

# PR742: (NORTH NOWRA/BOMADERRY) CAMBEWARRA SUBSTATION

## MAJOR PROJECT BUSINESS CASE

Project	Description
Primary Driver	Network Connection
Project Category	GREENFIELD AUGEX
Publish Date	

Approvals	Name	Designation	Date
Prepared	Andrew Hardy	Capacity Planner	13/9/17
Reviewed	Deepak Sahay	Network Planning Engineer	16/02/2018
Endorsed	Jason Lu	Capacity Planning Manager	10/4/2018
Approved			

Revision	Amendment	Date

## 1.0 Background

The precinct of North Nowra/Bomaderry is an emerging residential development located on the north and south sides of Moss Vale Road between Bomaderry and Cambewarra Village which is a new greenfield growth area being fast tracked. The precinct of North Nowra/Bomaderry is in the process of being rezoned from rural to urban and will ultimately provide up to 5,066 new dwellings within the local government area of Shoalhaven City Council.

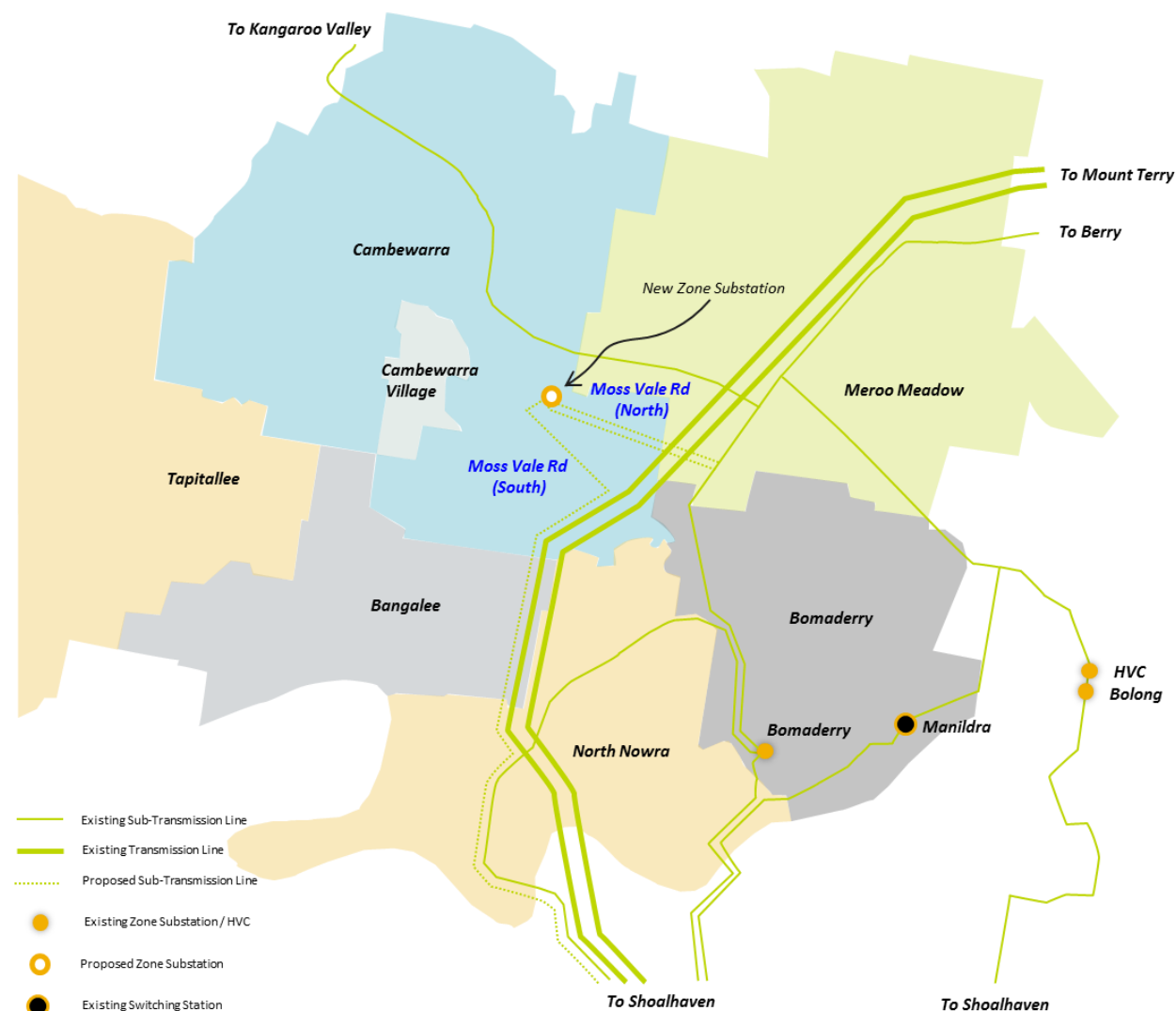


Figure 1 - Overview

Figure 1 presents an overview of the North Nowra/Bomaderry growth area and highlights existing and future investments required to service the growing number of dwellings and businesses requiring connection to grid services.

Growth in the North Nowra/Bomaderry area is presently addressed by a small amount of capacity available from the existing Bomaderry Zone Substation which services the existing urban Bomaderry, Cambewarra Village and North Nowra residential and commercial area as well as the rural areas to the northwest. Endeavour Energy has communicated to developers, the Department of Planning and Shoalhaven City Council the Moss Vale Rd development area can be initially supplied by the existing distribution network from Bomaderry ZS.

The NSW Government – Department of Planning through the Wollongong office co-ordinates the Illawarra-Shoalhaven Development Program. It aims to manage continued land and housing supply in the Illawarra and Shoalhaven through implementation of regional strategies.

Figure 2 provides alternative views from the Housing Industry Association and the Department of Planning in relation to dwelling forecasts for the region. The HIA data indicates the trend in dwelling commencements whereas the DoP data displays the trend in dwelling production for the Shoalhaven LGA. It should be noted the precinct of North Nowra/Bomaderry is an emerging greenfield release area and as yet is not included and reflected in the DoP Shoalhaven forecast.

