# Addressing reliability requirements in the Clovelly load area

NOTICE ON SCREENING FOR NON-NETWORK OPTIONS REPORT

JUNE 2018

Ausgrid

# Addressing reliability requirements in the Clovelly load area

Notice on screening for non-network options – 22 June 2018

## Title of Contents

# Disclaimer

Ausgrid is registered as both a Distribution Network Service Provider and a Transmission Network Service Provider. This Draft Project Assessment Report has been prepared and published by Ausgrid under clause 5.17 of the National Electricity Rules to notify Registered Participants and Interested Parties of the results of the regulatory investment test for distribution and should only be used for those purposes.

This document does not purport to contain all of the information that a prospective investor or participant or potential participant in the National Electricity Market, or any other person or interested parties may require. In preparing this document it is not possible nor is it intended for Ausgrid to have regard to the investment objectives, financial situation and particular needs of each person who reads or uses this document.

This document, and the information it contains, may change as new information becomes available or if circumstances change. Anyone proposing to rely on or use the information in this document should independently verify and check the accuracy, completeness, reliability and suitability of that information for their own purposes.

Accordingly, Ausgrid makes no representations or warranty as to the accuracy, reliability, completeness or suitability for particular purposes of the information in this document. Persons reading or utilising this document acknowledge that Ausgrid and their employees, agents and consultants shall have no liability (including liability to any person by reason of negligence or negligent misstatement) for any statements, opinions, information or matters (expressed or implied) arising out of, contained in or derived from, or for any omissions from, the information contained in this document, except insofar as liability raised under New South Wales and Commonwealth legislation.

# 1 Introduction

The underground electricity distribution lines (‘feeders’) supplying the Clovelly zone substation (ZS) were commissioned in the 1960s and 1970s, and are now reaching, or past, the end of their technical lives. These feeders, connecting Zetland and Clovelly zone substations, are self-contained fluid filled (SCFF) cables, which are now considered an obsolete and dated technology. They are becoming less reliable and approaching the point at which their replacement maximises the net benefit for the community.

Ausgrid identified the need to replace the feeders supplying the Clovelly ZS in 2017 and identified a preferred solution to mitigating the identified risks.

Since early 2018, Ausgrid has engaged with the local community seeking feedback on the preferred replacement option identified in 2017. These activities included notifying Randwick City Council and RMS, holding community information sessions, as well as having representatives from the Ausgrid project team speak to many businesses and visiting residents in the area. This consultation included visiting and distributing project information to residents along the impacted streets. Ausgrid encourages community feedback and has committed to keep the community informed as the project progresses through notification letters, door knocks and the Ausgrid website. Ausgrid wishes to thank all those consulted with for their time and suggestions.

Rule changes to the National Electricity Rules (NER) in July 2017 have meant that the replacement plans for ageing feeders are now subject to the RIT-D. Accordingly, Ausgrid has initiated this RIT-D for replacing ageing feeders supplying the Clovelly ZS in order to investigate and consult on options to ensure Ausgrid is able to satisfy the reliability and performance standards that it is obliged to meet.

A full discussion of asset conditions and the identified need can be found in the Draft Project Assessment Report (DPAR) for addressing reliability requirements in the Clovelly load area.

This notice has been prepared under cl. 5.17.4(d) of the NER and summarises Ausgrid’s determination that no non-network option is, or forms a significant part of, any potential credible option for this RIT-D. In particular, it sets out the reasons for Ausgrid’s determination, including the methodologies and assumptions used.

# 2 Forecast load and capacity

## 2.1 Load forecast

Figure 1 and Figure 2 below show the historical actual demand, the 50% Probability of Exceedance level (50 POE) weather corrected historical actual demand and the 50 POE forecast demand for both winter and summer for Clovelly and Zetland zone substations.

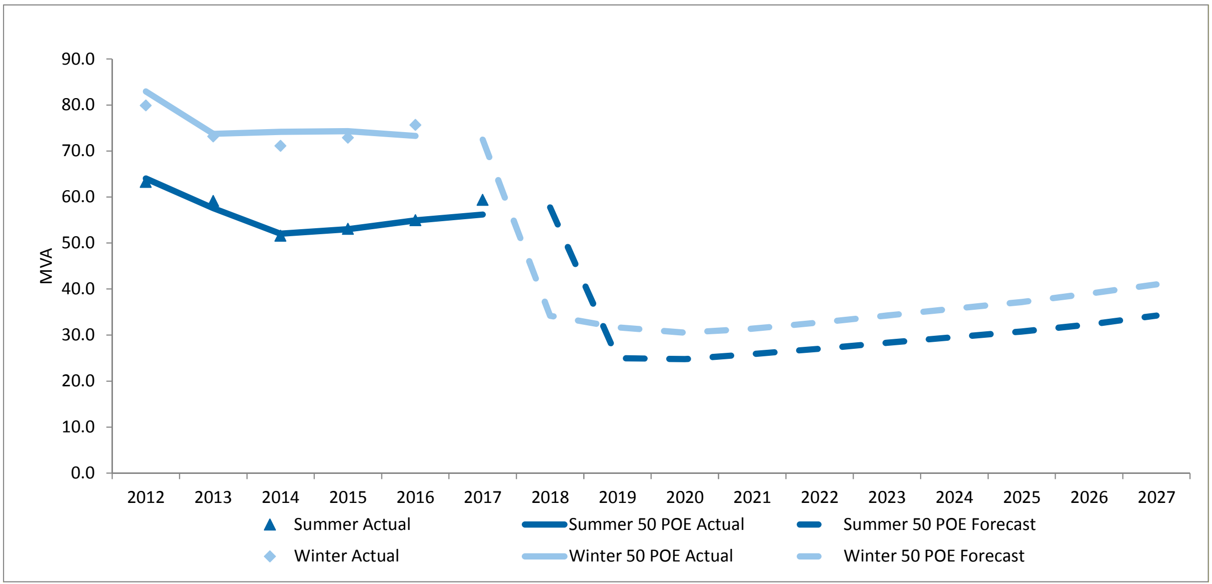
### 2.1.1 Load forecast – Clovelly ZS

The Clovelly zone substation has a total capacity of 128 MVA and a firm capacity of 87.6 MVA. In 2016, the maximum demand on the zone substation was 75.6 MVA at 7:15pm AEST on 27 June 2016. The weather corrected demand at the 50 POE level was 73.3 MVA. The power factor at the time of summer maximum demand was 0.98.

Maximum demand has consistently occurred in winter in past years, common for zone substations serving predominantly residential load situated along the coast. In the winter season, the maximum demand typically occurs between 7:00pm and 7:30pm AEDT.

Note that the significant drop in the winter load forecast for Clovelly ZS reflects the committed project to decommission compound 11 kV switchgear at Clovelly ZS and transfer load to nearby Waverley and Kingsford zone substations. The 7 year compound annual growth rate (CAGR) for the 50 POE forecast to 2023/24 (net of 2019 load transfer) for maximum demand is 0.4% for winter and 2.7% for summer.

