⁶	-	-72.1	3	Non-preferred as will lead to unacceptable risk or higher cost for customers if opportunity not captured
1	Establish Austral ZS 132/11kV with a firm capacity of 45MVA	Network solution	-	9.6	65.1	55.4	1	Greatest Net Benefits, Preferred Long Term option
2	Staged Austral ZS 132/11kV with a firm capacity of 45 MVA	Network solution	-	9.3	55.4	46.1	2	Technically feasible, lower net benefits

Notes:

- 1: PV residual risk cost (or savings for opportunities) post the investment.
- 2: PV of total costs, both Capex and Opex. See Appendix **Error! Reference source not found.** for further details.
- 3: PV of total quantified benefits, both risk mitigated and any forecast decrease in Capex or Opex arising as a result of undertaking the investment (opportunities).
- 4: PV Benefits less PV Investment Costs.
- 5: The breakdown of PV is based on the central demand forecast scenario
- 6: This is the additional BAU cost for 11kV feeders to supply the Austral Precinct from Hinchinbrook ZS.

3.4 Sensitivity and Scenario Analysis

3.4.1 Sensitivity Analysis

Sensitivity tests and analysis have been applied to the economic evaluation in the Houston Kemp model and results are shown below.

To confirm the robustness of the economic evaluation and to demonstrate the results over a range of variation in some of the key variables, the sensitivity analysis was conducted on all of the credible network options.

The key variables included in the sensitivity analysis and shown below in Figure 17 were:

- Discount rate used for the discounted cashflow in the evaluation.
- Capital cost estimates.
- Value of customer reliability

The results show that Option 1 remains the most favourable option in all sensitivity tests as there was no tipping point found between the options as shown in Figure 18

