Addressing reliability requirements in the City East area

NOTICE ON SCREENING FOR NON-NETWORK OPTIONS

APRIL 2018

Ausgrid

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Notice on screening for non-network options – April 2018

Title of Contents

DISCLAIMER 1

1 INTRODUCTION 2

2 FORECAST LOAD AND CAPACITY 3

2.1 Load forecast 3

2.1.1 Load forecast – City East 3

2.1.2 Load forecast – Dalley Street 3

2.2 Pattern of use 4

2.2.1 Pattern of use – City East 4

2.2.2 Pattern of use – Dalley Street 7

2.3 Customer characteristics 9

2.4 Key assumptions underpinning the identified need 10

2.4.1 Ageing assets at each zone substation have an increasing likelihood of failure 10

2.4.2 Legacy technologies add to expected maintenance costs and asset failure risks 11

2.5 Load transfer capacity and supply restoration 11

3 PROPOSED PREFERRED NETWORK OPTION 13

4 ASSESSMENT OF NON-NETWORK SOLUTIONS 15

4.1 Required demand management characteristics 15

4.2 Demand management value 15

4.3 Demand management options considered 16

4.3.1 Customer power factor correction 16

4.3.2 Customer solar power systems 16

4.3.3 Customer energy efficiency 16

4.3.4 Demand response (curtailment of load) 17

4.3.5 Dispatchable generation 17

4.3.6 Large customer energy storage 17

5 CONCLUSION 18

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1 Introduction

The main issues for the City East and Dalley Street zone substations relate to asset condition and if left unaddressed they are likely to lead to increased incidences of involuntary load shedding, non-conformance with reliability standards set out in Ausgrid's license conditions, and increased risks of non-compliance with environmental standards.

Ausgrid considers that reliability correction action is required for the City East and Dalley Street zone substations to comply with its electricity distribution license reliability and performance standards. While replacing assets and refurbishing City East and Dalley Street zone substations is technically possible, Ausgrid considers that transferring existing loads to a nearby zone substation (Belmore Park), and then decommissioning the City East and Dalley Street zone substations, is more economically and technically efficient compared to replacing capital assets on a one-for-one basis.

Planning for a solution to address concerns at the City East and Dalley Street zone substations begun in early 2016, with staged plans being formulated for both zone substations. At the time, it was identified that there was a high degree of commonality in the task of transferring load away from each substation, ie, by building of pits and ducts along George, Bridge, Bond, Margaret, Pitt and College streets. The first stage of this plan commenced in 2016 to make the most of the limited window of opportunity for these works to occur given the construction of the CBD and South East Light Rail by the ALTRAC Light Rail consortium during this time.

Rule changes to the National Electricity Rules (NER) in July 2017 has meant that later stages of the project to address deteriorating and ageing assets at City East and Dalley Street zone substations are now subject to the Regulatory Investment Test for Distribution (RIT-D). Accordingly, Ausgrid has initiated this RIT-D for the remaining stages of the City East and Dalley Street zone substations projects in order to identify a preferred option that would ensure Ausgrid is able to satisfy its reliability and performance standards.

Ausgrid committed to initial stages of transferring approximately two thirds of the load at Dalley Street zone substation to the City North zone substation in 2016 prior to NER rule changes requiring replacement projects undergo a RIT-D process. Subsequent works to complete the transfer of the remaining load at Dalley Street zone substation and the load at City East zone substation are planned to occur between 2019 and 2025 and are the focus of this RIT-D.

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 City East and Dalley Street zone substations.

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

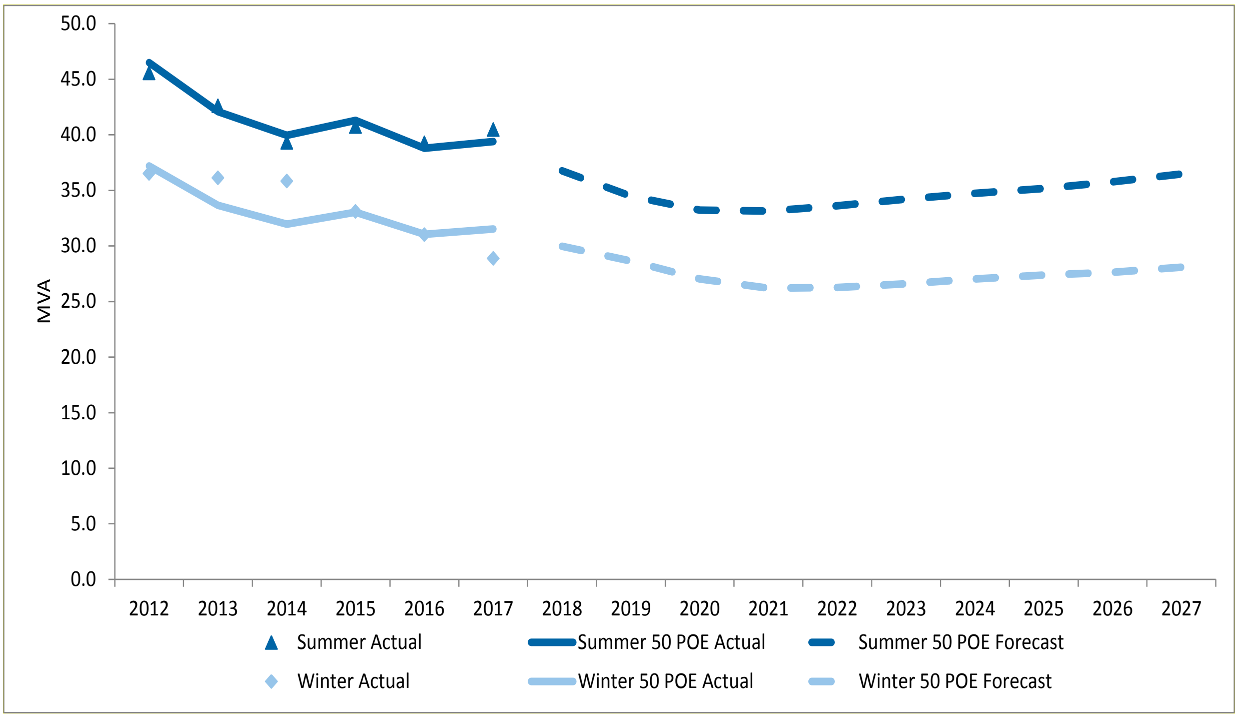
Figure 1 and Figure 2 below show the historical actual demand, the 50% Probability of Exceedance level (50 POE) weather corrected historical actual demand and the 50 POE forecast demand for both winter and summer for City East and Dalley Street zone substations.

2.1.1 Load forecast – City East

The City East zone substation has a total capacity of 103.7 MVA and a firm capacity of 70.7 MVA. In 2016/17, the maximum demand on the zone substation was 40.4 MVA at 12:30pm AEDT on 6 February 2017. The weather corrected demand at the 50 POE level was 39.4 MVA. The power factor at the time of summer maximum demand was 0.967.

Maximum demand has typically occurred in summer in past years. In the summer season, the maximum demand typically occurs between 11:15am and 2:30pm AEDT. The 50 POE forecast 7 year compound annual growth rate (CAGR) to 2023/24 for maximum demand is -1.8% for summer and -2.2% for winter.

