PR425: AUSTRAL ZONE SUBSTATION
MAJOR PROJECT BUSINESS CASE

Project	Description
Primary Driver	Greenfield Release Area Development
Project Category	
Publish Date	

Approvals	Name	Designation	Date
Prepared	Joe Degabriele	Capacity Planner	04/09/2017
Reviewed	Deepak Sahay	Network Planning Engineer	
Endorsed	Jason Lu	Capacity Planning Manager	
Approved	Peter Langdon	Manager Asset Strategy & Planning	

Revision	Amendment	Date

1.0 Background

The Austral precinct is part of the NSW Government's Western Sydney Priority Growth Area. The precinct is approved for 14,289 residential dwellings plus 420,000m^2 of employment land and a town centre representing a combined forecast load of 57MVA.

Development has commenced with initial electricity supply provided from the neighbouring Hinchinbrook Zone Substation to the east and Kemps Creek Zone Substation to the west.

The proposed North Leppington Zone Substation in Bringelly Rd will also provide some capacity into the south of the Austral precinct although this substation is designed to provide capacity into the Leppington North precinct which is approved for 23,000 dwellings plus 700,000m2 of employment land and a major town centre representing a combined forecast load of 90MVA.

Figure 1 presents an overview of the Western Sydney Priority Growth Area and highlights existing and future investments required.

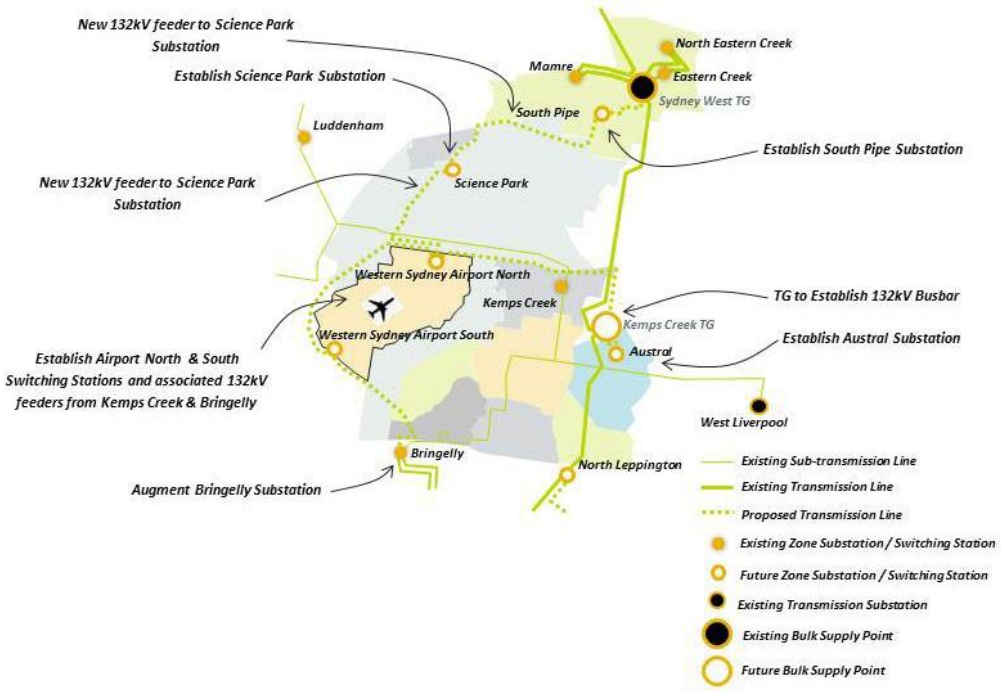


Figure 1 - Overview

Figure 2 provides a view from the Housing Industry Association in relation to dwelling forecasts for the region showing a recent acceleration of construction starts and a forecast that supports a sustained level of activity that is higher than average.