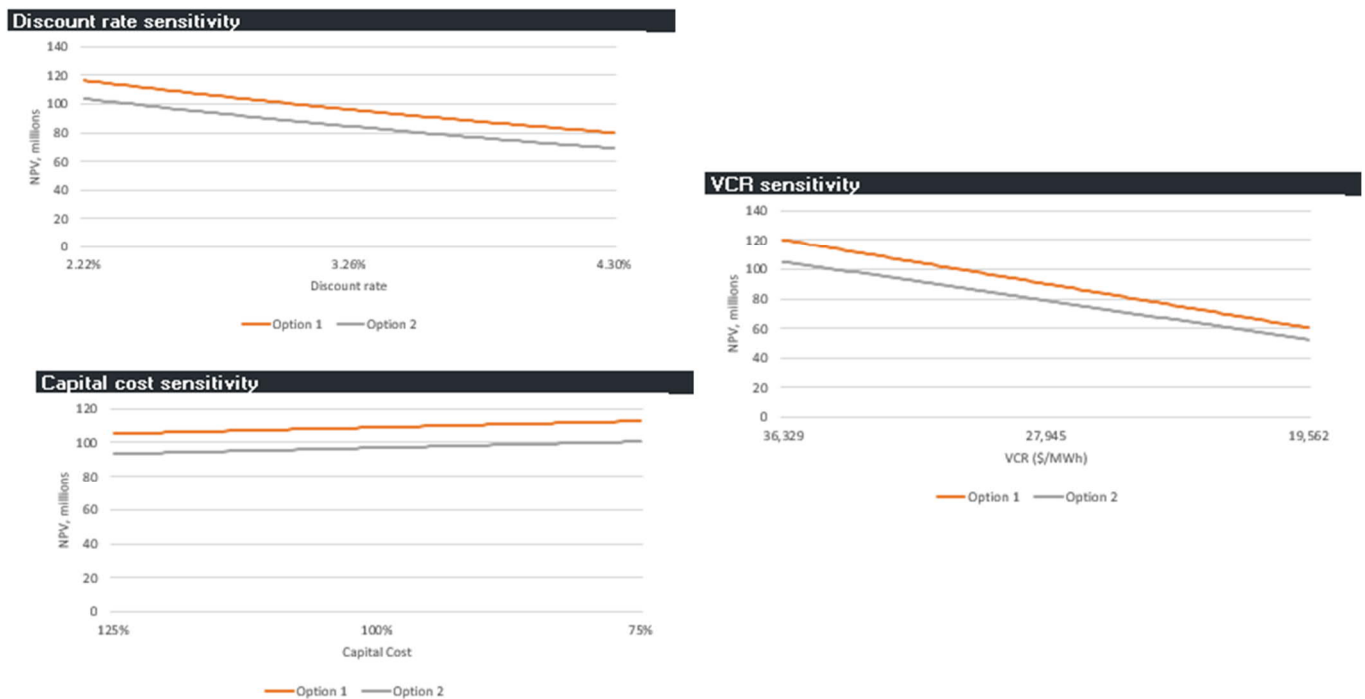


Figure 17: Sensitivity analysis

Thresholds and tipping points

Rank	Option	Weighted NPV
1	Option 1	108,857,556
2	Option 2	96,834,792

Goal seek values

Parameters	Units	Value	Notes
Discount rate	Percent	3.26%	Users should provide the seed values for goal seek values, which can be the same value from the central scenario. Using extreme seed values may cause issues with the model.
Capital cost	Factor	1.0000	
VCR	\$/MWh	27,945	
Risk costs	Factor	1.0000	

Rank 1 Option 1 for zero NPV

Parameters	Units	Value	Notes
Discount rate	Percent	27.91%	No reasonable risk costs can achieve zero NPV
Capital cost	Factor	8.2754	
VCR	\$/MWh	2,692	
Risk costs	Factor	-335,543.3200	

Rank 2 Option 2 for zero NPV

Parameters	Units	Value	Notes
Discount rate	Percent	22.74%	No reasonable risk costs can achieve zero NPV
Capital cost	Factor	7.5907	
VCR	\$/MWh	2,952	
Risk costs	Factor	#####	

Tipping points for Rank 1 to Rank 2

Parameters	Units	Value	Notes
Discount rate	Percent	✓ #N/A	No tipping points were identified
Capital cost	Factor	✓ #N/A	No tipping points were identified
VCR	\$/MWh	✓ #N/A	No tipping points were identified
Risk costs	Factor	✓ #N/A	No tipping points were identified

Figure 18: Summary of Sensitivity Analysis & Tipping Point

3.4.2 Scenario Analysis

Scenario analysis has been carried out by the model. The parameters of the scenario analysis are presented below.

General inputs							
General	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Commercial discount rate	Percent	3.26%	Central	Central	High	Low	Central
Cost inputs							
Cost	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Capital cost	Percent	100%	Central	Central	High	Low	Central
Planned routine maintenance and refurbishment	Percent	100%	Central	Central	High	Low	Central
Unplanned corrective maintenance	Percent	100%	Central	Central	High	Low	Central
Decommissioning costs	Percent	100%	Central	Central	Central	Central	Central
Non-network option provider costs	Percent	100%	Central	Central	High	Low	Central
Cost X	Percent	100%	Central	Central	High	Low	Central
Cost Y	Percent	100%	Central	Central	Central	Central	Central
Cost Z	Percent	100%	Central	Central	Central	Central	Central
Benefit inputs							
Avoided 'risk cost' benefits	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Reliability and security risk costs	Scenario	NA	Central	Central	Low	High	Central
Safety and health risk costs	Scenario	NA	Central	Central	Low	High	Central
Environmental risk costs	Scenario	NA	Central	Central	Low	High	Central
Legal/regulatory compliance risk costs	Scenario	NA	Central	Central	Low	High	Central
Financial risk costs	Scenario	NA	Central	Central	Low	High	Central
Market benefits	Unit	Value	Selection	Scenario 1	Scenario 2	Scenario 3	User defined
Involuntary load shedding - VCR	\$/MWh	26,008	Central	Central	Low	High	Central
Involuntary load shedding - MWh	Scenario	NA	Central	Central	Low	High	Central
Difference in timing of unrelated expenditure	Scenario	NA	Central	Central	Low	High	Central
Difference in timing of unrelated expenditure	Percent	100%	Central	Central	Low	High	Central
Voluntary load curtailment - VCR	\$/MWh	26,008	Central	Central	Low	High	Central
Voluntary load curtailment - MWh	Scenario	NA	Central	Central	Low	High	Central
Costs for non RIT-D proponent parties	Percent	100%	Central	Central	Central	Central	Central
Electricity energy losses	\$/MWh	100	Central	Central	Central	Central	Central
Change in load transfer capacity and the capacity for embedded g	Percent	100%	Central	Central	Central	Central	Central
Other classes of market benefits	Percent	100%	Central	Central	Central	Central	Central

Figure 19: Houston Kemp model scenario parameters

Sensitivity tests have been applied to the economic evaluation and results are shown below. The output demonstrates that Option 1 remains the most favourable option in all sensitivity tests.