Figure 1 – Demand forecast at City East zone substation

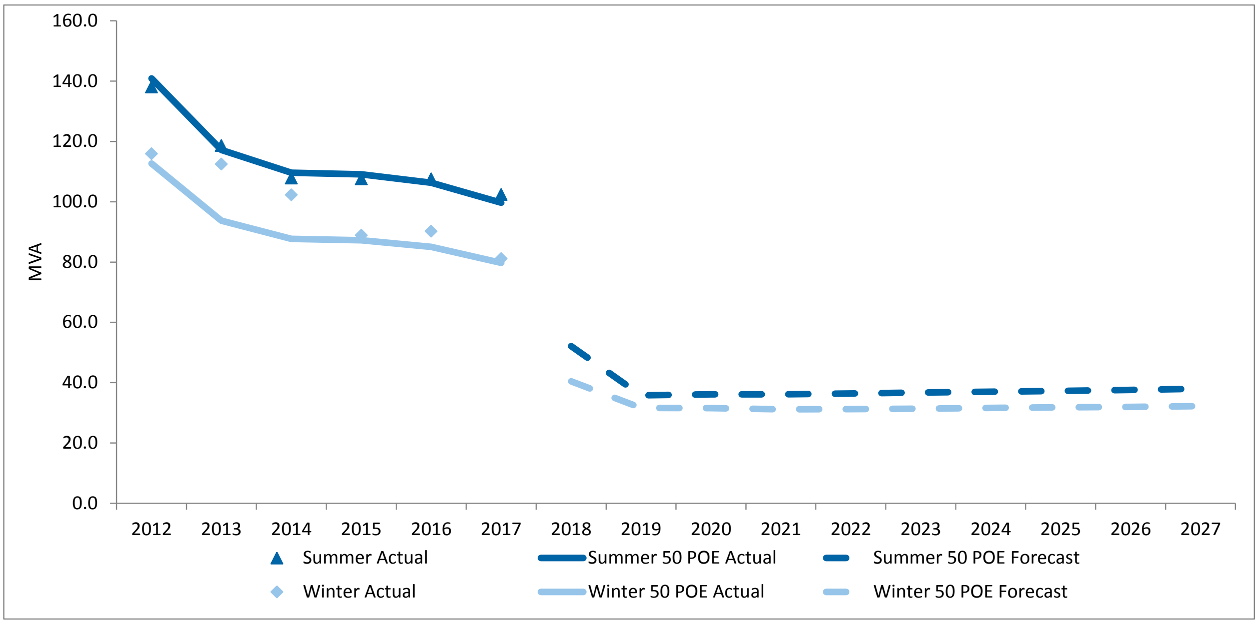


2.1.2 Load forecast – Dalley Street

The Dalley zone substation has a total capacity of 243.2 MVA and a firm capacity of 123.6 MVA. In 2016/17, the maximum demand on the zone substation was 102.3 MVA at 12:30pm AEDT on 6 February 2017. The weather corrected demand at the 50 POE level was 99.7 MVA. The power factor at the time of summer peak demand was 0.978.

Maximum demand has typically occurred in summer in past years. In the summer season, the maximum demand typically occurs between 12:30pm and 2:30pm AEDT. The 50 POE forecast 7 year compound annual growth rate (CAGR) to 2023/24 for maximum demand is -13.2% for summer and -12.4% for winter. (Note: this is because Ausgrid has commited to initial stages of transferring approximately two thirds of the load at Dalley Street zone substation to the City North zone substation.).

Figure 2 – Demand forecast at Dalley Street zone substation



2.2 Pattern of use

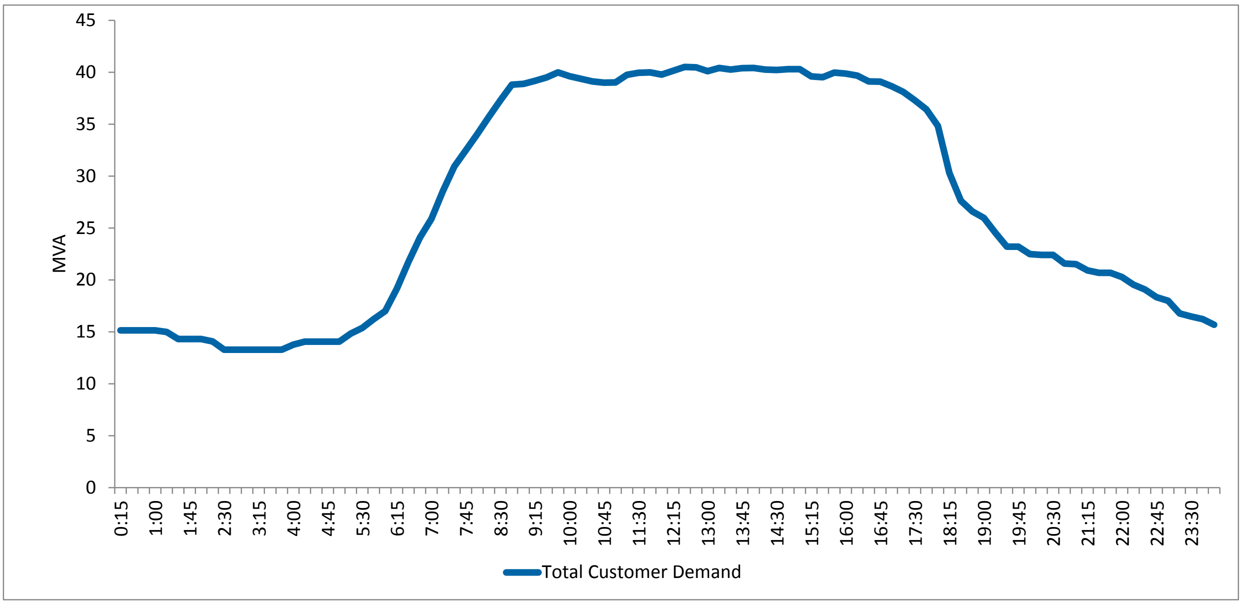
Summer peak electricity demand at City East and Dalley Street zone substations occur on hotter days driven predominantly by commercial loads.

2.2.1 Pattern of use – City East

Over the past 7 years, and where peak annual demand occurs in summer, the time of peak has typically occurred between 12:15pm and 2:00pm AEDT. As noted above, the most recent summer maximum demand occurred at 12:30pm AEDT.

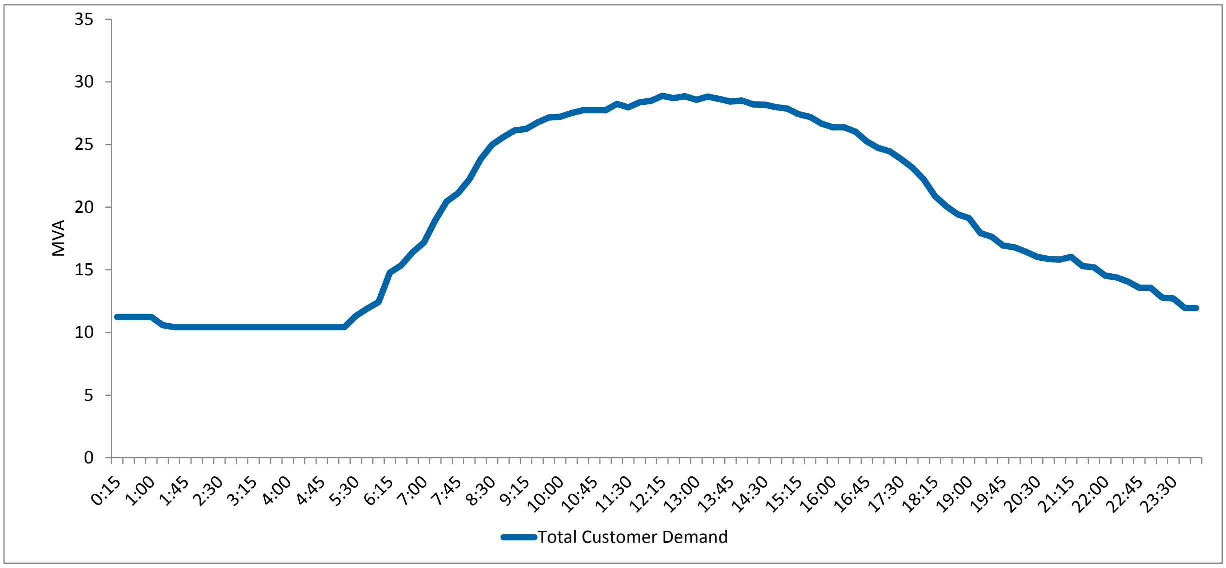
There is a total capacity of about 0.10 MW of solar PV connected to the zone substation. At the peak time on 6 February 2017, these PV systems supplied about 0.07 MW of the customer load. Figure 3 below shows the load profile for the 6 February 2017 maximum demand day including the contribution from customer installed solar power systems.