**Figure 1 – Demand forecast at Clovelly zone substation**

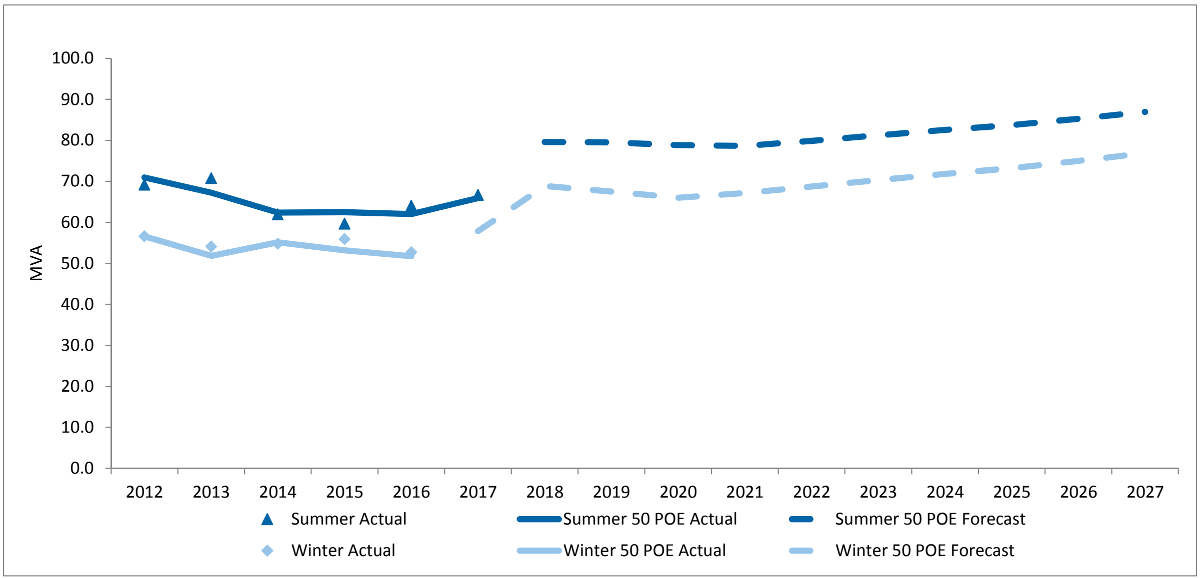



### 2.1.2 Load forecast – Zetland ZS

The Zetland zone substation has a total capacity of 152.4 MVA and a firm capacity of 86.3 MVA. In 2016/17, the maximum demand on the zone substation was 66.7 MVA at 11:30am AEDT on 24 January 2017. The weather corrected demand at the 50 POE level was 65.9 MVA. The power factor at the time of summer peak demand was 0.98.

Maximum demand has typically occurred in summer in past years. In recent years, the maximum demand has typically occured between 11:30am and 3:30pm AEDT. The 7 year compound annual growth rate (CAGR) for the 50 POE forecast to 2023/24 for maximum demand is 3.3% for summer and 4.5% for winter, driven substantially by large new customer connections.

**Figure 2 – Demand forecast at Zetland zone substation**




## 2.2 Pattern of use

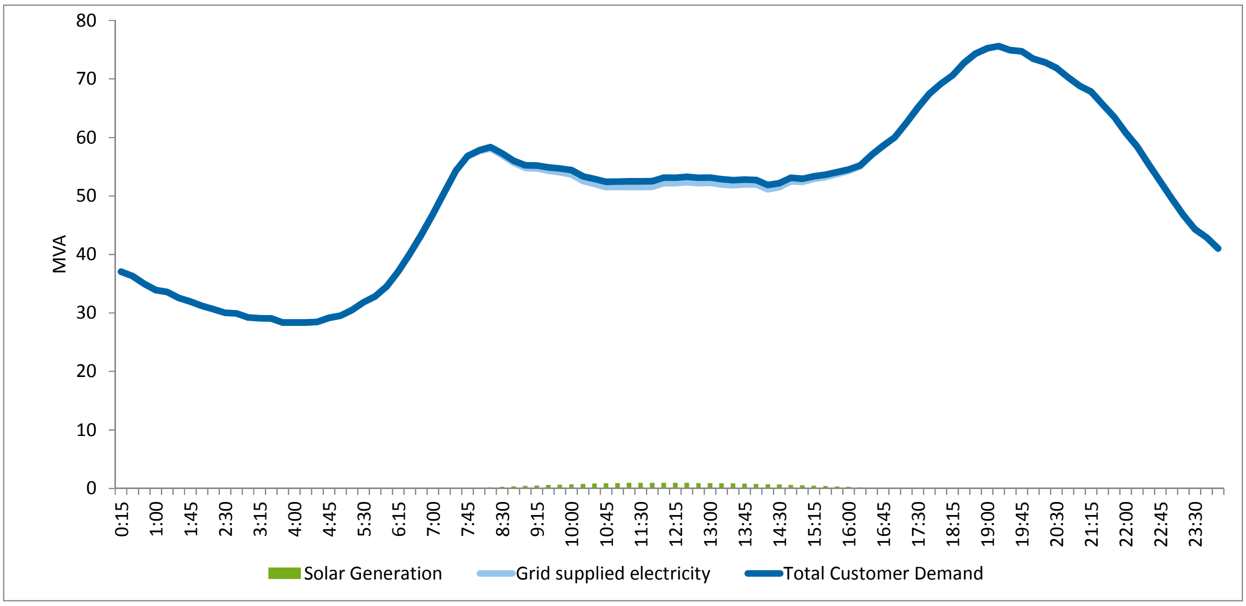
Peak electricity demand at Clovelly zone substation occurs on cold winter days driven predominantly by residential heating loads. Summer peak electricity demand at Zetland zone substation occurs on hotter days driven predominantly by non-residential cooling loads.

### 2.2.1 Pattern of use – Clovelly ZS

Over the past 7 years, the time of peak has typically occurred between 7:00pm and 7:30pm AEST. As noted above, the most recent winter maximum demand occurred at 7:15pm AEST.

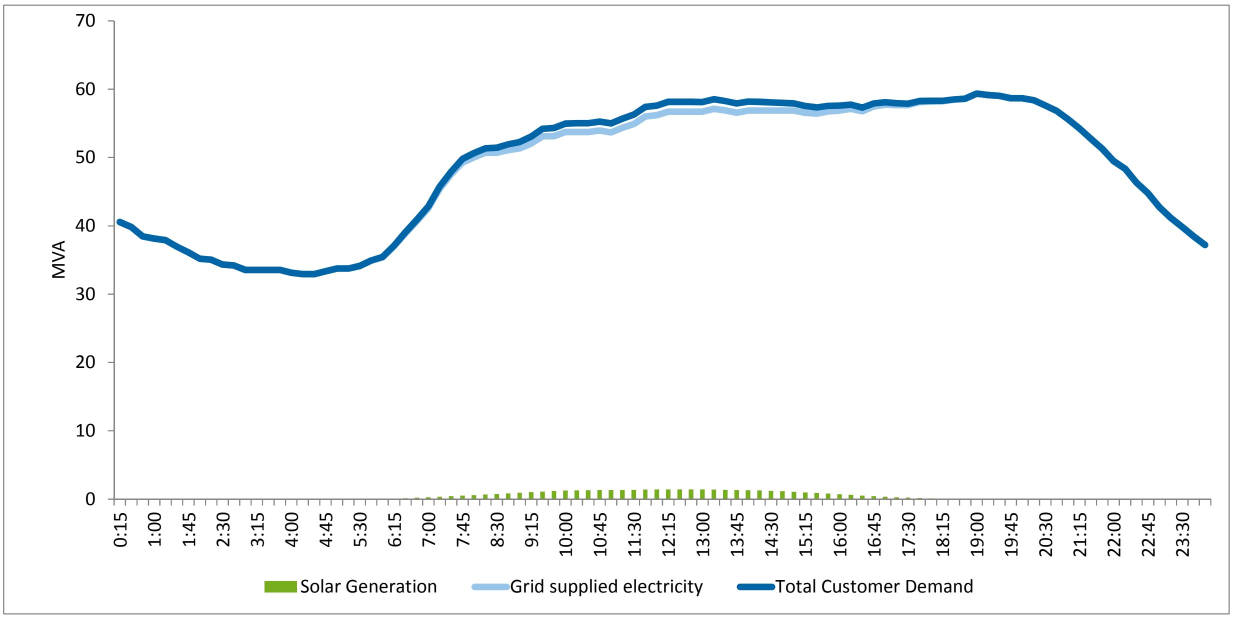
There is a total capacity of about 2.2 MW of solar PV connected to the zone substation. At the peak time on 27 June 2016, these PV systems are estimated to have supplied 0 MW of the customer load. Figure 3 below shows the load trace for the 27 June 2016 maximum demand day including the contribution from customer installed solar power systems.