Table 15: Summary of scenarios investigated

Variable	Scenario 1 - baseline	Scenario 2 – high benefits	Scenario 3 – low benefits
Capital cost	Estimated network capital costs	25% decrease in the estimated network capital costs	25% increase in the estimated network capital costs
Value of customer reliability (VCR)	\$27.9/kWh (from AER VCR report)	\$36.3/kWh 30% higher than baseline	\$19.6/kWh 30% lower than baseline
Discount rate	3.26% (WACC)	4.33%	2.22%
Maintenance costs	Estimated network maintenance costs	25% increase in the estimated network maintenance costs	25% decrease in the estimated network maintenance costs
Scenario weighting	50%	25%	25%

The scenarios have been weighted as 50% for Scenario 1 (Central) being the most likely with Scenarios 2 (High) and 3 (Low) being given a weighting of 25%. This is a reasonable approach to incorporate the uncertainty in the timing of development across the three scenarios that form the basis of the demand forecasts. Table 16 shows that Option 1 still has the highest NPV and is still the preferred option.

Table 16: Weighted NPV of network options

Option	Scenario 1 NPV (\$M)	Scenario 2 NPV (\$M)	Scenario 3 NPV (\$M)	Weighted NPV (\$M)	Option ranking
Option 1	55.4	332.7	-8.2	108.9	1
Option 2	46.1	309.1	-14.0	96.8	2

3.5 Optimal Timing for the investment

The optimal timing for the investment using the AER’s ‘crossover’ method is 2025 as per Figure 20. This is the first year when net operating benefits are larger than the annualised cost of an option. However, due to the need date for the project being driven by the need to connect customers and it being a ‘reliability corrective action’ to meet the connection of customers in accordance with the 5.2.3(d) of the NER, the expected commissioning date is in 2028.

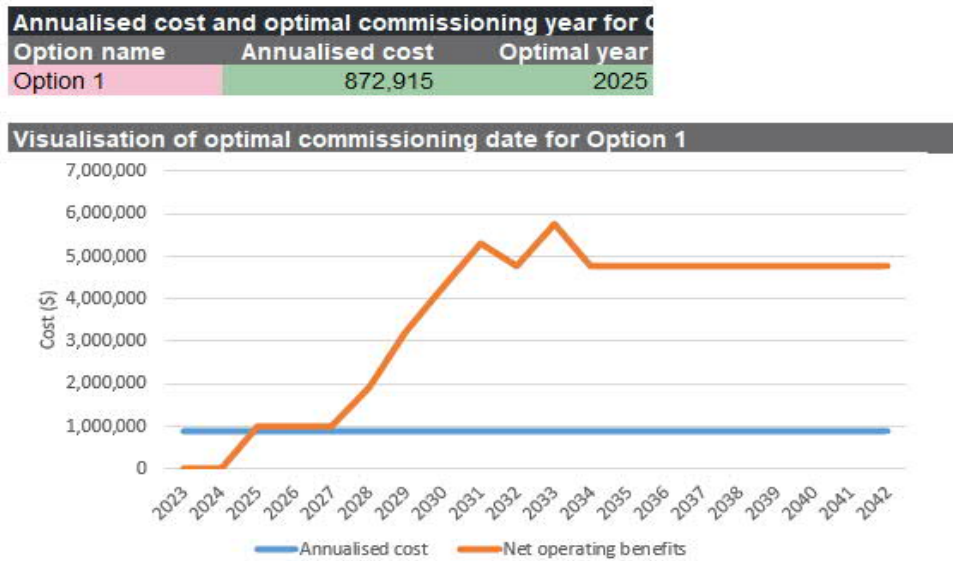


Figure 20: Houston Kemp optimal timing output

3.6 Non-Network Options

3.6.1 Scope

Electricity Distributors in NSW operate under the licence requirement (under the NSW Electricity Supply Act 1995) to investigate non-network alternatives to network augmentation for specific capital expenditure projects. The National Electricity Rules (NER) require Distribution Network Service Providers (DNSP) to investigate non-network options by utilising a consultation process as part of planning for major network augmentations.