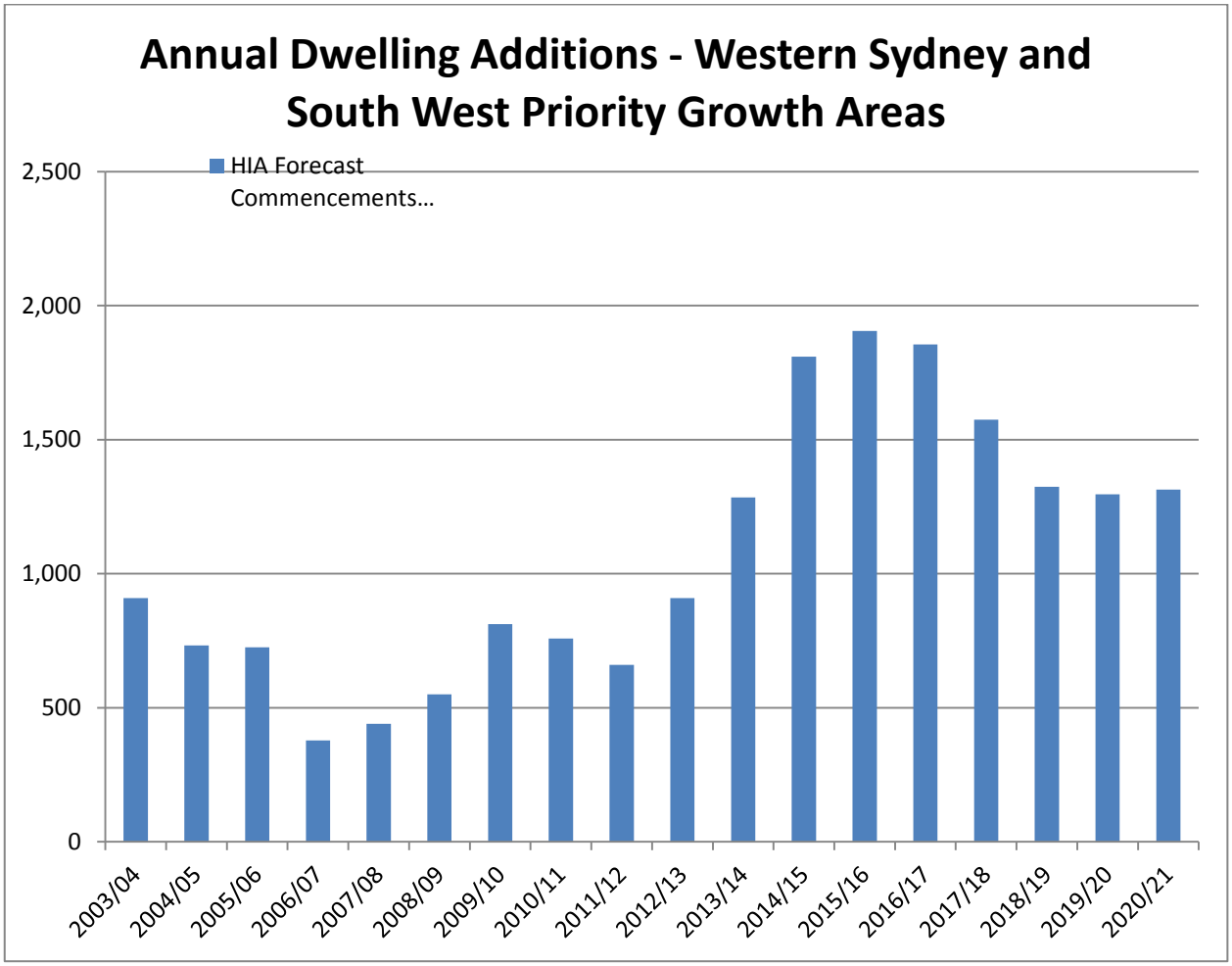


Figure 2 - Trends in residential dwelling commencements and completions. (Source: HIA)

2.0 Need/Opportunity

Given the projected dwelling numbers, significant investment in additional distribution feeder capacity from neighbouring zone substations is comparable to establishing a zone substation closer to the load within the Austral precinct. Supply to initial developments in the precinct is limited and accounts for approximately 1,350 dwellings. In order to cater for the ultimate development, timely construction of an appropriately situated zone substation will minimise investments in what would otherwise become redundant distribution assets.

2.1 Forecast Demand

Forecast demand for the Austral precinct is indicated in Figure 3. A limited amount of initial development will be supplied from the existing Hinchinbrook Zone Substation through the existing distribution network in the area. Upstream works in the Middleton Grange precinct are progressively being made to off-load feeders currently supplying into the Austral precinct to divert capacity into Austral. Connections activity in Austral is increasing with 12 subdivisions representing 420 dwellings processed to date. This is 31% of the 1,350 initial dwellings to be supplied from the existing network. Further south there have been 17 subdivisions representing 1,000 dwellings processed within the Leppington North precinct on network that would provide initial capacity to the southern part of the Austral precinct from the proposed North Leppington Zone Substation.