**Figure 3 – Winter maximum demand profile at Clovelly zone substation (27 June 2016)**



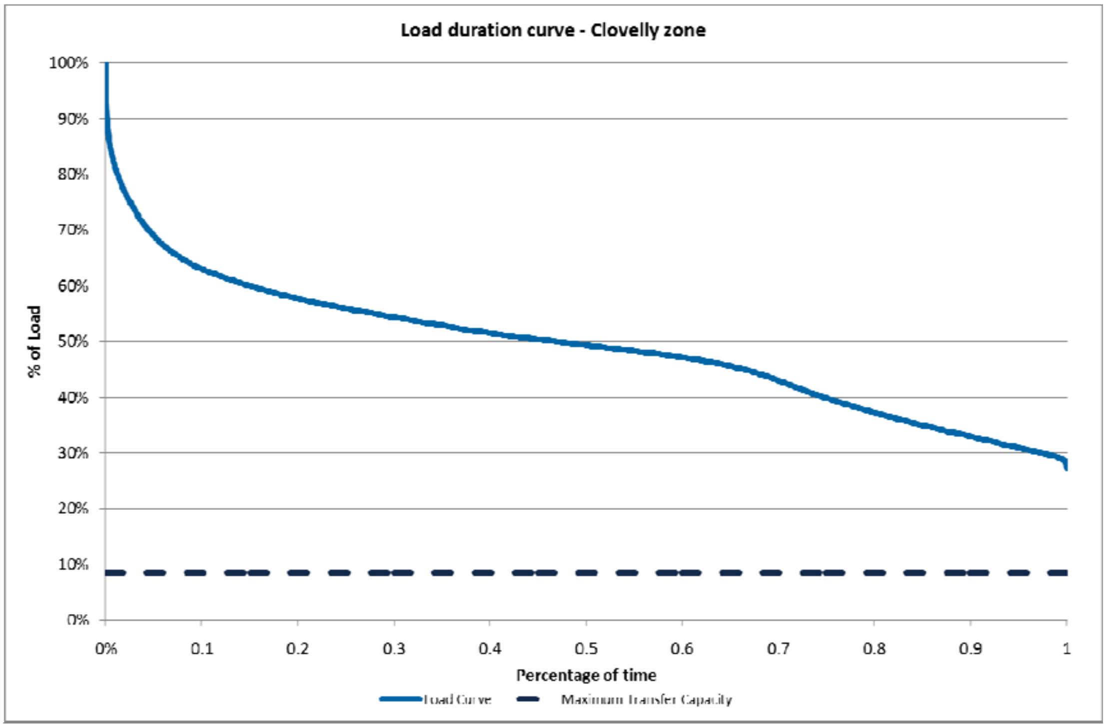

Summer peak electricity demand at Clovelly zone substation typically occurs in the evening. Over the past 7 years, the time of summer peak has occurred between 4:00pm and 8:00pm AEDT. Figure 4 below shows the load trace, including the contribution from customer installed solar power systems, for 6 February 2017 when maximum demand occurred at 7pm AEDT.

**Figure 4 – Summer maximum demand profile at Clovelly zone substation (6 February 2017)**



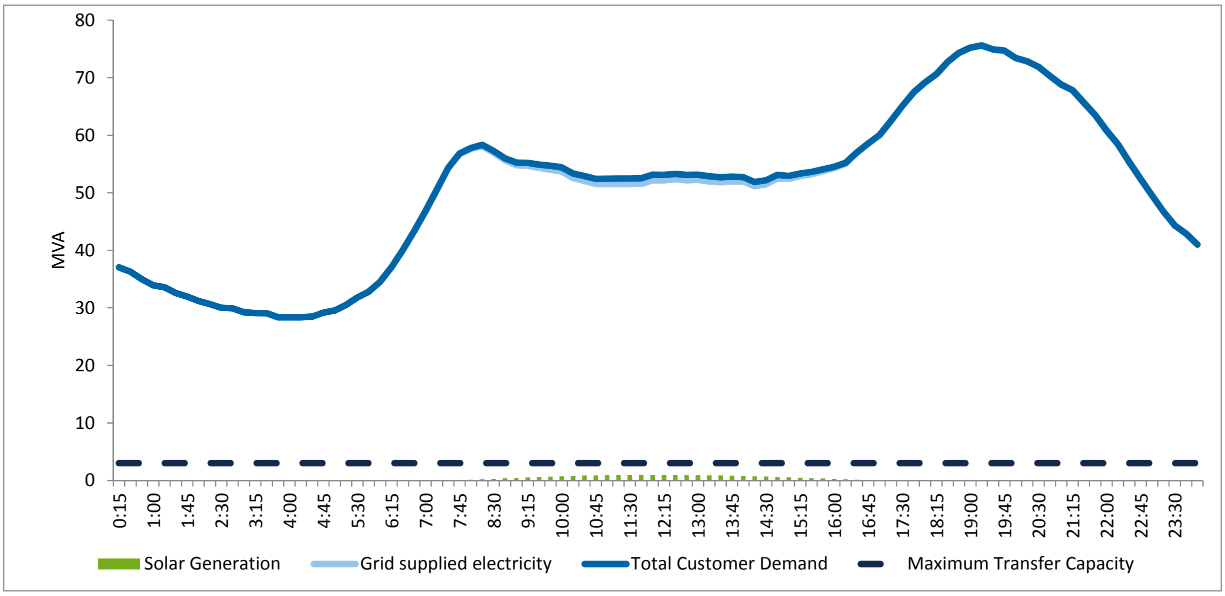

Post 2019 load transfers to Waverley and Kingsford ZSs, Clovelly ZS has a remaining load transfer capacity of 3 MVA or about 12% of the 2016/17 maximum summer demand adjusted for the 2019 load transfer and 8% of adjusted 2016 maximum winter demand. Based upon the seasonal data for 1 May to 31 August 2016 and 1 November 2016 to 5 March 2017, and adjusted for the committed load transfers, electricity demand for Clovelly zone substation exceeds the remaining available transfer capacity 24 hours per day for the entire period. Due to the scale of the shortfall, it is expected that demand would exceed capacity for all hours in the year. Over the seasonal data period analysed, there is a total of about 78,000 MWh of unmet load in the case of a loss of network supply from Clovelly zone substation. The load duration curve for this selected period, adjusted for the committed 2019 load transfers, and noting the transfer capacity, is shown below in Figure 5.