The New Technology Master Plan (NTMP) tool was used to evaluate credible non-network options with the constraint of the existing Bringelly ZS. Figure 21 shows the comparison of non-network solutions and network solutions against the base case (“no proactive intervention”), while Figure 22 compares non-network solutions against the network solution.

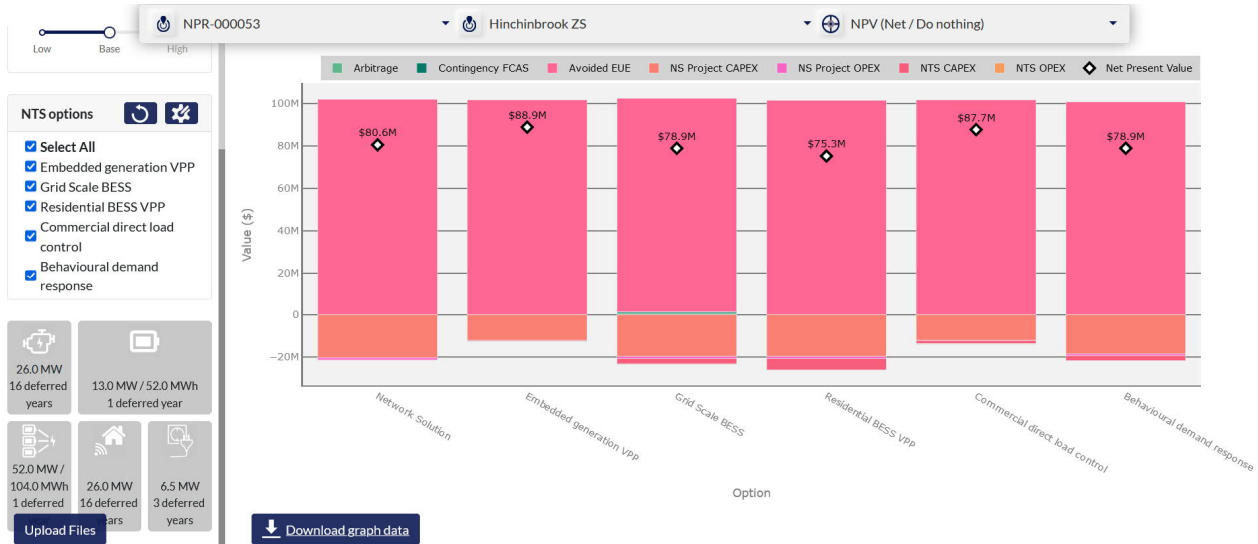


Figure 21: NTMP Output for Non-Network Options when compared to the Base Case (“no proactive intervention”)