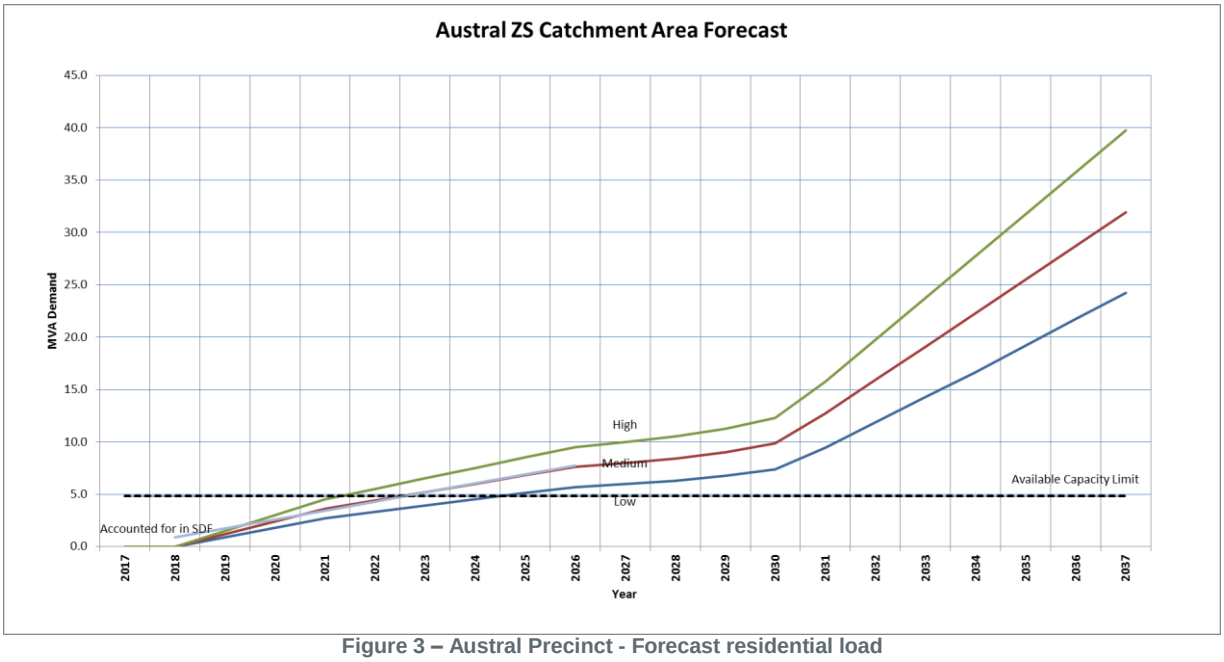


Figure 3 – Austral Precinct - Forecast residential load

2.2 Existing Supply

The closest supply point to the Austral precinct is Hinchinbrook Zone Substation located approximately 3 km to the east. Kemps Creek Zone Substation is 3.5km to the north-west and the proposed North Leppington Zone Substation will be 2.9km to the south end of the Austral precinct but 4km to where the initial development is currently occurring. Refer to the accompanying "Common Considerations" document for a discussion on how supply from existing assets is evaluated.

Based on an ultimate yield of 14,289 dwellings, 0.4km^2 of employment area and a new town centre, approximately 57MVA of capacity is required to service this area. The precinct would require a minimum of thirteen 11kV distribution feeders to service the load at an average of 4.4MVA per feeder. The existing rural network in the area has an available capacity of 4.8MVA and can service up to 1,350 dwellings at most and would be supplied predominantly from Hinchinbrook ZS.

2.3 Load at Risk

Available distribution capacity in the area is 4.8MVA. Continued connection of new dwellings beyond the first three years of development will lead to load at risk on the distribution network, resulting to an inability to supply continued development.