**Figure 5 – Clovelly Zone Substation Load Duration Curve (1 May to 31 August 2016 and 1 November 2016 to 5 March 2017 adjusted)**



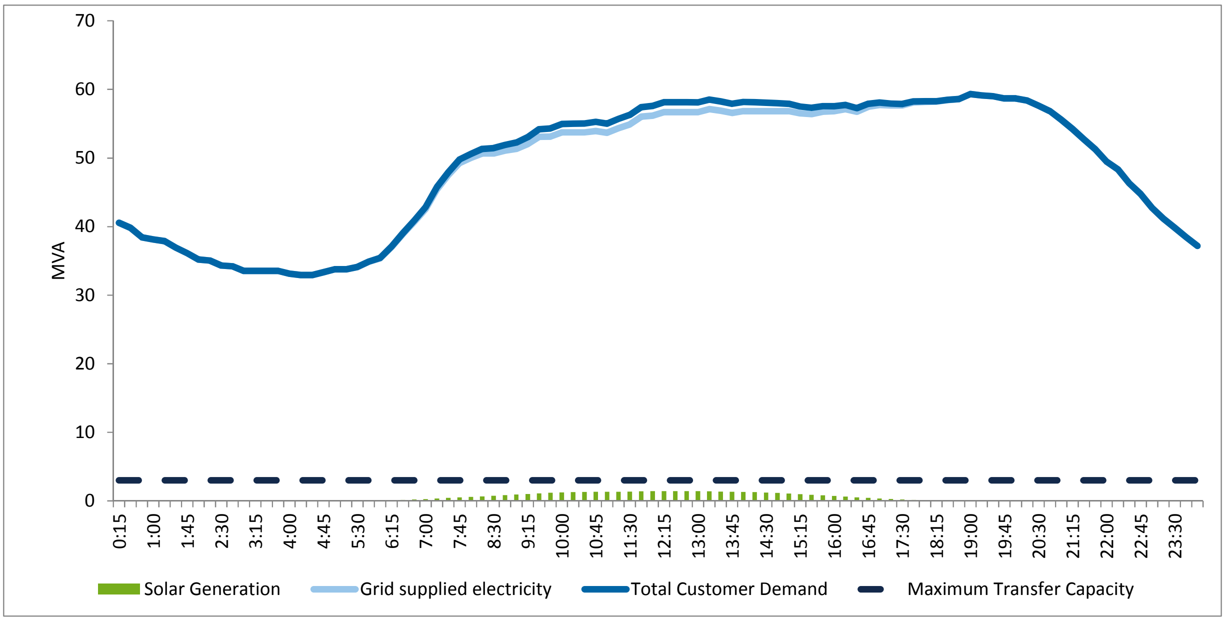
In the event of a network outage, and on a maximum winter peak demand day, after use of the maximum transfer capacity in an emergency switching of the network, there is a shortfall of network supply for the whole day or 24 hours. The maximum shortfall in network supply on 27 June 2016 would have been 72.6 MW at peak. See Figure 6 below.

**Figure 6 – Winter 2016 maximum demand profile at Clovelly substation with maximum load transfer**




Similarly for a summerpeak demand day, the shortfall in network supply would be for the whole day or 24 hours. The maximum shortfall in network supply on 6 February 2017 would have been 56.3 MW at time of peak demand. See Figure 7 below.

**Figure 7 – Summer 2016/17 maximum demand profile at Clovelly substation with maximum load transfer**

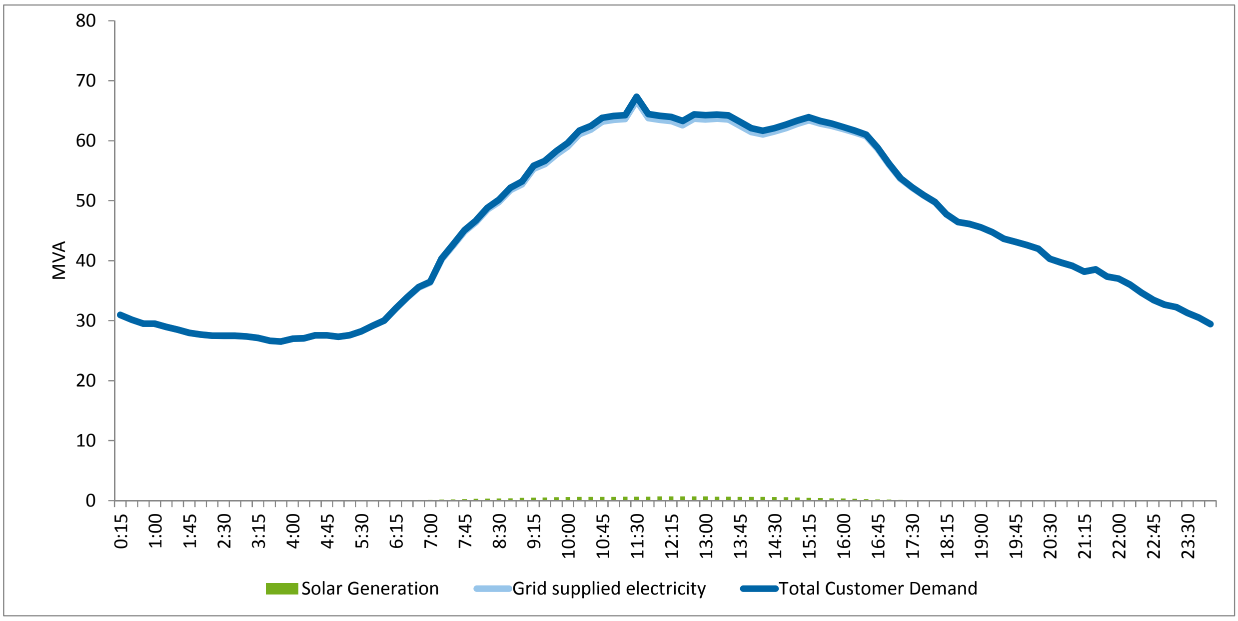


## 2.2.2 Pattern of use – Zetland ZS

Over the past 7 years, and where peak annual demand occurs in summer, the time of peak has typically occurred between 11:30am and 3:30pm AEDT.  As noted above, the most recent summer maximum demand occurred at 11:30am AEDT.

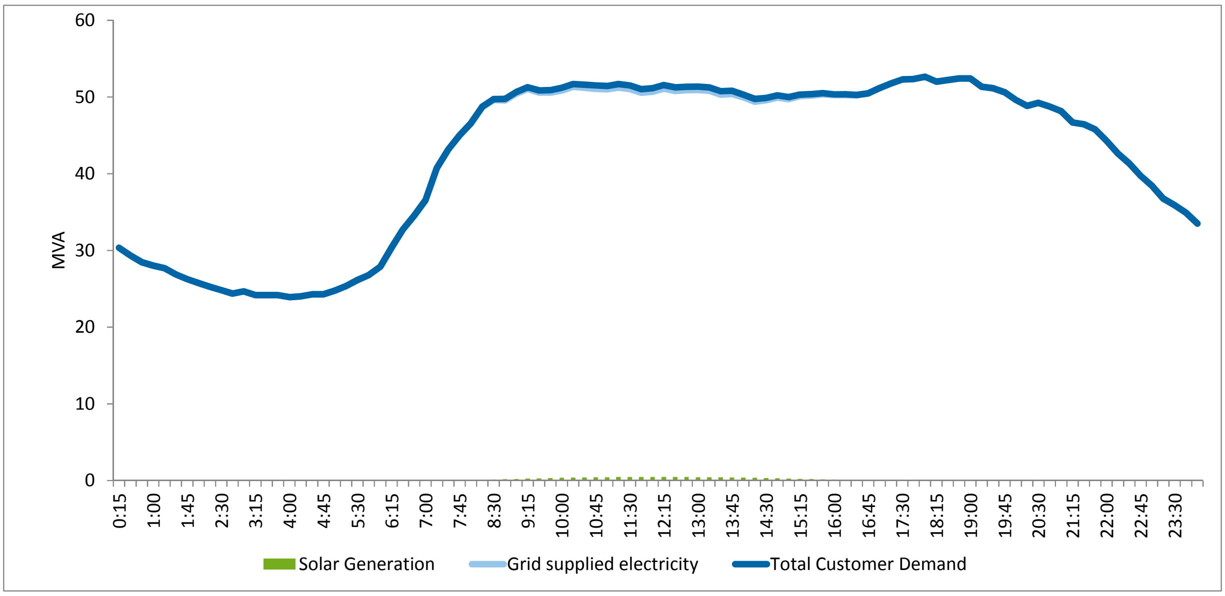
There is a total capacity of about 1.05 MW of solar PV connected to the zone substation.  At the time of 11:30pm on 24 January 2017, these PV systems supplied about 0.66 MW of the customer load. Figure 8 below shows the load trace for the 24 January 2017 peak demand day including the contribution from customer installed solar power systems.