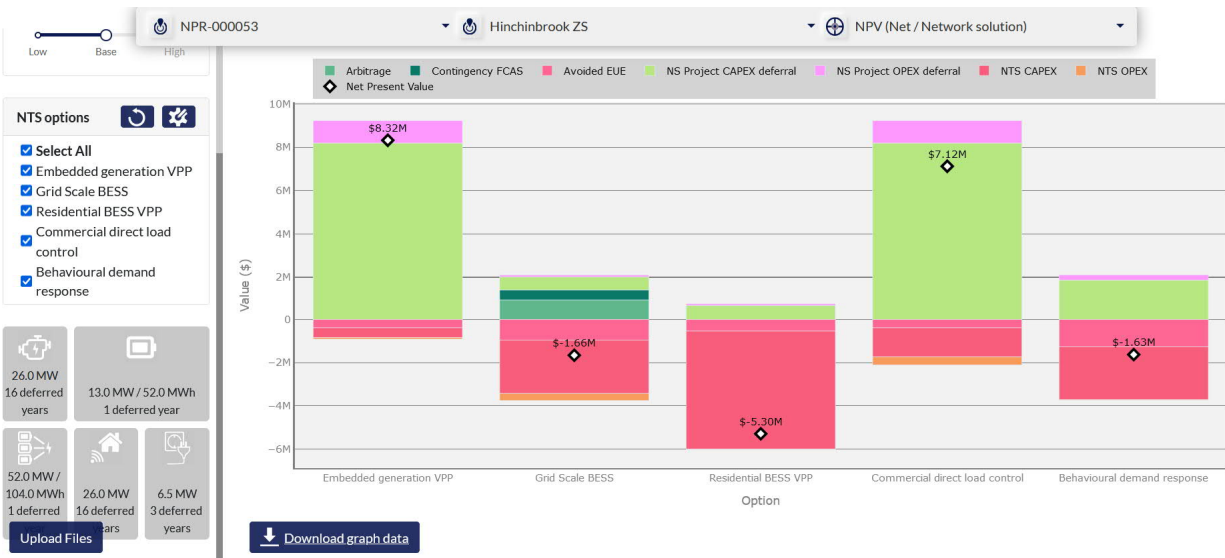


Figure 22: NTMP Output for Non-Network Options when compared to the Network Solution

Table 17 provides an overview of the outputs from the NTMP tool and overlays with qualitative assessment.

Table 17: Non-Network / New Technology Options

Non-Network Options	Outcomes	Qualitative Assessment	Comments
Grid-Scale Storage (13MW /52 MWh)	Potentially defer the network investment by 1 year	✗	Not a feasible option as it provides minimal deferral of network investment and is NPV negative when compared to the network option
VPP (26 MW)	Potentially defer the network investment by 16 years	✗	Not a feasible option as this is a new development. Additionally, the proposed capacity is large for a new technology and represents more than 50% of the forecasted demand in 2041. This uptake initially requires customers to connect to the network, which is not feasible with the existing network infrastructure
Residential BESS VPP 52MW /104.0 MWh)	Potentially defer the network investment by 1 year	✗	Not a feasible option as it provides minimal deferral of network investment and is NPV negative when compared to the network option
Commercial Direct Load Control (26 MW)	Potentially defer the network investment by 16 years	✗	Not a feasible option as this is a new development. Additionally, the proposed capacity is large for a new technology and represents more than 50% of the forecasted demand in 2041. This uptake initially requires customers to connect to the network, which is not feasible with the existing network infrastructure
Behavioural Demand Response (6.5 MW)	Potentially defer the network investment by 3 years	✗	Not a feasible option as this is a new development and is NPV negative when compared to the network option

3.6.2 Summary

The NTMP tool and the subsequent qualitative analysis found no feasible non-network option for this project due to the lack of network capacity in this development area. As part of the RIT-D process, Endeavour Energy will issue a screening report before progressing with the Draft Project Assessment Report (DPAR). However, non-network options may be feasible once the network infrastructure has been commissioned to defer future network investment.

4. Detailed description and costs of preferred option

The preferred option proposed Austral ZS be a complete build with firm 45MVA providing the N-1 security.

The scope of works for the preferred network option includes:

Zone substation:

- 2 x 132/11kV 45MVA power transformer (space for third transformer)
- 132kV bus bar with 2 x 132kV feeder bays (space for third feeder bay)
- 11kV indoor switchgear and switchboard with 14 CB's

Transmission lines:

- Two 132kV transmission connections made by looping in and out of existing 132kV Feeder 93X. Cable rating to match existing rating of ~250MVA at a total Length of approximately 0.5km.

Distribution works:

- Five initial 11kV feeders providing connection to existing 11kV routes. Estimated cost \$2.2m.
- Conversion of any remaining Arc Flash Circuit interrupter (AFCI) related network equipment (time clocks, smart meters, streetlight control points etc.)

Cost estimates for zone substation works have been calculated using the PIP unit rates table and using Box Hill ZS PR713 as an example of costs.

The recommended option establishes a new Austral ZS which will be supplied from feeder 93X with overhead cabling. The estimated feeder length will be 0.5km (two connections at approximate route length of 0.25km).