Figure 3 – Summer maximum demand profile at City East zone substation (6 February 2017)



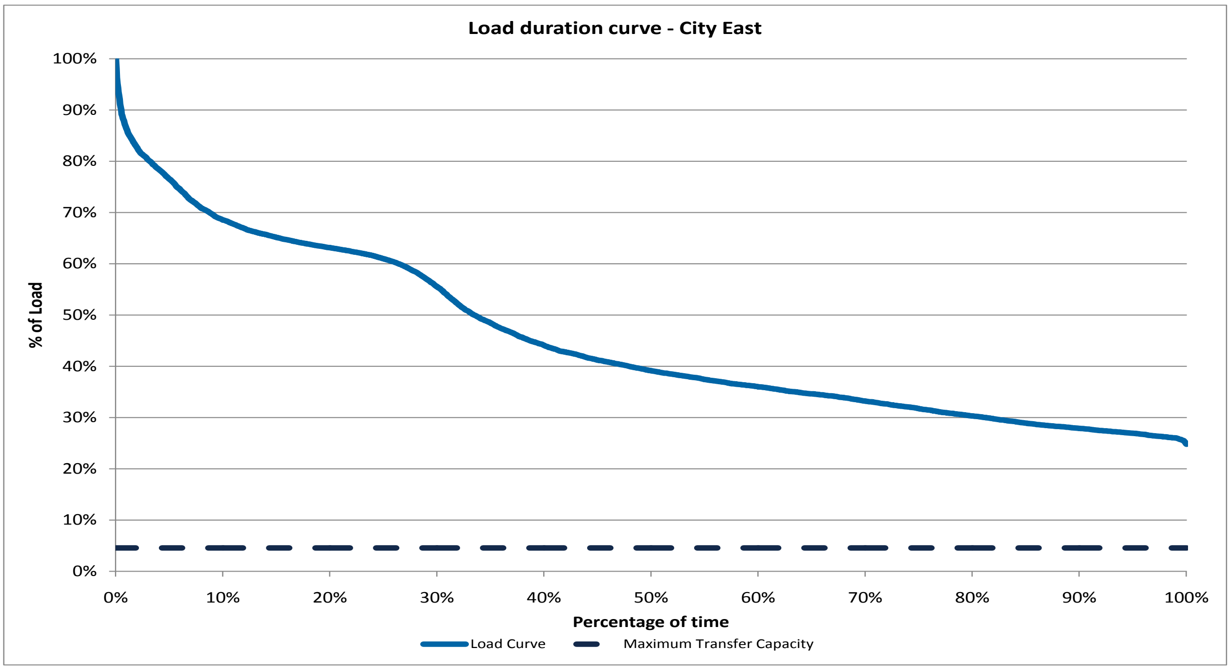
Winter peak electricity demand at City East zone substation typically occurs in the early afternoon. Over the past 7 years, the time of winter peak has typically occurred between 12:15 pm and 14:45pm AEST. Figure 4 below shows the load profile for the 23 May 2016 peak demand day including the contribution from customer installed solar power systems.

Figure 4 – Winter maximum demand profile at City East zone substation (23 May 2016)



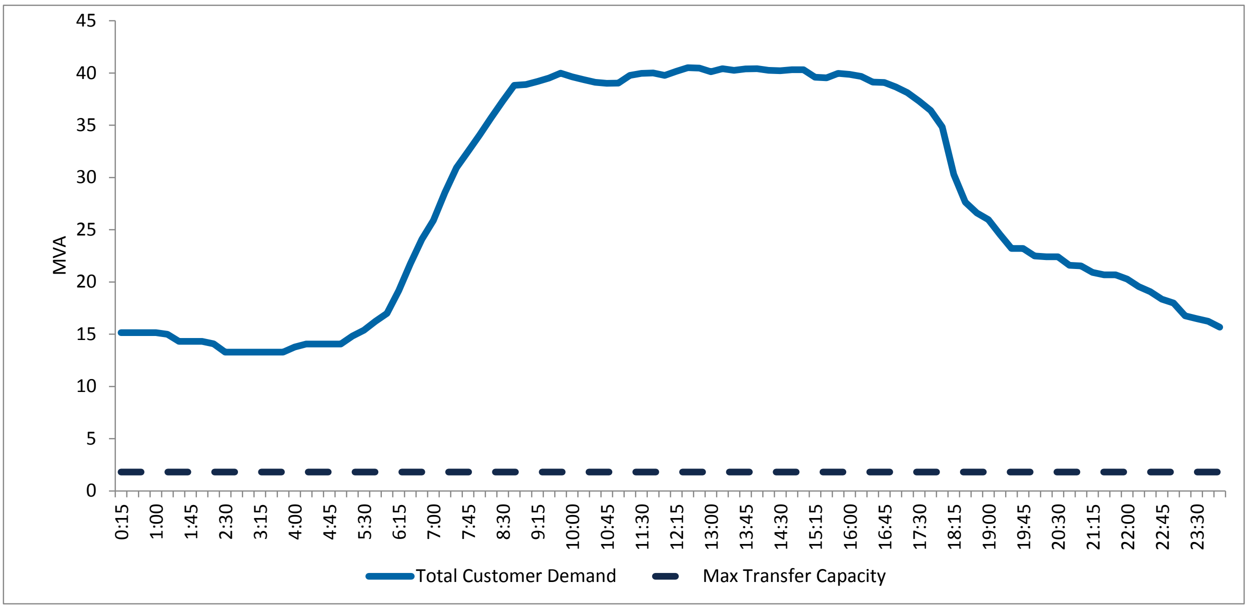
The City East zone substation has a current load transfer capacity of 1.8 MVA or about 4.5% of the most recent actual maximum summer demand and 6.2% of most recent actual maximum winter demand. Based upon the data period from May 2016 to April 2017, electricity demand for City East zone substation exceeds the transfer capacity for all hours of the year. . The load duration curve for the period from May 2016 to April 2017, noting the transfer capacity, is shown below in Figure 5.