**Figure 8 – Summer maximum demand profile at Zetland zone substation (24 January 2017)**



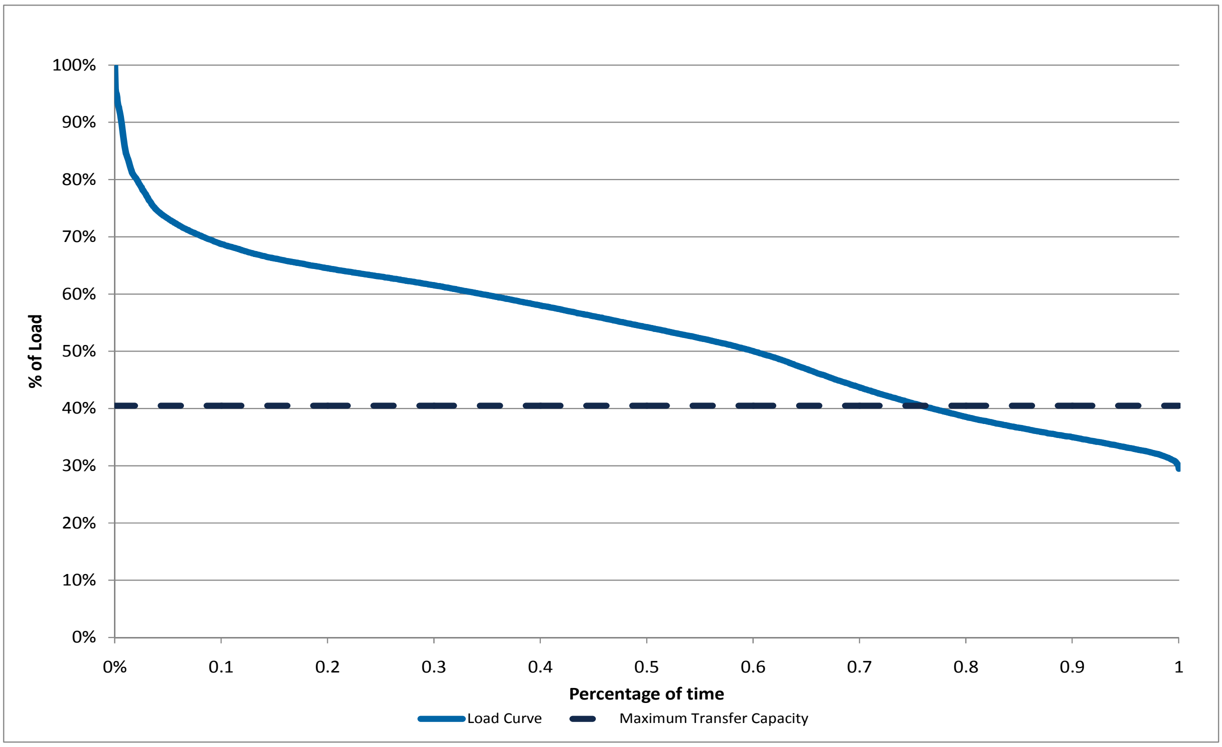

Winter peak electricity demand at Zetland zone substation typically occurs on a weekday.  Over the past 7 years, the time of winter peak has occurred as early as 9:30am and as late as 6:00pm AEST.  Figure 9 below shows the load trace for the 27 June 2016 maximum demand day including the contribution from customer installed solar power systems.

**Figure 9 – Winter maximum demand profile at Zetland zone substation (27 Jun 2016)**



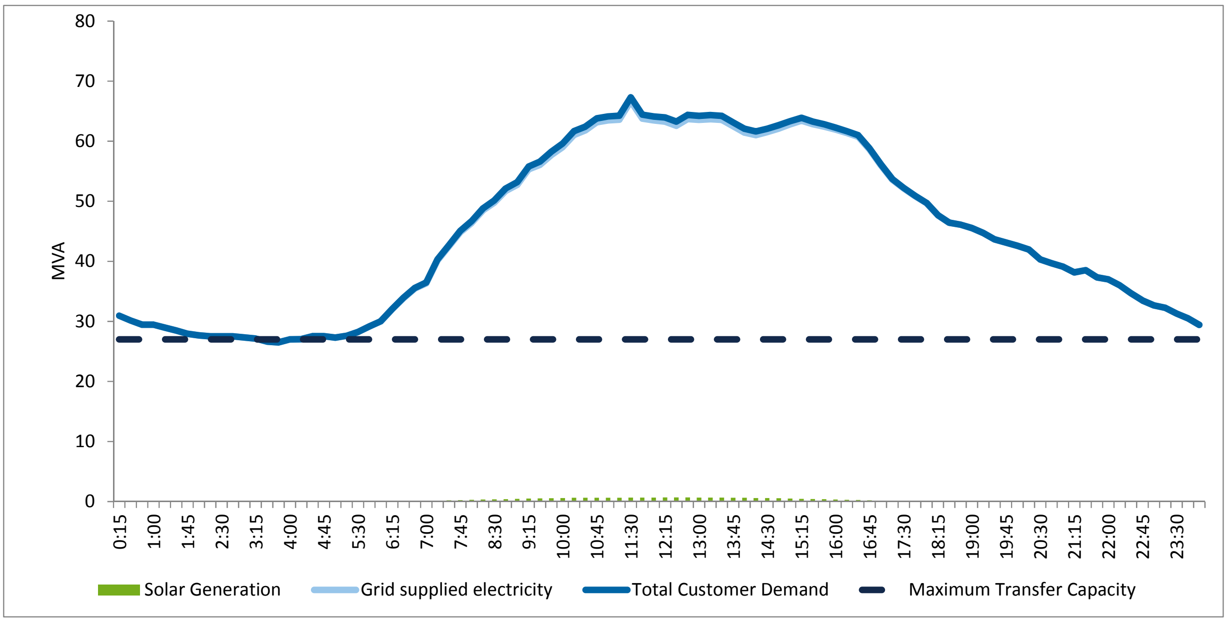

The Zetland zone substation has a current load transfer capacity of 27 MVA or about 40% of the most recent actual maximum summer demand and 51% of most recent maximum winter demand.  Based upon the seasonal data for 1 May to 31 August 2016 and 1 November 2016 to 5 March 2017, electricity demand for Zetland zone substation exceeds the remaining available transfer capacity every day for the entire period, with a shortfall in demand for about 78% of all hours. Due to the scale of the shortfall and the commercial load profile, it is expected that demand would exceed capacity for 365 days of the year and 70-80% of all hours. Over the seasonal data period analysed, there is a total of about 60,000 MWh of unmet load in the case of a loss of network supply from Zetland zone substation. The load duration curve for this selected period, noting the transfer capacity, is shown below in Figure 10.