The nominal project cost is estimated to be \$21.4m. A contingency amount of \$2.05 million (approx. 10% of the project costs) has been built into the cost estimates covering unforeseen site conditions which may arise and cause delays. The forecast zone substation construction expenditure will occur from 2025/26 to 2027/28 as shown in the Table 18 below.

Table 18: Project expenditure spread

Estimated Cost	2025/26	2026/27	2027/28	Total
Substation, Transmission, Distribution cost (nominal) (\$)	3,209,000	9,626,000	8,557,000	21,392,000
Contingency (\$)	-	-	-	2,046,200
Total (\$)	3,209,000	9,626,000	8,557,000	23,438,200

5. Recommendations and Next Steps

This CFI recommends the establishment of a 132/11kV outdoor 45MVA zone substation to supply the Austral development area (prior to 2028). Austral ZS would be supplied by looping in and out of the existing 132kV feeder (93X), establishing two 132kV feeders supplying Austral ZS (One from Sydney West BSP and the other from North Leppington ZS). This option is NPV positive \$24.7 million with an estimated cost of 21.4 million with a contingency of 2.0 million. This cost is expected to be spread over three years, from FY25 to FY28.

It is recommended that the project value of \$23.4M be approved for consideration in the FY25-FY29 regulatory period.

Based on the Endeavour Energy's RIT-D process (Figure 23), it is recommended that the next steps are:

- Endeavour Energy publish a screening report before progressing to a Draft Project Assessment Report (DPAR) as per the RIT-D process (Refer to Figure 23). This is because the identified need for this investment is a reliability correction action to meet Endeavour Energy's connection obligations in the NER. This requires installation of headwork infrastructure, which can only be addressed with a *network only* credible option.
- The project proceeds to preliminary release with preferred Option 1 which recommends capital expenditure to build Austral ZS with a firm capacity of 45 MVA by FY28. Preliminary release enables development of project definitions, detailed design, environmental assessment, and preliminary market engagement activities in accordance with Company Procedure GRM0051.

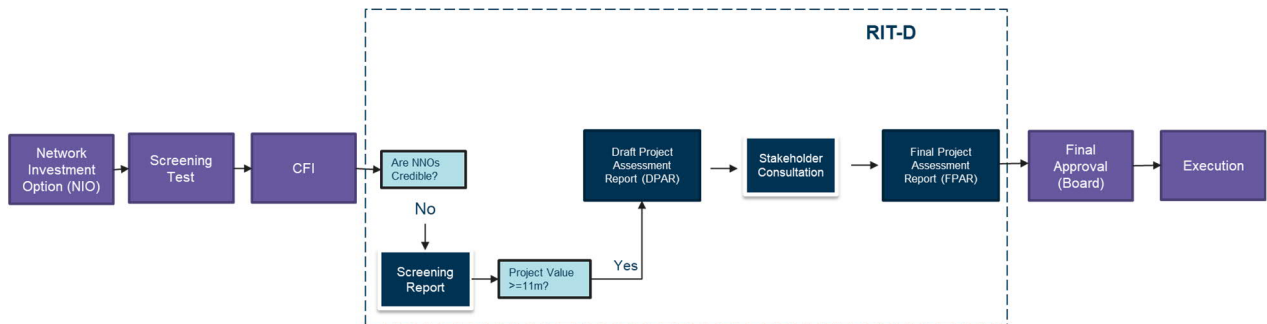


Figure 23: Endeavour Energy's RIT-D Process for this Project



Appendices

A. Referenced documents and appendices

- [1] Planning & Infrastructure, *Austral and Leppington North Precinct Plan*, NSW Government, 2012
- [2] Network Demand Forecasting, *Summer Demand Forecast 2022-2031*. Endeavour Energy, 2021.
- [3] Capacity Planning, PIP Input 23.0 Augex, Endeavour Energy, 2021.
- [5] Capacity Planning, *PR713 Supply to Box Hill Development Area Case for Investment*. Endeavour Energy, 2020.
- [6] AEMO, *2021 Inputs, Assumptions and Scenarios Report*. AEMO, 2021.

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