Figure 5 – City East Zone Substation Load Duration Curve (May 2016 to April 2017)



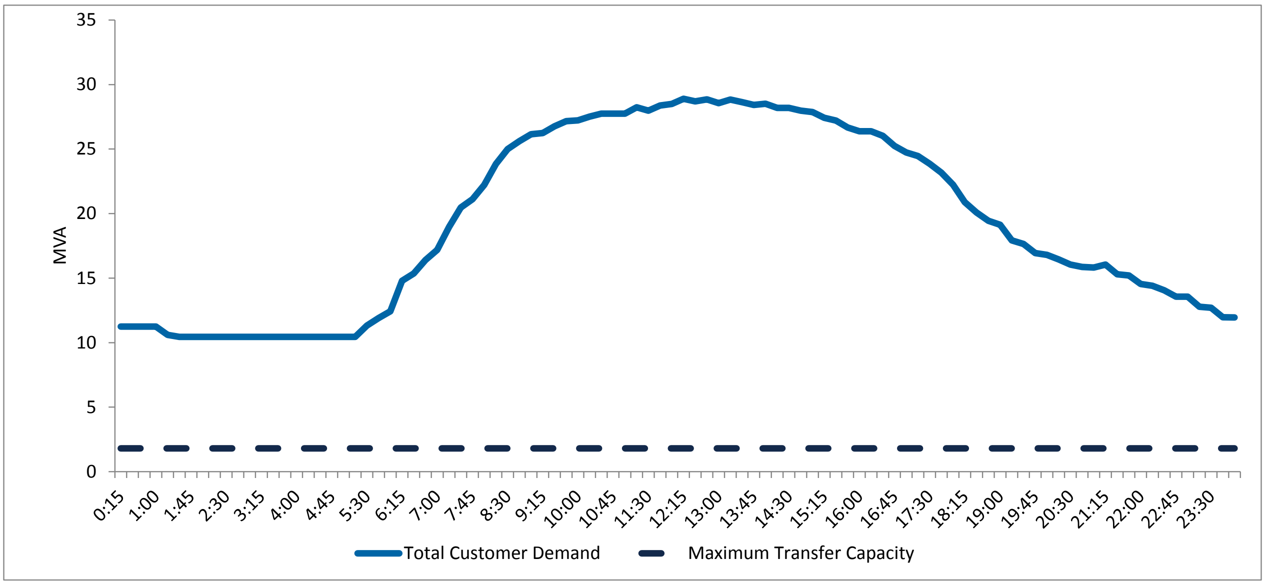
In the event of a network outage on a maximum summer peak demand day, after use of the maximum transfer capacity in an emergency switching of the network, there is a shortfall of network supply from 0:00 to 24:00 or 24 hours. The maximum shortfall in network supply on 30 January 2017 would have been 38.7 MVA at peak and 11.5 MVA at off peak times (overnight). See Figure 6 below.

Figure 6 – Summer maximum demand profile at City East zone substation with maximum load transfer



Similarly for a winter peak demand day, the shortfall in network supply would be for a total of 24 hours in the period from about 0:00 to 24:00. The maximum shortfall in network supply on 27 June 2016 would have been 27.1 MVA at time of peak demand and 8.6 MVA at off peak times (overnight). See Figure 7 below.

Figure 7 – Winter maximum demand profile at City East zone substation with maximum load transfer

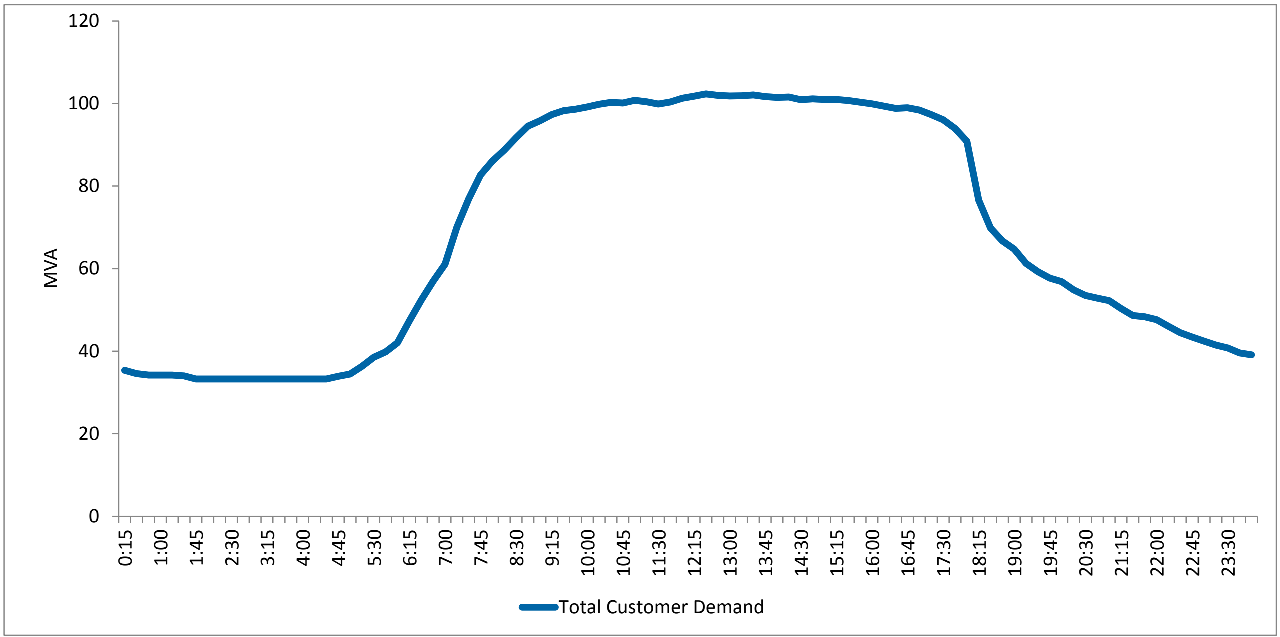


2.2.2 Pattern of use – Dalley Street

Over the past 7 years, and where peak annual demand occurs in summer, the time of peak has typically occurred between 12:30pm and 14:30pm AEDT. As noted above, the most recent summer maximum demand occurred at 12:30pm AEDT.

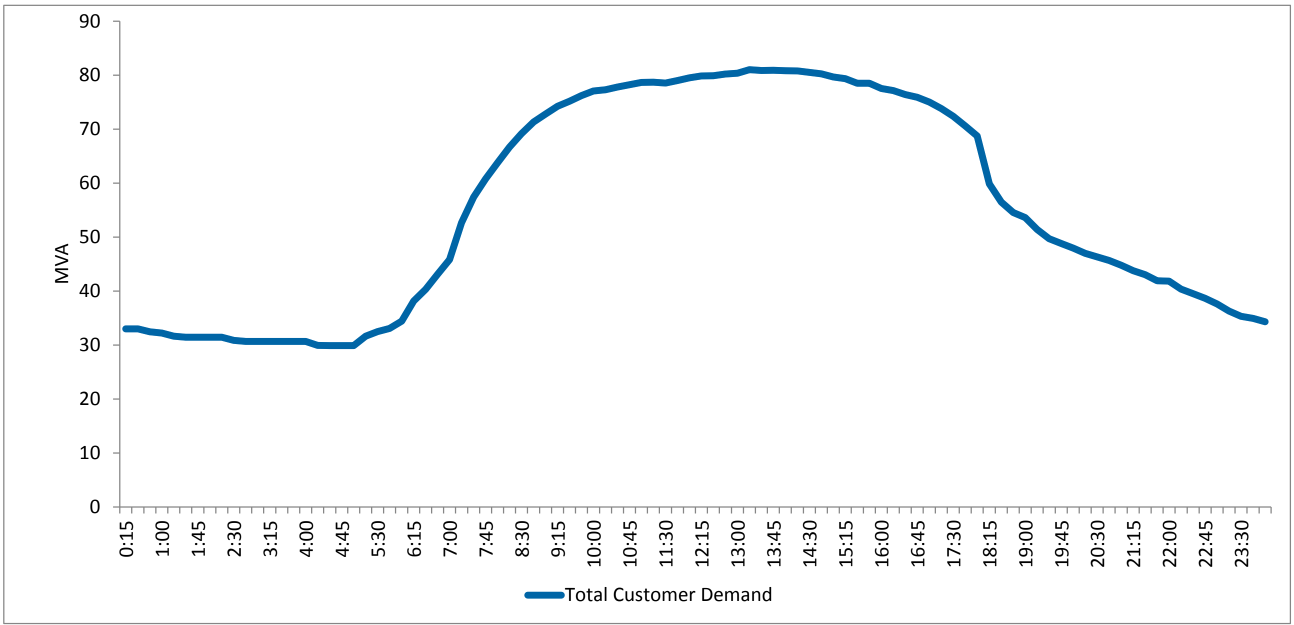
Figure 8 below shows the load profile for the 6 February 2017 peak demand day including the contribution from customer installed solar power systems.