**Figure 10 – Zetland Zone Substation Load Duration Curve (1 May to 31 August 2016 and 1 November 2016 to 5 March 2017)**



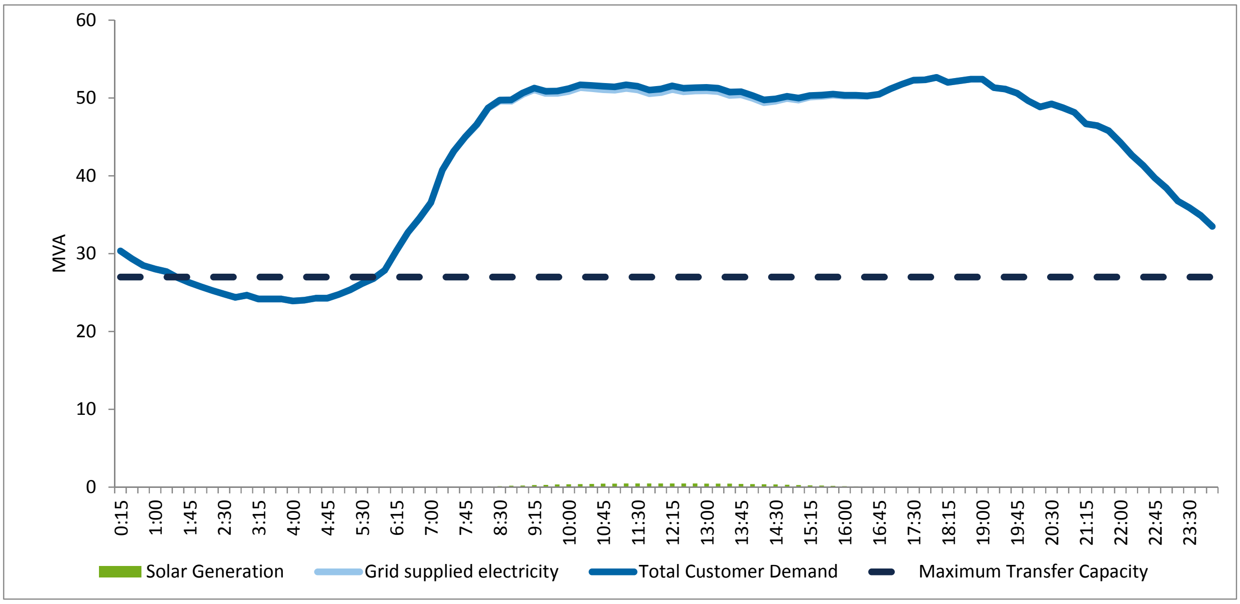

In the event of a network outage, and on a maximum summer peak demand day, after use of the maximum transfer capacity in an emergency switching of the network, there is a shortfall of network supply for 23 hours. The maximum shortfall in network supply on 24 January 2017 would have been 39.7 MW at peak. See Figure 11 below.

**Figure 11 – Summer maximum demand at Zetland zone substation with maximum load transfer**



Similarly for a winter peak demand day, the shortfall in network supply would be for 19 hours. The maximum shortfall in network supply on 27 June 2016 would have been 25.6 MW at time of maximum demand. See Figure 12 below.

**Figure 12 – Winter maximum demand at Zetland zone substation with maximum load transfer**




## 2.3 Customer characteristics

Clovelly and Zetland zone substations serve a mixture of residential and non-residential customers. A breakdown of the customer characteristics for the 2016/17 period is as follows:

**Table 1 – Customer characteristics - Clovelly**

| Item | Residential | Small Non-Residential | Large Non-Residential | Total |
|---|---|---|---|---|
| Number of Customers | 31,562 | 1,866 | 117 | 33,545 |
| % of Customers | 94.1% | 5.6% | 0.3% | |
| Annual Consumption (MWh) | 141,729 | 39,558 | 40,626,994 | 40,808,282 |
| % of Annual Consumption | 0.3% | 0.1% | 99.6% | |
| Number of Solar Customers | 693 | 34 | 5 | 732 |
| % of Customers | 94.7% | 4.6% | 0.7% | |
| Average Annual Consumption (MWh per customer) | 4.5 | 21 | 347,239 | |

About 28% of residential customers live in detached homes with an average usage of about 6.8 MWh per year. Households living in apartments, townhouses and flats have an average usage of about 3.6 MWh per year.

**Table 2 – Customer characteristics - Zetland**

| Item | Residential | Small Non-Residential | Large Non-Residential | Total |
|---|---|---|---|---|
| Number of Customers | 18,426 | 2,012 | 259 | 20,697 |
| % of Customers | 89.0% | 9.7% | 1.3% | |
| Annual Consumption (MWh) | 64,270 | 50,382 | 165,981 | 280,634 |
| % of Annual Consumption | 22.9% | 18.0% | 59.1% | |
| Number of Solar Customers | 131 | 51 | 4 | 186 |
| % of Customers | 70.4% | 27.4% | 2.2% | |
| Average Annual Consumption (MWh) | 3.5 | 25 | 641 | |

About 18% of residential customers live in detached homes with an average usage of about 5.2 MWh per year. Households living in apartments, townhouses and flats have an average usage of about 3.1 MWh per year.

## 2.4 Key assumptions underpinning the identified need

The need to undertake action is predicated on the deteriorating condition of the two existing 132kV underground feeders from the Zetland ZS to Clovelly ZS and the characteristics of any resultant outages, as well as the fact that maintaining technologies present heightened maintenance and asset failure risks.

A critical assumption underpinning the identified need is that retaining SCFF feeders supplying Clovelly ZS are expected to increase the risk of involuntary load shedding that leads to breaches of distribution reliability standards.

The major factor contributing to the risk of involuntary load shedding is the age of the feeders (132kV feeders 260/2 and 261/2) supplying Clovelly ZS, which are therefore reaching the end of their useful life. The SCFF technology used by the feeders is also obsolete and requires specialist skills to repair and maintain. Consequently, outage times can be lengthy, and spares are not readily available.

Performance of these feeders has been poor with the occurrence of significant oil leaks over the past 15 years, affecting the reliability of supply to Clovelly ZS. More recently, a cable failure occurred on feeder 261/2 in 2016, this was attributed to cable leaking from a cable joint while the feeder was out-of-service. The cable's fluid pressure alarms did not register a decrease in fluid volume and the cable was considered suitable to be returned to service. Upon switching the cable into service, the cable system failed, resulting in two link box lids blowing-out (one along Bourke Road, Alexandria and the other within the Moore Park Golf Course) and a joint falling in the Moore Park Gold Course. This resulted in a substantial amount of insulating fluid entering the environment and presented a risk to public safety. The cost to repair this failure was approximately $1.3 million over a 12-month period, which was predominately driven by direct equipment repair costs.

## 2.5 Load transfer capacity and supply restoration

The level of cost expected from any involuntary load shedding is dependent on underlying assumptions relating to the level of redundancy in feeders and the capacity to transfer load to other substations that could supply load currently served by Clovelly ZS.

Current supply arrangements for these zone substations have a degree of redundancy. As noted above, multiple feeders supply Clovelly ZS and therefore load could be transferred to the two remaining feeders should one of the fluid-filled feeders experience a fault or be out of service. However, outages of multiple feeders supplying each substation would likely lead to some degree of involuntary load shedding. While there is existing transfer capacity, this is not a viable solution given that the capacity will be limited to 3MVA upon the completion of related projects in the Clovelly ZS area (2019 onwards). Further, as feeders age, the likelihood of multiple feeder failures increases that in turn is likely to lead to involuntary load shedding.