Table 1 - Load at risk (MW)

Network	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Distribution Capacity LAR (Hinchinbrook ZS)	-	-	0.4	1.5	2.7	3.7	4.7	5.7	6.7	7.7

2.4 Energy at Risk

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

Table 2 - Energy at Risk (MWh)

Network	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Energy at Risk	-	-	2.4	71.6	220.9	451.2	830.9	1353.0	1970.1	2339.1

Energy unable to be supplied (no capacity)	-	-	0.0	0.0	1.8	10.9	39.7	100.6	193.9	256.6
Sum	-	-	0.0	2.4	71.6	222.8	462.1	870.7	1453.5	2164.1

3.0 Project Value

Continued connection of new customers with the small amount of 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 14,289 new customers 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 1,350 of these customers, resulting in 12,939 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 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 Hinchinbrook ZS	$75.0m

The VCR benefits are high for this project as connection capacity will be exceeded in 2020 and if no action is taken, development will not be able to proceed beyond the initial 1,350 dwellings.

3.2 Project Costs

Distribution feeders from existing zone substations will have to traverse distances in excess of up to 4km in order to service the Austral precinct. Increasing density around existing zone substations will reduce feeder capacity and make voltage drop an issue for long feeders. Assuming voltage drop remains within acceptable limits, a minimum of thirteen dedicated 11kV distribution feeders will be required to service the precinct and will cost in excess of $20million.

The 132kV sub-transmission network passing through the Austral precinct, and with 11kV feeders likely to be up to 3km shorter than from nearby zone substations, a new zone substation in Austral is estimated to cost $25million. The nearby zone substation networks would provide alternate supply during planned outages and back-up restoration supply during contingencies associated with Austral ZS and its network.

4.0 Supply Options

The options considered for this business case these are summarised as follows;

Option 1 - Non-Network Solution

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. However, given that surrounding areas are also developing and connections to these feeders are likely to increase, the available capacity to supply the developing areas reduces and obtaining sufficient demand reduction becomes more challenging. 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.

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.

Given that surrounding areas are also developing and connections to these feeders are likely to increase, potential for reduction in forecast peak demand is limited to efficiency measures and technology take-up associated with new houses. This has the potential to influence timing of network build options. 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.

Option 2 - Establish a new 11kV Distribution Feeder

The first stage of supply is to utilise capacity from the adjacent Hinchinbrook ZS and Kemps Creek ZS. Existing 11kV feeders from these two neighbouring substations will be used to supply up to 1,350 initial residential dwellings. A further option to establish one 11kV feeder from Hinchinbrook ZS once this capacity is exhausted will cost approximately $2.7 million and provide 4.6MVA of capacity.

Option 3 - Establish New Mobile Zone Substation

The establishment of a 132/11kV mobile zone substation is estimated to cost $2.4 million and provide up to 15MVA of capacity subject to 11kV constraints. This is the preferred option based on greater net market benefits and is NPV positive compared the value of expected unserved energy.

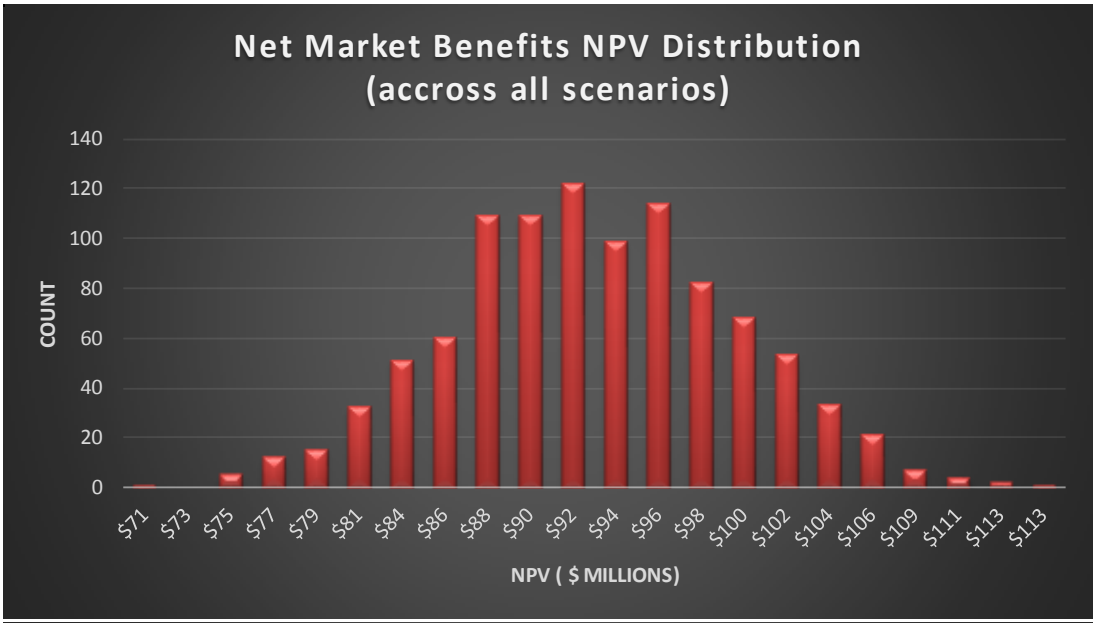
This option has been determined as being required by the year 2022 when network capacity will be exhausted. This ultimately required option forms part of the South West Growth Sector Supply Strategy and will provide capacity for the entire precinct.