Figure 8 – Summer maximum demand profile at Dalley Street zone substation (6 February 2017)



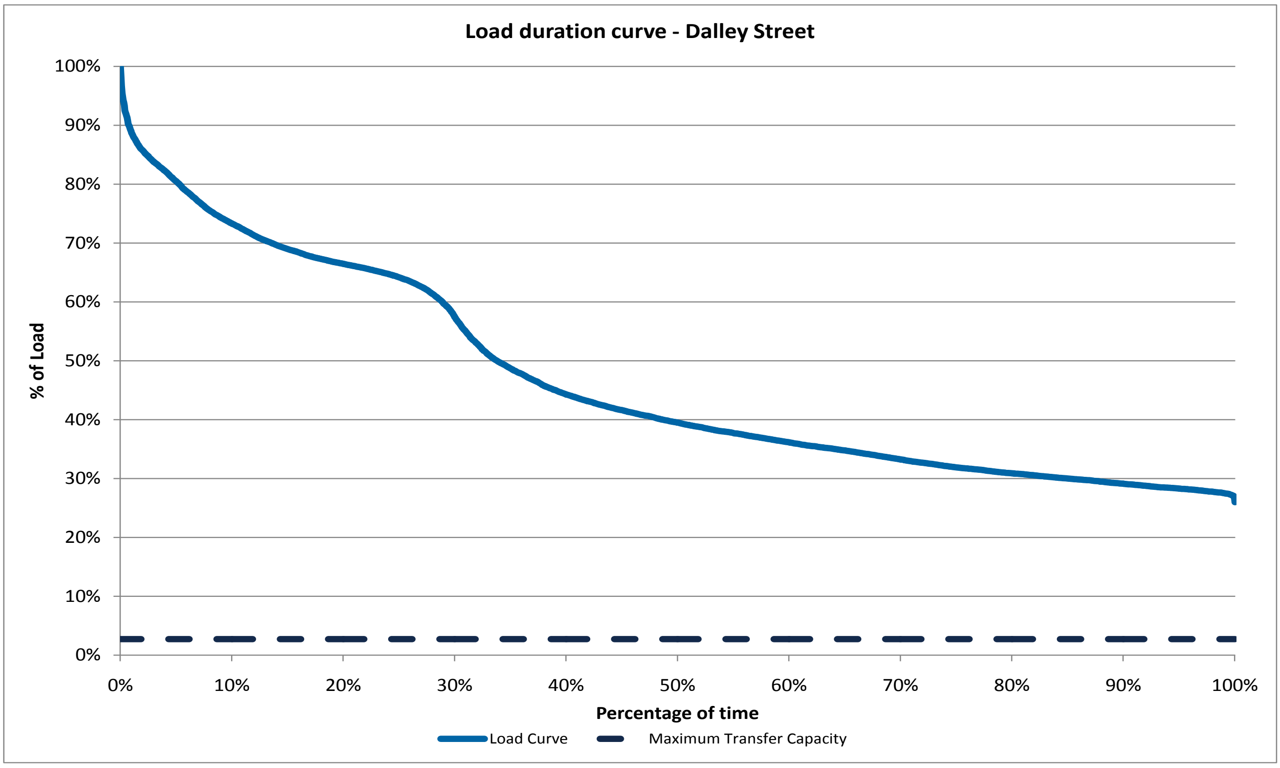
Winter peak electricity demand at Dalley Street zone substation typically occurs on a weekday. Over the past 7 years, the time of winter peak has typically occurred between 12:45pm and 2:15pm AEDT. Figure 9 below shows the load profile for the 4 May 2016 maximum demand day including the contribution from customer installed solar power systems.

Figure 9 – Winter maximum demand profile at Dalley Street zone substation (4 May 2016)



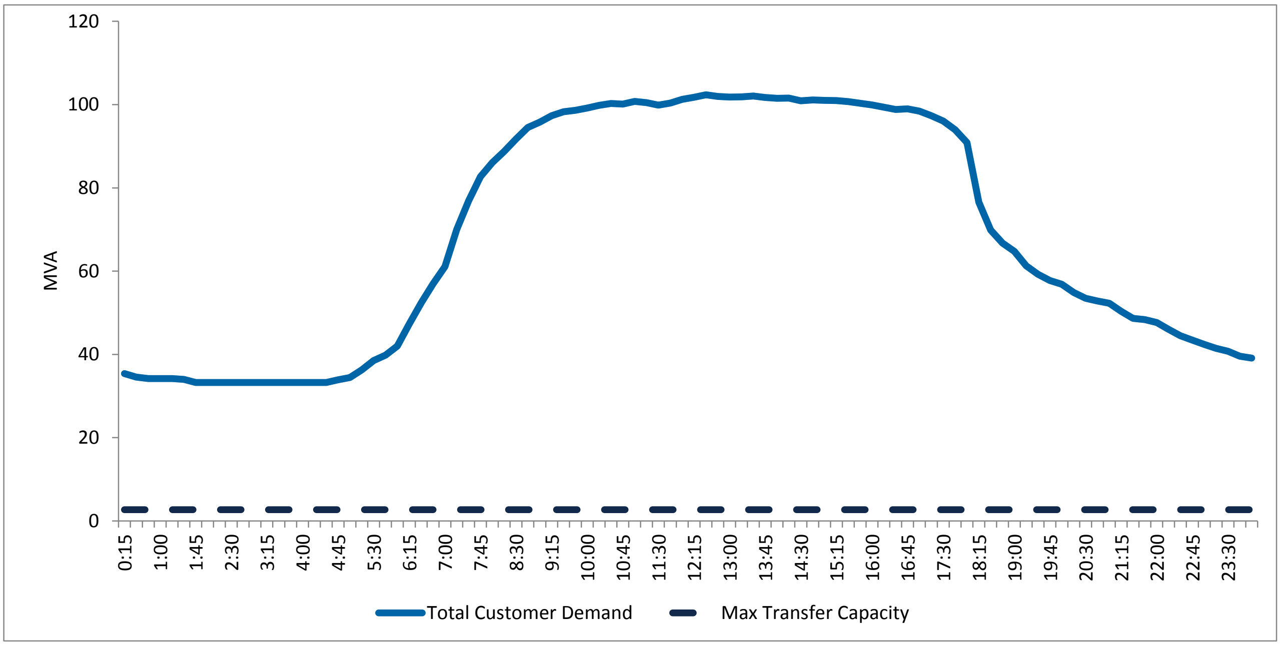
The Dalley Street zone substation has a current load transfer capacity of 2.7 MVA or about 2.6% of the most recent actual maximum summer demand and 3.3% of most recent maximum winter demand. Based upon the data period from May 2016 to April 2017, electricity demand for Dalley Street zone substation exceeds the transfer capacity for all hours of the year. The load duration curve for the period from May 2016 to April 2017, noting the transfer capacity, is shown below in Figure 10.