A concurrent outage of feeders 262 and 261/2 would initially result in the temporary loss of supply to Clovelly ZS. Supply restorations can be achieved via manual switching operations or by manually closing the normally open 132kV feeder 260/2 between Clovelly ZS and Zetland ZS. Additionally, supply can be partially restored after a time delay (i.e. switching time) via manual switching operations and/or by changing network open points on the existing 11kV interconnected network between Clovelly ZS and nearby zone substations.

Consequently, the aggregated expected involuntary load shedding associated with these feeders has been calculated to be approximately 50MWh in total in the FY2020-2024 regulatory period. This is the result from the low risk of the complete failure of supply to Clovelly ZS resulting in unplanned shedding of around 50MVA of load for several hours each year.

Both the degree of redundancy and the ability to transfer load elsewhere have been considered by Ausgrid in forecasting expected unserved energy.

The following Table 3 presents additional detail on the supply restoration assumptions and probability of failure assumptions made by Ausgrid.

**Table 3 – Supply restoration assumptions**

| Equipment outage | Action | Outage duration |
|---|---|---|
| Fluid filled cable failure | <u>Repair</u><br>The cable is repaired on site. | 7.0 weeks |
| Fluid filled cable third party damage | <u>Repair</u><br>The cable is repaired on site. Additional time is typically required to repair third party damage. | 5.5 weeks |
| Fluid filled cable corrective action | <u>Repair</u><br>One of the following repairs may take place depending on the failure mode:<br>1. in service repair (65 per cent)<br>2. out of service repair (35 per cent) | 1. In service repair (no outage)<br>2. 1.06 weeks |

# 3 Proposed preferred network option

Ausgrid has elected to assess three alternative future scenarios – namely:

- Low benefit scenario – Ausgrid has adopted several assumptions that give rise to a lower bound NPV estimate for each credible option, in order to represent a conservative future state of the world with respect to potential market benefits that could be realised under each credible option;
- Baseline scenario – the baseline scenario consists of assumptions that reflect Ausgrid's central set of variable estimates, which, in Ausgrid's opinion, provides the most likely scenario; and
- High benefit scenario – this scenario reflects an optimistic set of assumptions, which have been selected to investigate an upper bound on reasonably expected potential market benefits.

A summary of each scenario and the sets of variable values adopted is presented in the Table 4 below.

**Table 4 – Summary of the three scenarios investigated**

| Variable | Scenario 1 – baseline | Scenario 2 – low benefits | Scenario 3 – high benefits |
|---|---|---|---|
| Demand | POE50 | POE90 | POE10 |
| VCR | $40/kWh<br><br>(Derived from the AEMO VCR estimates) | $28/kWh<br><br>(30 per cent lower than the central, AEMO-derived estimate) | $90/kWh<br><br>(Consistent with the recent IPART review of transmission reliability standards for this area) |
| Commercial discount rate | 6.13 per cent | 8.07 per cent | 4.19 per cent |

Ausgrid has identified two network options that either replace the existing Clovelly ZS feeders by installing one new 132kV feeder, coupled with a spare conduit for a future feeder, from the nearby Kingsford ZS or undertaking a like-for-like replacement of the existing Clovelly to Zetland ZS feeders.

## Preferred option at this draft stage

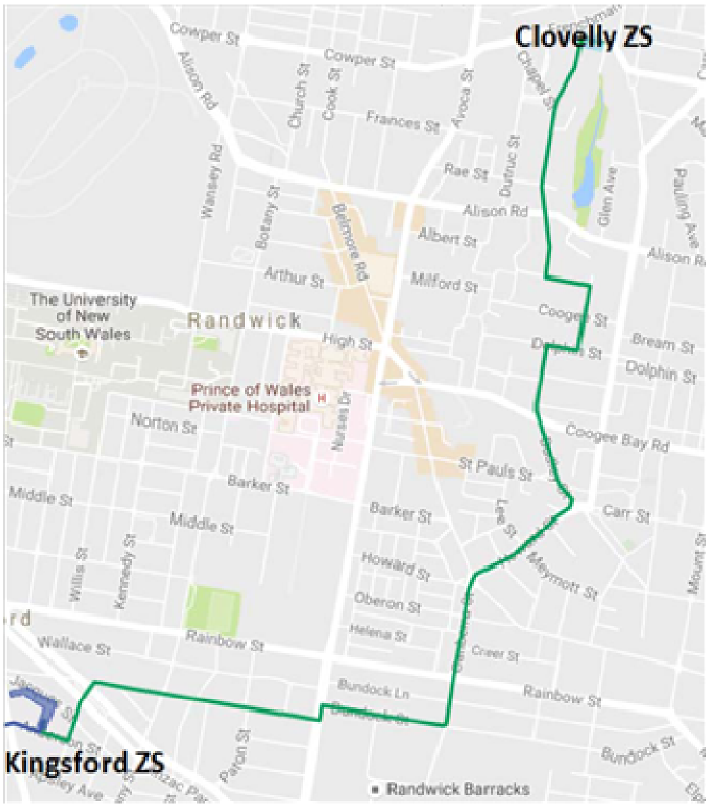
This option involves the replacement of the two existing feeders from Zetland ZS to Clovelly ZS with a new feeder from Kingsford ZS. Specifically, this option involves the installation of one new 132kV feeder and a spare conduit line (for a future feeder) from Kingsford ZS to Clovelly ZS.

The scope of this project includes:

- works at Clovelly ZS and Kingsford ZS to facilitate the new 132kV feeder connection;
- use of the existing 132kV circuit breaker at Kingsford ZS to connect the new feeder;
- installation of one 132kV XLPE feeders of approximately 4.1km from Clovelly ZS to Kingsford ZS, with a firm rating of 230MVA;
- installation of one spare duct to accommodate a future second circuit to occupy the same trench;
- associated control and protection communication upgrades at Clovelly ZS and Kingsford ZS; and
- decommissioning of existing SCFF feeders between Clovelly ZS and Zetland ZS.

The preferred route runs south from the Clovelly ZS along St Marks Road to Oswald Street, east to Courland Street and south to Dolphin Street. At Dolphin Street, the route would travel south along St Luke Street and Dudley Street to Howard Street, crossing Coogee Bay Road. From Howard Street, the cables would run south along Canberra Street and west along Bundock Street and Sturt Street, crossing Avoca Street, to Anzac Parade. The cables would cross Anzac Parade into Hayward Street and Anderson Street where they would connect into the Kingsford substation. The route of the proposed feeder under Option 1 is depicted in Figure 13 below.

**Figure 13 – Proposed Route Plan for the new 132kV feeder**




Ausgrid has engaged with the local community and already has held two community information sessions in April 2018 on the preferred route as part of the community consultation process. Ausgrid encourages community feedback and has committed to keep the community informed as the project progresses through notification letters, door knocks and the Ausgrid website. Ausgrid has also notified Randwick City Council and RMS regarding the proposed project.

The estimated capital cost of this option is approximately $14.7 million. Ausgrid assumes that the necessary construction to install the new feeders would commence in 2018/19 and end in 2019/20. Once the new installation is complete, operating costs are expected to be $70,000 per annum (around 0.5 per cent of capital expenditure).