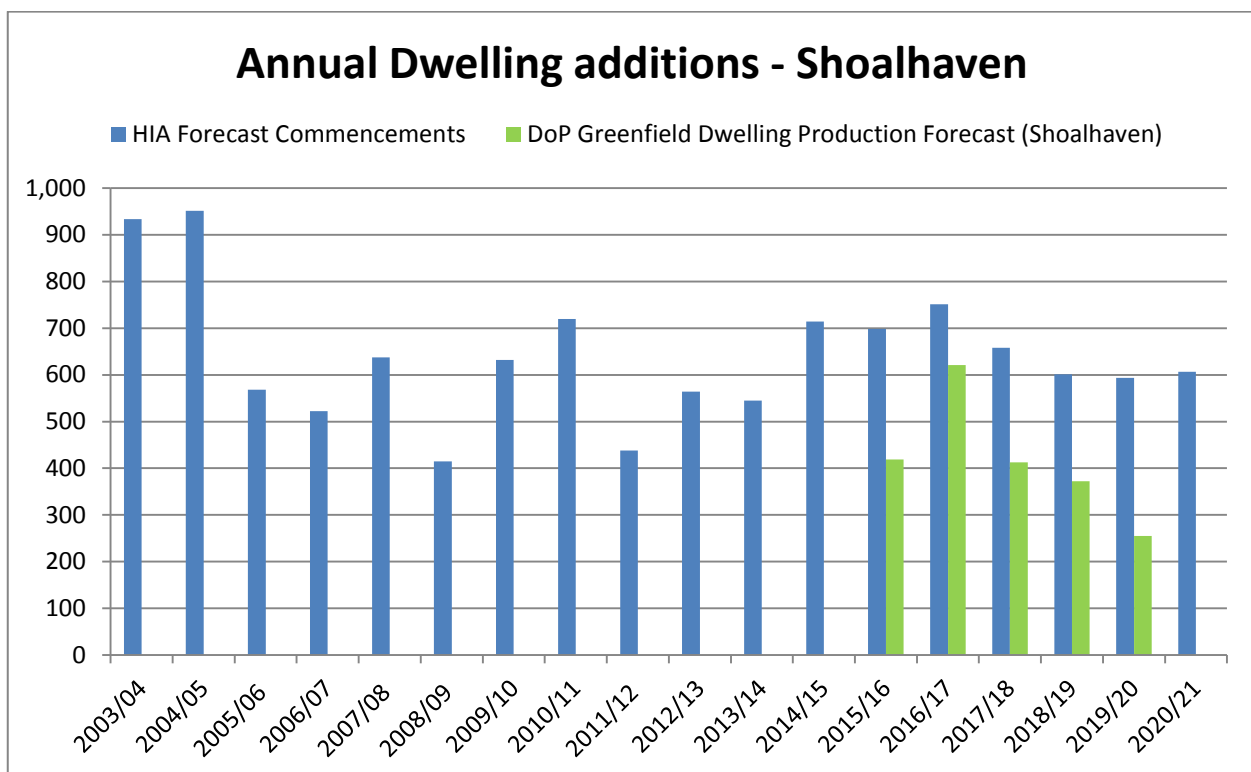


Figure 2 - Trends in residential dwelling commencements and completions. (Source: HIA, Department of Planning)

## 2.0 Need/Opportunity

Supply to the initial stages of the Moss Vale Rd South precinct will be managed through capacity being made available from Bomaderry Zone Substation. It is planned to marginally increase the capacity from Bomaderry ZS through a new distribution feeder required to address an existing overload on feeder 'BDF2 – Cambewarra'. Given the projected dwelling numbers, significant investment in additional distribution feeder capacity is comparable to establishing a zone substation closer to the load within the precinct of Moss Vale Rd. Short term supply issues are planned to be managed by using existing and proposed distribution assets. In order to cater for the ultimate development, timely construction of an appropriately situated zone substation will minimise investments in what would become redundant distribution assets.

### 2.1 Forecast Demand

Forecast demand for the new precinct of North Nowra/Bomaderry is indicated in Figure 3. Limited initial development in this precinct will be supplied from the existing Bomaderry Zone Substation through both existing and new distribution network in the area. Connections activity in this region is at enquiry stage and anticipated to convert into firm applications over the next 6-months as the NSW Government and Shoalhaven City Council fast track the release area due to a shortage of greenfield land stock.