Figure 10 – Dalley Street Zone Substation Load Duration Curve (May 2016 to April 2017)



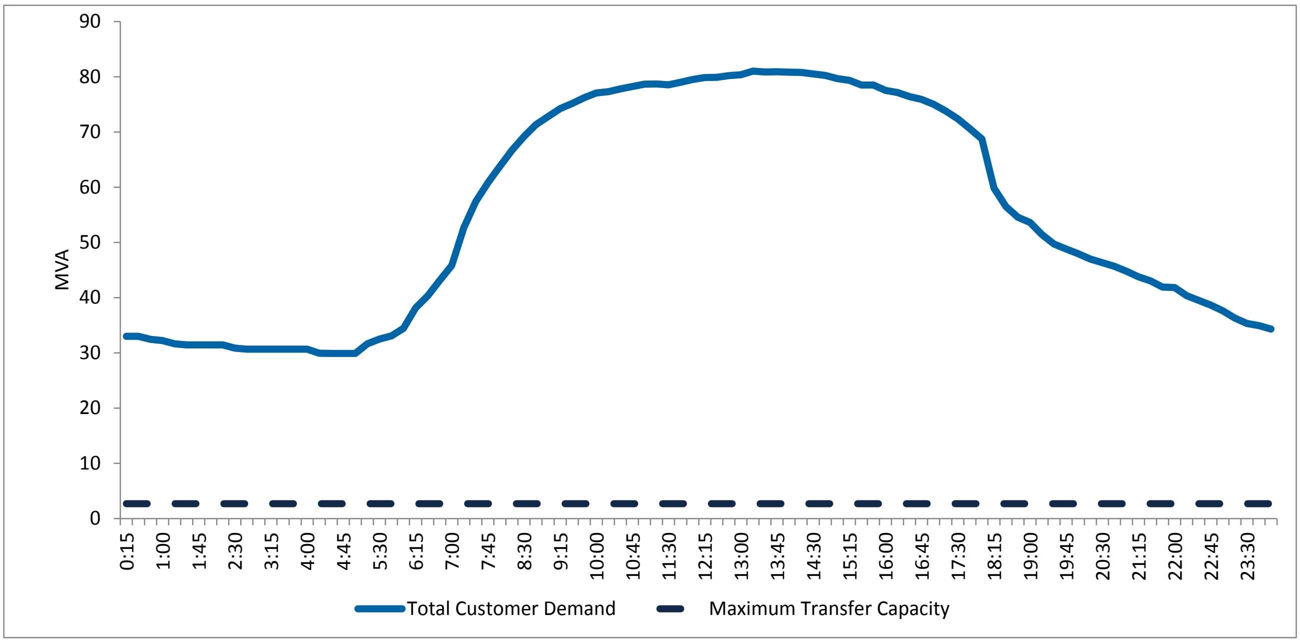
In the event of a network outage on a maximum summer peak demand day, after use of the maximum transfer capacity in an emergency switching of the network, there is a shortfall of network supply from 0:00am to 24:00 or 24 hours. The maximum shortfall in network supply on 6 February 2017 would have been 99.6 MVA at peak and 30.6 MVA at off peak times (overnight). See Figure 11 below.

Figure 11 – Summer maximum demand at Dalley Street zone substation with maximum load transfer



Similarly for a winter peak demand day, the shortfall in network supply would be for a total of about 24 hours in the period from about 0:00 to 24:00. The maximum shortfall in network supply on 4 May 2016 would have been 78.3 MVA at time of maximum demand and 27.2 MVA at off peak times (overnight). See Figure 12 below.

Figure 12 – Winter maximum demand at Dalley Street zone substation with maximum load transfer



2.3 Customer characteristics

City East and Dalley Street zone substations serve a mixture of residential and non-residential customers with over 98% of annual electricity consumption for each zone substation from non-residential customers. A breakdown of the customer characteristics for the 2016/17 period is as follows:

Table 1 – Customer characteristics – City East

Item	Residential	Small Non-Residential	Large Non-Residential	Total
Number of Customers	193	925	122	1,240
% of Customers	16%	75%	10%	
Annual Consumption (MWh)	1,433	23,832	116,150	141,415
% of Annual Consumption	1.0%	16.9%	82.1%	
Number of Solar Customers	0	5	13	18
% of Solar Customers	0%	28%	72%	
Average Annual Consumption (MWh per customer)	7.4	26	952	

Table 2 – Customer characteristics – Dalley Street

Item	Residential	Small Non-Residential	Large Non-Residential	Total
Number of Customers	1,262	3,226	353	4,841
% of Customers	26%	67%	7%	
Annual Consumption (MWh)	6,324	83,501	258,413	348,238
% of Annual Consumption	1.8%	24%	74.2%	
Number of Solar Customers	0	12	16	28
% of Solar Customers	0%	43%	57%	
Average Annual Consumption (MWh) per Customer	5.0	26	732	

2.4 Key assumptions underpinning the identified need

The need to undertake action is predicated on the deteriorating condition of assets at the existing City East and Dalley Street zone substations, and the characteristics of any resultant outages, as well as the fact that maintaining technologies present heightened maintenance and asset failure risks.

This section summarises the key assumptions underpinning the identified need for this RIT-D. The Draft Project Assessment Report provides additional detail on assumptions used, and methodologies applied, to estimate the costs and market benefits as part of this RIT-D.

2.4.1 Ageing assets at each zone substation have an increasing likelihood of failure

Several network assets located at or connected to City East and Dalley Street are ageing legacy assets and are showing signs of deterioration. Continued use of these assets is expected to increase the risk of involuntary load shedding going forward, corrective maintenance costs and safety/environmental costs.

Notable assets in this condition include:

- Feeders at the City East zone substation
    - The 33 kV feeder cables connected to the City East zone substation were mostly commissioned in 1964 (currently 51 years old), but there are sections on feeders 507 and 508 that were commissioned in 1946 (currently 69 years old) and some on section 509 that were commissioned in 1930 (currently 85 years old).
    - These cables have standard technical lives of 60 years and, unsurprisingly, older cables have a higher number of failures and are predominantly those on which recent failures have occurred.
- Distribution cable tunnel at City East zone substation
    - The existing tunnels were constructed in two stages with the original tunnel section constructed in 1960 (90 metres) and an extension undertaken in 1963 (150 metres).
    - The original tunnel section was constructed as a reinforced concrete box section with asbestos sheeting used as formwork to support the concrete for the roof section when it was poured. Defects identified during inspections included degradation of the reinforced concrete roof in the original tunnel section, exposed asbestos sheeting, cracking of the Gunite and concrete lining, water seepage and corrosion of steel cable brackets and other components within the tunnel.
- 132 kV gas insulated switchgear and circuit switches at the Dalley Street zone substation
    - Switchgear at Dalley Street have experienced SF_6 gas leaks,[Error! Bookmark not defined.] which indicates that they are reaching the end of their serviceable life.