# 4 Assessment of non-network solutions

## 4.1 Required demand management characteristics

A viable demand management solution must be capable of reducing the load on Clovelly and Zetland zone substations sufficiently to retain supply to customers over the required time for restoration of supply in the event of an unplanned cable outage. This reduction in supply can be permanent or temporary but must:

- offer support year round;
- align with the load profiles after emergency load transfer; and
- be cost effective in comparison with the preferred network alternative.

Due to the scale of the shortfall in electricity supply, we consider that a combination of permanent and temporary demand reductions would offer the most plausible scenario for a possible cost effective non-network alternative. Refer to Section 2 for details on the load profiles, demand forecasts, emergency load transfer capacities and customer characteristics.

A detailed assessment of the load profile for Clovelly and Zetland zone substations over the period from 1 May to 31 August 2016 and 1 November 2016 to 5 March 2017 shows that the shortfall in supply after emergency load transfers have been implemented is significant. Refer to Table 5 below for details on the estimated network support requirements for 2019 which show that the shortfall at Clovelly and Zetland zones is very large with demand reductions or availability required year-round for up to 24 hours per day.

**Table 5 – Network supply shortfall at Clovelly and Zetland zone substations in 2019**

| Zone | Required MW in 2019 | MWh | Days | Hours |
|---|---|---|---|---|
| | | | Year - round | Year - round |
| Clovelly | 28.7 | 108,000 | 365 | est 8,760 |
| Zetland | 40.5 | 160,000 | 365 | est 6,200 |

To be considered a feasible option, any demand management solution must be technically feasible, commercially feasible; and able to be implemented in sufficient time to satisfy the identified need in 2019 for deferral of the network investment.

## 4.2 Demand management value

Ausgrid has assessed potential demand management options to achieve the required demand reduction to make the project deferral technically and economically viable. Table 6 shows the required energy reductions and available funds to achieve a sufficient risk reduction to be considered as part of a viable solution to the need. We have expressed the available funds on an energy basis as the demand management support is principally associated with a shortfall in energy rather than a shortfall in peak demand capacity. Note that the energy reduction is expressed as the maximum required for the 7 week repair time associated with the primary asset risks. As noted above, availability is required year-round.

**Table 6 – Funds available for demand management (combined Clovelly & Zetland zones) in 2019**

| Average % EUE reduction in 2019 | Average % total risk reduction in 2019 | Available funds in 2019 | Proposed Peak Load Reduction (MW) | Est. MWh reduction required | Available $ per MWh |
|---|---|---|---|---|---|
| 80% | 14% | $660,000 | 25 | 25,500 | $26 |
| 86% | 16% | $686,000 | 30 | 29,500 | $23 |

As shown in the Table 6 values, the EUE risk is only a small portion of the total risk. Other risks such as those related to environment, safety and repairs comprise the majority of the risk for this project. For example, if we reduce maximum demand by 25 MW, the unserved energy risk will be reduced by 80%, but the total risk would be reduced by only 14%. Consequently, any potential demand management solution can only impact a small portion of the overall risk.

These figures are indicative only and any credible demand management solution proposed will need to be evaluated against the preferred network solution in a detailed cost benefit assessment.

Note that Ausgrid also considered an estimated option value as part of it's assessment of non-network alternatives. Due to the significant demand reductions required, the inclusion of an option value resulted in no change in the viability of non-network options to form part of the least cost solution.

## 4.3 Demand management options considered

Ausgrid considered a number of demand management technologies to determine their commercial and technical feasibility to assist with the identified need at the Clovelly and Zetland zone substations. Each of the demand management technologies considered is summarised below.

### 4.3.1 Customer power factor correction

While this option is technically feasible and offers permanent reductions sufficient to cover the large number of unmet load hours, there are a few customers on a kVA demand tariff supplied from Clovellyand Zetland zone substations. Of the 54,242 customers connected to Clovelly and Zetland zone substations, only 376 are on a kVA demand tariff. Analysis of customer interval data indicates a technical potential of only about 0.6 MVA. Commercial potential is likely to be about 0.2 MVA. At a likely cost of about $25-50 per kVA, this solution is likely to be cost effective, but is estimated to contribute less than 1% of the requirement.

### 4.3.2 Customer solar power systems

While this option is technically feasible and offers permanent reductions, solar power systems are not estimated to offer a material reduction in grid supplied demand during the period when there is a shortfall in grid supply.

Analysis of interval data for Clovelly zone substation shows that solar generation is greater than about 30% of maximum panel capacity for 31% of unmet load hours in winter, 44% of unmet load hours in summer and about 37% of overall unmet load hours. This is principally due to the 24 hour requirements for demand reductions. And as the zone peak typically occurs on winter evernings, solar does impact the peak demand.

Analysis of interval data for Zetland zone substation shows that solar generation is greater than about 30% of maximum panel capacity for 49% of unmet load hours in winter, 65% of unmet load hours in summer and about 57% of overall unmet load hours. This is principally due to the demand requirements over 16-20 hours per day.

At present there are 3.22 MW of solar connected to Clovelly and Zetland zone substations. A 300% increase in installed solar power systems above the current projected trend (75% additional) is estimated to contribute less than 2% of the network support requirement for reduced energy use.

### 4.3.3 Customer energy efficiency

While this option is technically feasible and offers permanent reductions, improvements to customer energy efficiency are not estimated to offer a sufficiently cost efficient alternative, nor potentially a sufficiently material reduction in grid supplied demand during the period when there is a shortfall in grid supply. Assuming modest incentives of 10-15% of customer investment cost could encourage customers to install a greater scale of energy efficiency improvements than would otherwise occur, we estimate an average cost of about $1000-2000 per MWh depending upon the level of additionality and coincidence with the demand shortfall. This solution is not likely to offer a cost competitive alternative.

### 4.3.4 Demand response (curtailment of load)

Customer curtailment of load is a common and effective technique for deferring network investment where the need is for short time periods and few days but has not been shown to be viable for the extensive hours and consecutive days of network support required for the network issue at Clovelly and Zetland zone substations.

Large customer demand response has historically been priced at $75-150 per kVA for 20-60 hours of dispatch per season while residential air conditioner demand response has been shown to be acceptable to small customers at incentive payment levels of about $150 to $250 per kVA for 20-30 hours of dispatch per season (excluding acquisition costs). Considering the costs of acquisition and requirement for support year-round, we would estimate the average cost for demand response to be well in excess of the available funds.

### 4.3.5 Dispatchable generation

Dispatchable generation is another common and effective technique for deferring network investment where the need is for short time periods and few days but has not been shown to be viable for the extensive hours and consecutive days of network support required for the network issue at Clovelly and Zetland zone substations.

Large customer dispatchable generation has historically been priced at $50-150 per kVA for 20-60 hours of dispatch per season. Considering the costs of acquisition and requirement for support year-round, we would estimate the average cost for this form of demand response to be well in excess of the available funds. Furthermore, as this solution commonly sources existing standby diesel generators; environmental compliance issues are likely to constrain the number of available operating hours.

### 4.3.6 Large customer energy storage

While this option is technically feasible and offers a viable form of demand response, current and near term pricing of commercial scale battery storage solutions are unlikely to result in a material take-up of these systems by large customers. Recent surveys by Ausgrid of medium and large customers on issues related to investments in solar power, battery storage and energy efficiency has shown that these customers expect a return on investment which is not projected to be available for some time.

# 5 Conclusion

Based on the demand management options considered in Section 4, it is not considered possible that sufficient demand management measures could be feasibly implemented to achieve the required demand reduction to make project deferral technically and economically viable. Consequently, a Non-Network Options Report has not been prepared in accordance with rule 5.17.4(c) of the National Electricity Rules.

Ausgrid

Ausgrid