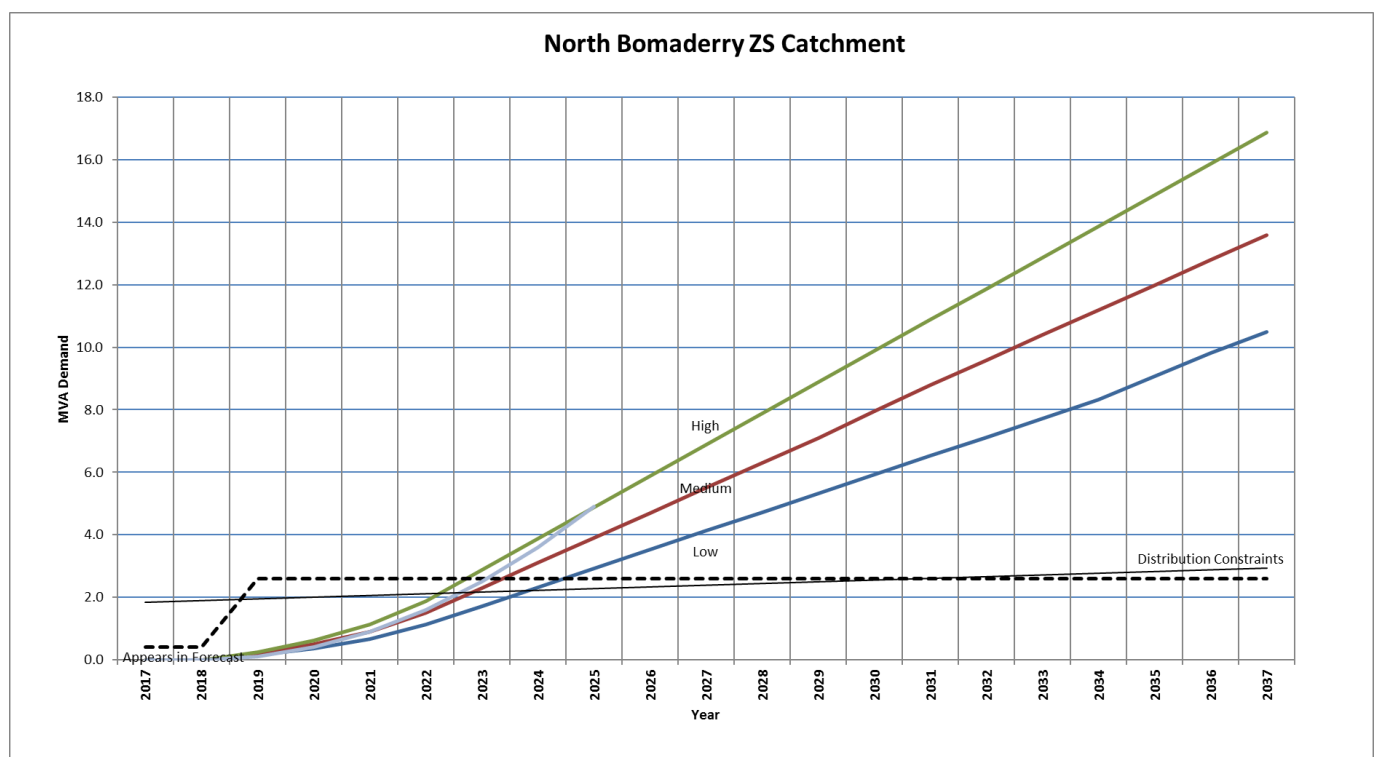


Figure 3 – North Nowra/Bomaderry Precinct - Forecast residential load

### 2.2 Existing Supply

The closest supply point to the new precinct of North Nowra/Bomaderry is Bomaderry Zone Substation approximately 3.8km to the northwest across the Bomaderry Creek Regional Park to the main precinct area. The existing Cambewarra area rural properties are supplied from two urban/rural 11kV feeders from Bomaderry Zone Substation. One of these feeders is 'BDC2 – North Bomaderry' where the System Operations Control Room utilises this feeder as the primary back up to Kangaroo Valley ZS which is normally supplied at N security via 33kV feeder 7512/7513. The next closest Zone Substation is Nowra located approximately 7.0km south and on the southern side of the Shoalhaven River which has no distribution network within the precinct area.

Based on a dwelling yield of 5,066 approximately 20MVA of load is required to service this area excluding additional retail/commercial and other community facilities (e.g. school). The precinct would require six 11kV distribution feeders to service the area. The existing rural network in the area only has

available capacity of 400kVA and is only able to support 100 dwellings, supplied from Bomaderry ZS. With the establishment of the proposed new 11kV distribution feeder from Bomaderry ZS it is expected the available capacity could be increased to a total capacity of 2600kVA to support 650 dwellings.

### 2.3 Load at Risk

Potential available distribution capacity in the area is 2600kVA. Continued connection of new dwellings following 2023 of the development will lead to load at risk on the distribution network, leading quickly to an inability to supply the development.

Table 1 - Load at risk (MW)

Network	2019	2020	2021	2022	2023	2024	2025	2026	2027
Distribution Capacity LAR (Bomaderry ZS)	-	-	-	-	-	0.5	1.3	2.1	2.9

### 2.4 Energy at Risk

On the basis of supply to initial developments within the new precinct, energy at risk over the forecast period is estimated as follows:

Table 2 - Energy at Risk (MWh)

Network	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy at Risk	0	1	164	1576	4563	7616	10496	12917	14837
Energy unable to be supplied (no capacity)	0	0	0	0	1	27	251	870	2044
Sum	0	1	164	1576	4563	7643	10747	13787	16881

## 3.0 Project Value

Continued connection of new customers to the small capacity available within the local distribution network will result in unacceptably high values for expected unserved energy and consequently VCR risk costs.