- Furthermore, the Reyrolle LMT switchgear has experienced failure as recently as December 2014, where humidity and the air-gap clearances between the busbar and the barrier caused a partial discharge at the K busbar. The failure highlights the potential for new failure modes to appear as assets age and approaches the end of their useful life.

Section 2.4.4 presents technical detail on the engineering assumptions and methodologies that have been used to model the availability of these assets going forward and the consequences for expected involuntary load shedding, corrective maintenance costs and safety/environmental costs.

2.4.2 Legacy technologies add to expected maintenance costs and asset failure risks

City East and Dalley Street zone substations make use of legacy technologies that increases the cost of maintenance and heightens environmental risk and can potentially prevent Ausgrid from undertaking replacements in the event of asset failures.

Notable legacy technologies used at City East and Dalley Street zone substations include:

- Switchgear and circuit breakers at City East zone substation
    - These network assets utilise compound insulated switchboards with oil filled circuit breakers. This technology is unique in the Ausgrid network and is no longer supported by suppliers.
    - Consequently, there is a lack spares to undertake unit replacement. In the event of failure, there is a risk that the substation maybe left switched for an abnormally extended period of time.
- Switchgear at the Dalley Street zone substation
    - Dalley Street zone substation contains both compound insulated Email HQ and air insulated Reyrolle LMT types of 11 kV switchgear.
    - The Email HQ switchgear was last tested in 2004 and results did not indicate any action was required at the time. However, Ausgrid has experience an explosive failure of this type of switchgear at Dulwich Hill in 2012 that compromised the structural integrity of the substation building.
- 132 kV oil feeders at the Dalley Street zone substation
    - Feeders into the Dalley Street zone substation employ self-contained fluid filled (SCFF) cable technology that were installed in the 1960s and 1970s.
    - These cables are more expensive to maintain compared to more modern cable technologies due to maintain fluid pressure. Additionally, synthetic oils are used as fluid in SCFF, which presents environmental risk where fluid leakages occur.

These legacy technologies present Ausgrid with operational risks related to the ability to undertake corrective maintenance, and environmental risks from fluid leakages into the environment.

2.5 Load transfer capacity and supply restoration

Dalley Street zone substation has potential 11kV interconnection with City East, City Central and City North Zones. In the event of a total loss of supply to Dalley Street, approximately 2.7 MVA of peak load can be recovered within days via the 11kV load transfer capacity of the existing network.

City East Zone has potential 11kV interconnection with Dalley Street Zone. In the event of a total loss of supply to City East, approximately 1.8 MVA of peak load can be recovered within days via the 11kV load transfer capacity of the existing network. A range of equipment outages are considered in this study.

In the event of an equipment outage, the network may be returned to a normal configuration by one of the following actions:

- repairing the failed equipment
- initiating a contingency plan
- replacing the failed equipment with spares.

The assumed supply restoration actions and the time taken to implement the action are detailed in the table below. These actions are the most likely actions for the contingencies considered in this planning study.

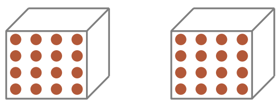
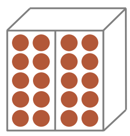
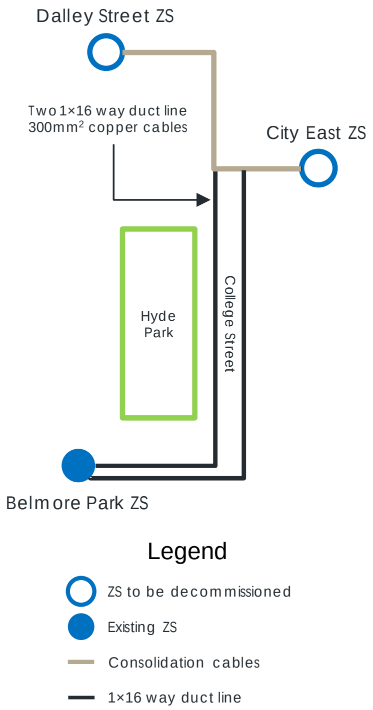
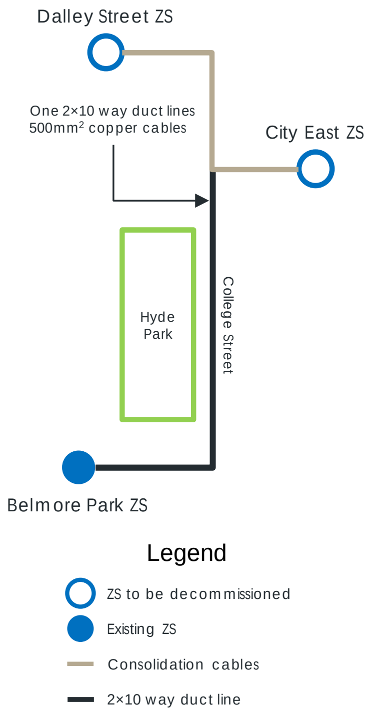
Table 3 – Equipment outage assumptions

Equipment outage	Action	Outage duration
Major compound insulated switchboard failure – Dalley Street zone substation	Contingency plan One of the following contingency plans is implemented: 1. Load is transferred from the failed switchboard to the spare switchgear located in the capacitor room. 2. The failed switchboard is removed and replaced with new switchgear because the spare switchgear has been previously utilized. 3. Load is transferred to an adjacent switchboard if the loading of the substation permits	Plan 1: 30 days Plan 2: 90 days Plan 3: 30 days
Major air insulated switchboard failure – Dalley Street zone substation	Replace The failed switchboard is replaced with parts that may be internally sourced, externally sourced or manufactured depending on the failure scenario.	21 days
Major compound insulated switchboard failure – City East zone substation	Contingency plan Ausgrid's emergency switch room is deployed and load is transferred from the failed switchboard Contingency plan One of the following contingency plans is implemented: 1. Ausgrid's emergency switch room is deployed and load is transferred from the failed switchboard 2. The failed switchboard is removed and replaced with new switchgear because the deployment of the emergency switch room is not feasible due to prior failures.	Plan 1: 30 days Plan 2: 90 days
Oil filled cable failure	Repair The cable is repaired on site.	35 days
Oil filled cable third party damage	Repair The cable is repaired on site. Additional time is typically required to repair third party damage.	35 days
Oil filled cable corrective action	Repair One of the following repairs may take place depending on the failure mode: 1. in service repair (65 per cent) 2. out of service repair (35 per cent)	1. In service repair (no outage) 2. 35 days
HSL cable failure	Repair The cable is repaired on site	10.5 days
HSL cable third party damage	Repair The cable is repaired on site. Additional time is typically required to repair third party damage	14 days
132kV gas-insulated switchgear end of life failure	Replace Gas insulated gear and adjacent switch are replaced by a 132kV ring main circuit breaker	90 days

3 Proposed preferred network option

The two options that have been assessed to address future reliability concerns are summarised in the table on the next page. The key difference between the two options is the type and capacity of duct banks that are to be installed along College Street, which runs the length of Hyde Park – namely:

Table 4 – Summary of the two credible options considered

Option details	Option 1	Option 2
Option description	Install two standard 1×16 way 11 duct banks with 300mm^2 copper cables along College Street. Consolidate loads at City East and Dalley Street zone substation then transfer the loads to the Belmore Park zone substation. Decommission City East and Dalley Street zone substations.	Install one 2×10 way duct banks with 500mm^2 copper cables along College Street. Consolidate loads at City East and Dalley Street zone substation then transfer the loads to the Belmore Park zone substation. Decommission City East and Dalley Street zone substations.
Total capacity	80MVA	90MVA
Capital cost ($m, 17/18)	$51.9 million	$40.6 million
Decommissioning costs	$3.4 million	$3.4 million
Duct bank(s) used along College Street	 Two 1x16 way duct banks (one on each side of College Street) with 300mm2 copper cables – each with a 40MVA capacity	 One 2x10 way duct bank 500mm2 copper cables (on one side of College Street) – a total of 90MVA capacity
High-level network diagram[1]		

[1] Diagrams presented in Table 4 are indicative only and are not to scale.