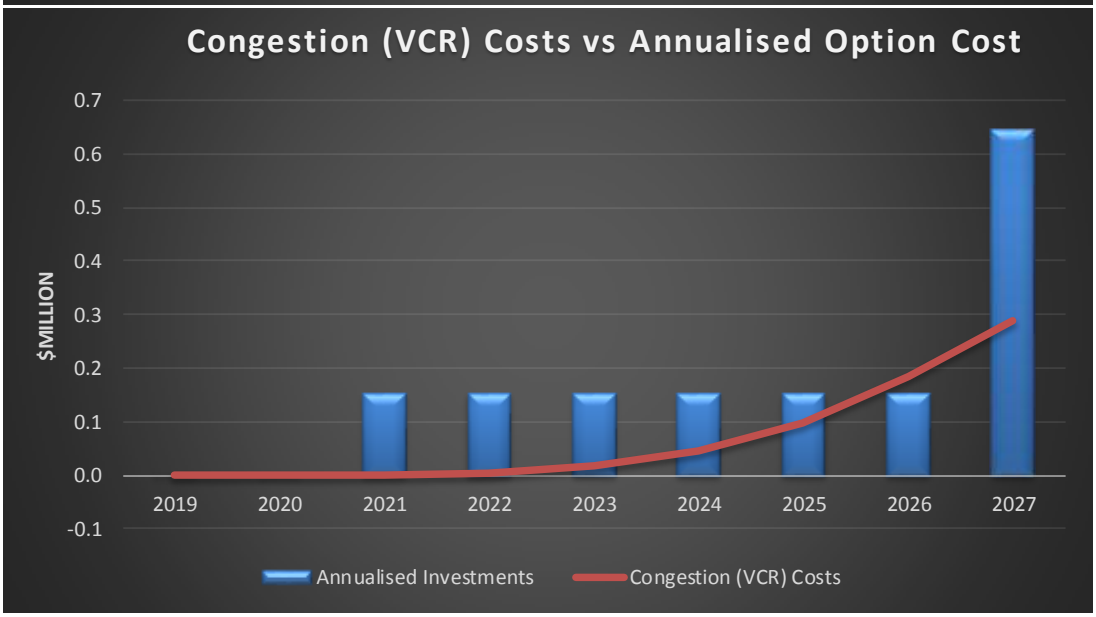
5.0 Preferred Option

The preferred option is to establish a new mobile zone substation to minimise unnecessary distribution works once an optimum number of feeders have been extended from nearby zone substations. The zone substation establishment can be in mobile/interim configuration as nearby substations will be able to provide some backup capacity. The mobile option represents capital outlay that is similar to the cost of establishing a single distribution feeder and provides similar market benefits. In terms of the network, however, this option will enable the distribution network to grow in a strategic manner within this greenfield precinct and minimise duplication and redundant assets once a permanent zone substation is established.

6.0 Appendix

Probabilistic VCR Template v3 Austral mobile.xlsm			
	PV investments ($m)	PV Market Benefits ($m)	NPV ($m)
Deterministic Assessment	$ 14.1	$ 106.8	$ 92.7
Proabablistic Assessment	**$ 15.1**	**$ 106.7**	**$ 91.9**
PV of Risk Costs (Potential Market Benefits)		**$ 106.9**	
	% Risk		
Risk of Negative Market Benefits	**0%**		





Probabilistic VCR Template v3 Austral dist feeders.xlsm			
	PV investments ($m)	PV Market Benefits ($m)	NPV ($m)
Deterministic Assessment	$ 14.2	$ 106.8	$ 92.6
Proabablistic Assessment	**$ 15.1**	**$ 106.3**	**$ 91.5**
PV of Risk Costs (Potential Market Benefits)		**$ 106.5**	
	% Risk		
Risk of Negative Market Benefits	**0%**