The precinct requires connections for up to 5,066 customers initially who will be entering the electricity market and generating business for market participants. In greenfield projects the VCR costs are strictly only applicable if supply is available. In this instance, capacity for new connections is only available for the first 650 of these customers, resulting in 4,416 new customers remaining unconnected unless further investment in the network is made. Application of the VCR to these unconnected customers is arguably not appropriate. Hence for the purpose of economic evaluation, an indicative retail value for the cost of energy (\$0.23 per kWh) has been applied to the energy that is not able to be served. This represents the value that market participants will be deprived of if these unconnected customers remained unconnected. This is considered extremely conservative as the economic costs of customers remaining unconnected are far greater than but arguably not as high as the connected cost customers would be willing to pay in the event of an outage.

Hence, by establishing additional subtransmission or distribution capacity to facilitate these connections, the following risk of non-supply costs would be addressed and available as benefits to the project proposal.

### 3.1 Modelled Project Benefits (VCR Risk Costs + Risk of Non-Supply)

Table 3 - VCR Risk Costs

Network	PV of VCR Risk + Non supply Risk Costs
Distribution Capacity from Bomaderry ZS	\$127.3m

The VCR benefits are high for this project as connection capacity will be exceeded in 2024 and if no action is taken development will not be able to proceed.

### 3.2 Project Costs

Distribution feeders from existing Bomaderry zone substation will have to traverse distances in excess of 3.8km in order to service the precinct. Increasing density around existing zone substations will make voltage drop an issue for long feeders. Assuming voltage drop remains within acceptable limits, a minimum of six distribution feeders will be required to service these precincts and will cost in excess of \$20million. It will preclude the opening up of further development frontiers in adjacent future precincts.

A new zone substation at Cambewarra is estimated to cost \$18.4million (\$FY19 real) an interim form.

## 4.0 Indicative Options

### 4.1 Option 1 – Establishment of Distribution Feeders

Generally, the establishment of initial distribution feeders from adjacent substations in such greenfield areas may be considered as credible options subject to a number of factors including:

- Available transformer capacity at adjacent zone substations
- Available circuit-breakers and switchboard capacity at zone substations
- the availability of suitable routes and established road layouts to establish feeders.

On the assumption that extension of further distribution feeders from Bomaderry ZS was feasible, six distribution feeders costing \$20 million would ultimately be required from Bomaderry ZS to the Moss Vale Road precinct. However, in this case, the extension of additional distribution feeders from Bomaderry ZS is not feasible for the reasons outlined below.

- There are no available circuit-breakers at Bomaderry ZS and augmentation works at Bomaderry would be required in order to connect additional feeders.
- Available capacity at Bomaderry Zone Substation is forecast to be exhausted by 2027 based on initial capacity being supplied to the precinct of Moss Vale Road and connections within its own catchment area. Connection of this load will drive an augmentation requirement for Bomaderry ZS where none currently exists.
- Suitable feeder routes and double cable feeder circuit breaker connections are not considered feasible from Bomaderry Zone Substation..

Notwithstanding the technical issues, to test the economic viability of this deferring the construction of a zone substation with this option, establishment of two distribution feeders initially followed by the construction of a new zone substation in 2027 has been modelled. The net market benefits are lower than the option of building the zone substation up front.

## **4.2 Option 2 – Establishment of a 33/11kV Zone Substation**

The establishment of a 33/11kV Zone substation is ultimately the preferred option on the basis of greater net market benefits over option 1 and given the size and extent of the development precinct. This option also removes forecast load at risk at Bomaderry Zone Substation.

The proposed capex in the next regulatory control period is \$18.4m which only allows for a single 33kV feeder and Stage 1 configuration of a zone substation.

The estimated net market benefits from this option has been evaluated to be \$112.5 Million.