- under Option 1, two 1×16 way duct banks are required along College Street - namely, two 1×16 way duct banks with 300mm2 copper cables with the capacity to carry 40MVA each are installed on College Street, one on each side of the street, in order to fully transfer the 45MVA load at City East zone substation; while
- under Option 2, a single 2×10 way duct bank with 500 mm2 copper cables is used - only one 2×10 way duct bank is required under this option because of its capacity to carry 90MVA compared to 40MVA for a 1×16 way duct bank.

Option 2 is the preferred option at this draft stage

Option 2 has been found to be the preferred option, which satisfies the RIT-D. It involves transferring the City East and Dalley Street substation loads to the Belmore Park zone substation in one 2×10 way duct bank and, subsequently, decommissioning the City East and Dalley Street substations. Ausgrid is the proponent for Option 2.

Option 2 offers the following benefits:

- it has significantly lower capital costs than Option 1 (eg, it involves $41 million of capital cost compared to $52 million for Option 1);
- it involves excavating only one side of College Street to lay new cables (Option 1 requires both sides to be excavated);
- it provides greater network capacity than Option 1 (ie, 90 MVA compared to 80 MVA);
- it addresses condition issues at both the City East and Dalley Street zone substations; and
- it involves less time to build than Option 1 and so causes less disruption to the community.[2]

In addition, both Option 1 and Option 2 have the significant benefit of being able to defer the likely build of a new zone substation in the CBD. In particular, if the City East and Dalley Street loads are not transferred to Belmore Park, then Ausgrid considers that a new zone substation would have to be constructed as soon as possible to cater for these loads. The estimated capital cost of such a substation is in the order of $155 million and so the avoidance of such a cost represents a significant benefit to both credible options. While noted, this benefit has not been estimated as part of this RIT-D since it would overwhelm the other benefits. Furthermore, the benefit from deferring the construction of a new zone substation is essentially the same magnitude for both credible options and therefore estimating would not assist in identifying the preferred option.

The scope of Option 2 includes:

- installing one 2×10-way duct bank with 500mm^2 copper cables on one side of College Street;
- measures to reduce the risk of duct bank common mode failure by altering the design of drop-in pits to limit the impact of a pit fire and having 500mm separation between banks;
- transfer of 11 kV load from the existing City East and Dalley Street zone substations to Belmore Park; and
- decommissioning of the existing City East and Dalley Street zone substations.

The estimated capital cost of Option 2 is $40.6 million with a further $3.4 million for decommissioning costs. Operating costs for Option 2 are assumed to be minimal given that it is expected new duct banks and feeders incur immaterial levels of maintenance over the 20 year period.

Ausgrid estimates that the environmental approval and construction timeline for Option 2 is 48 months, with commissioning of final stages expected during 2024/25. Final decommissioning of the existing zone substations and associated equipment at City East and Dalley Street is expected to be completed by 2025/26. Ausgrid intends to commence work on delivering Option 2 in 2018/19 (in particular, we intend to award the design and construction contract in July 2018, have environmental approvals finalised in August/September 2018 and to commence construction shortly after).

[2] For clarity, the benefit associated with lower community disruption has not explicitly been estimated, consistent with the RIT-D. However, Ausgrid considers this qualitative benefit is worth mentioning given the region of its network in question, ie, Sydney CBD where any community disruption is likely to come at a high cost.

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 City East and Dalley Street zone substation sufficiently to retain supply to customers over the 10-25 days required 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 in both summer and winter and all other times of the year,
- 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 at all times of the year, 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 City East and Dalley Street zone substations over the May 2016 to April 2017 period shows that the shortfall in supply after emergency load transfers have been implemented is significant. Refer to Table 5 and Table 6 below for details on the network support requirements for the years from 2022/23 to 2024/25.

Table 5 – Network support required at City East substation

Year	Days/ year	Hours/ year	Maximum demand (MW)	Daily suppy shortfall after transfer capacity (MWh/day)			Total MWh per year
				Min.	Max.	Average	
2022/23	365	8,760	32.4	202	531	338	123,186
2023/24	365	8,760	32.9	206	540	343	125,285
2024/25	365	8,760	33.4	209	547	348	127,026

Table 6 – Network support required at Dalley Street substation

Year	Days/ year	Hours/ year	Maximum demand (MW)	Daily suppy shortfall after transfer capacity (MWh/day)			Total MWh per year
				Min.	Max.	Average	
2022/23	365	8,760	34.3	218	546	364	132,720
2023/24	365	8,760	34.5	220	550	366	133,739
2024/25	365	8,760	34.9	222	556	370	135,181

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 2022/23 and/or 2024/25 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 7 indicates the available funds that can be spent to achieve a 1, 2, 3 year deferral of network option expressed both as an overall cost and on a $/MWh basis.

We have expressed the available funds on an energy basis as the demand management support is principally associated with a shortfall in energy capacity rather than a shortfall in peak demand capacity. These figures are indicative only and any credible demand management solution proposed will be evaluated against the preferred network solution in a full RIT-D evaluation.

Table 7 – Funds available for demand management (combined City East and Dalley St. substations)

Deferral benefits	Average % EUE reduction per year	Average % Total risk reduction per year	Total available funds in 2022/2023, 2023/2024, & 2024/25	Peak Load Reduction required (MW) per year	Total MWh per year	Available $ per MWh
1 yr deferral	100%	32%	$1.59m	66.7	255,906	$6
2 yr deferral	100%	34%	$4.62m	67.4	259,024	$18
3 yr deferral	100%	36%	$5.94m	68.3	262,207	$23

Note: the stated available funds are indicative only and in addition to an allowance of $75,000 per year to cover any Ausgrid administrative costs.

4.3 Demand management options considered

Ausgrid has considered a number of demand management technologies to determine their commercial and technical feasibility to assist with the identified need at the City East and Dalley Street 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 many customers on a kVA demand tariff supplied from City East and Dalley Street zone substations. Of the 6,081 customers connected to City East and Dalley Street zone substations, only 475 are on a kVA demand tariff. Analysis of customer interval data indicates a technical potential of only about 1.4 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 3.1% 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 City East zone substations show that solar generation is greater than about 30% of maximum panel capacity for 28% of unmet load hours in winter, 45% of unmet load hours in summer and about 38% of overall unmet load hours. This is principally due to the early afternoon time of peak in summer and in winter.

At present there are 0.1MW of solar connected to City East zone substation. A 300% increase in installed solar power systems above the current projected trend (75% additional) is estimated to contribute only about 1% of the network support requirement. There is no indication that a material share of the unmet load could be reduced through an increase in the take-up of new solar power systems in the area.

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. At about 4 to 8 times the available funds, 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 City East and Dalley Street 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 in two seasons each year, we would estimate the average cost for demand response to be about $2000 to $3000 per MWh for large customer demand response and greater than $5000 per MWh for small customer demand response. At a cost many times the available funds, this solution is not likely to offer a cost competitive alternative.

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 City East and Dalley Street 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 in two seasons each year, 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