## **4.3 Option 3 – Non-Network Options**

The principal contributors to the peak demand in this area are the existing rural area along with growth in demand from the new residential development. For demand management to be successful, peak demand on the existing feeders will need to be reduced as well as managing the demand growth in the development areas. A demand reduction or energy efficiency program is unlikely to achieve the required levels of demand reduction from an existing customer base for this greenfield development area. However, there may be some scope for a short deferral of the zone substation and this option needs to be explored further at the RIT-D stage.

Non-network solutions may be feasible for the new planned developments in conjunction with the developer where sufficient demand reduction exists within the existing customer base in conjunction with the initiatives within the development areas such as distributed energy resources. Newly constructed dwellings within the development areas are built to high energy efficiency standards. The associated demand reduction has been built into the demand forecast for these areas. Non-network solutions may also be feasible in managing the risks of unserviced load thus allowing further connections to be made.

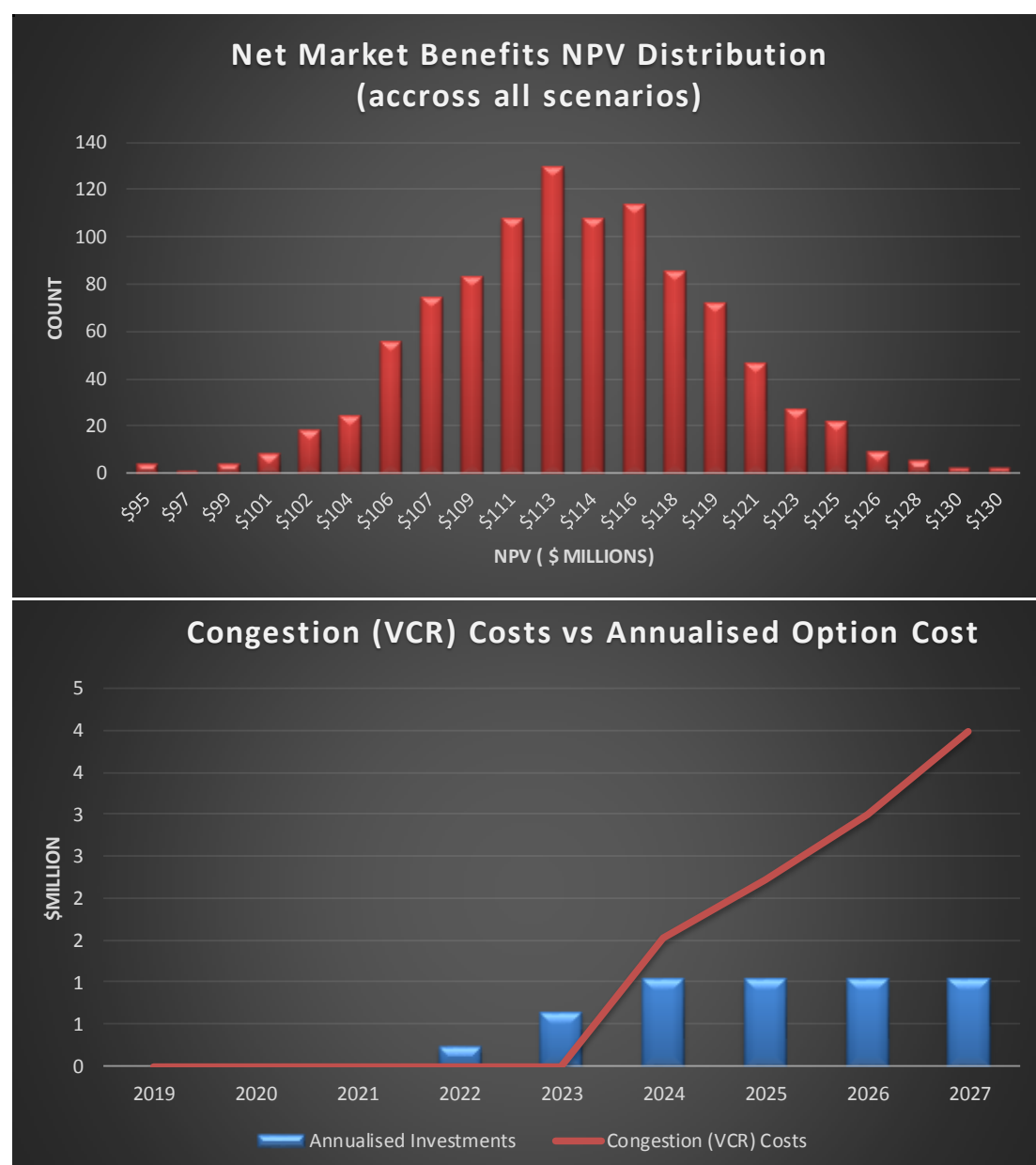
Subject to a DM screening test, this option will be explored further as part of the RIT-D process for this project. These opportunities will be further assessed during the RIT-D phase of the project.

## **5.0 Conclusion**

Based on the rates of growth and limited existing capacity, a zone substation of appropriate capacity needs to be established within the North Nowra/Bomaderry Precinct within the 2018/19-2023/24 regulatory period.

## 6.0 Appendix

Probabilistic VCR Template v4 North Bomaderry ZS Construction.xlsm				
	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)	
Deterministic Assessment	\$ 13.2	\$ 100.9	\$	87.7
Proabablistic Assessment	\$ 14.0	\$ 126.2	\$	112.5
PV of Risk Costs (Potential Market Benefits)		\$ 127.3		
		% Risk		
Risk of Negative Market Benefits		0%		



**Probabilistic VCR Template v4 North Bomaderry ZS Distribution Feeders.xlsm**

	PV investme nts (\$m)	PV Market Benefits (\$m)	NPV (\$m)
Deterministic Assessment	\$ 14.7	\$ 100.7	\$ 86.0

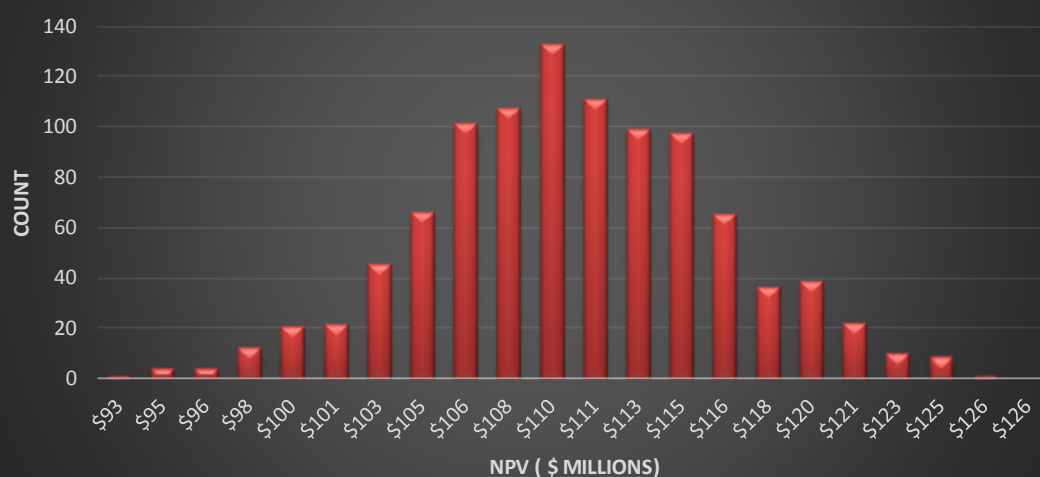
<b>Proabablistic Assessment</b>	<b>\$ 15.7</b>	<b>\$ 124.9</b>	<b>\$ 109.5</b>
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PV of Risk Costs (Potential Market Benefits) \$ 127.0

% Risk

<b>Risk of Negative Market Benefits</b>	<b>0%</b>
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**Net Market Benefits NPV Distribution  
(accross all scenarios)**



**Congestion (VCR) Costs vs Annualised Option Cost**

