Augmentation expenditure: major projects

Negotiating position for the Customer Forum

1. Negotiation scope

The augmentation expenditure (augex) for major projects is in scope of the proposed expenditure negotiations between AusNet Services and the Customer Forum and is also in scope of the negotiations that will be oversighted by the Australian Energy Regulator (AER).

AusNet Services is seeking to negotiate with the Customer Forum on options for two major augex projects in the 2021-25 period to address network constraints in key growth corridors (Clyde North and Doreen). The options include a preferred network option and alternatives (including deferral of the network augmentation and non-network options).

The Customer Forum's input is sought on their preferred price-service trade-off, based on their understanding of AusNet Services' customer preferences. If the Customer Forum chooses options that have a poorer reliability outcome relative to the preferred network project, AusNet Services would seek to make an appropriate adjustment to its Service Target Performance Incentive Scheme (STPIS) targets.

Additional questions have been posed by AusNet Services to the Customer Forum as part of the negotiation process in relation to the augex major projects. These are shown below. The expectation is that the Customer Forum will answer these questions as part of the negotiation process.

Box 1: Questions for the Customer Forum

- Do the proposed projects (i.e. the preferred network options) strike the right balance between cost and reliable supply to customers?
- Would customers be willing to consider project deferrals that would reduce costs but reduce network reliability?
- Have the customer outcomes of a range of network and non-network options been sufficiently considered?
- Do you have any comments about the design of non-network options, including non-network options that involve customer participation or impacts such as demand management/response or appliance control?
- Is further research and/or engagement, beyond which is planned, required to form a view on this issue?

The Customer Forum will participate in community energy forums to be held at Clyde North/ Berwick on 16 August, and Doreen on 5 September. Topics for discussion include price, reliability and demand response – all of which are relevant to establishing the position on augex.

2. Project options to address constraints

AusNet Services is proposing augmentation expenditure in two areas of its network that are experiencing strong population growth and hence growth in peak demand. These areas are Clyde North and Doreen. Expenditure is needed to secure reliable supply to the growing customer base in these areas. Figure 1 shows the location of these areas in relation to Melbourne's growth corridors.

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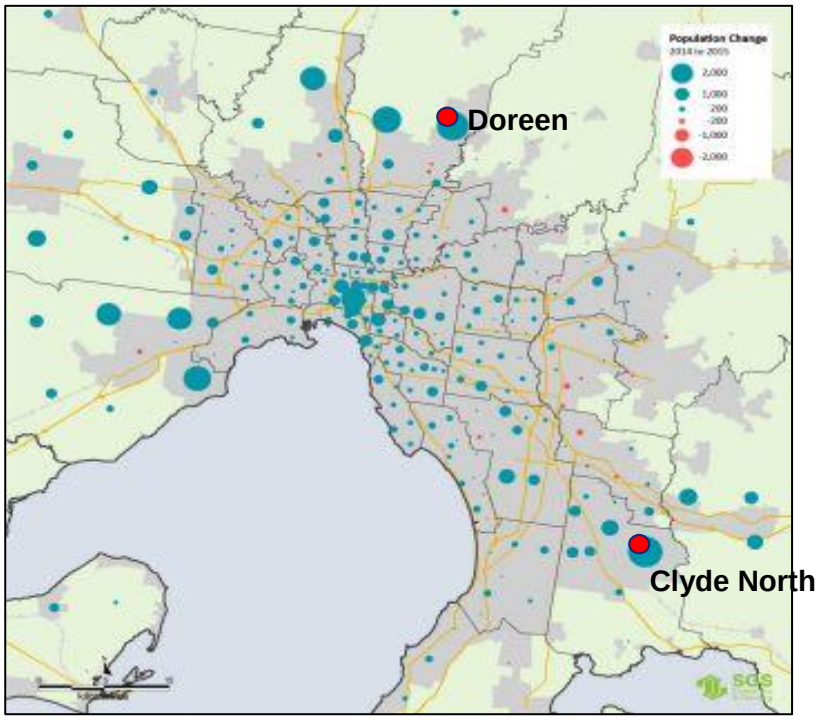
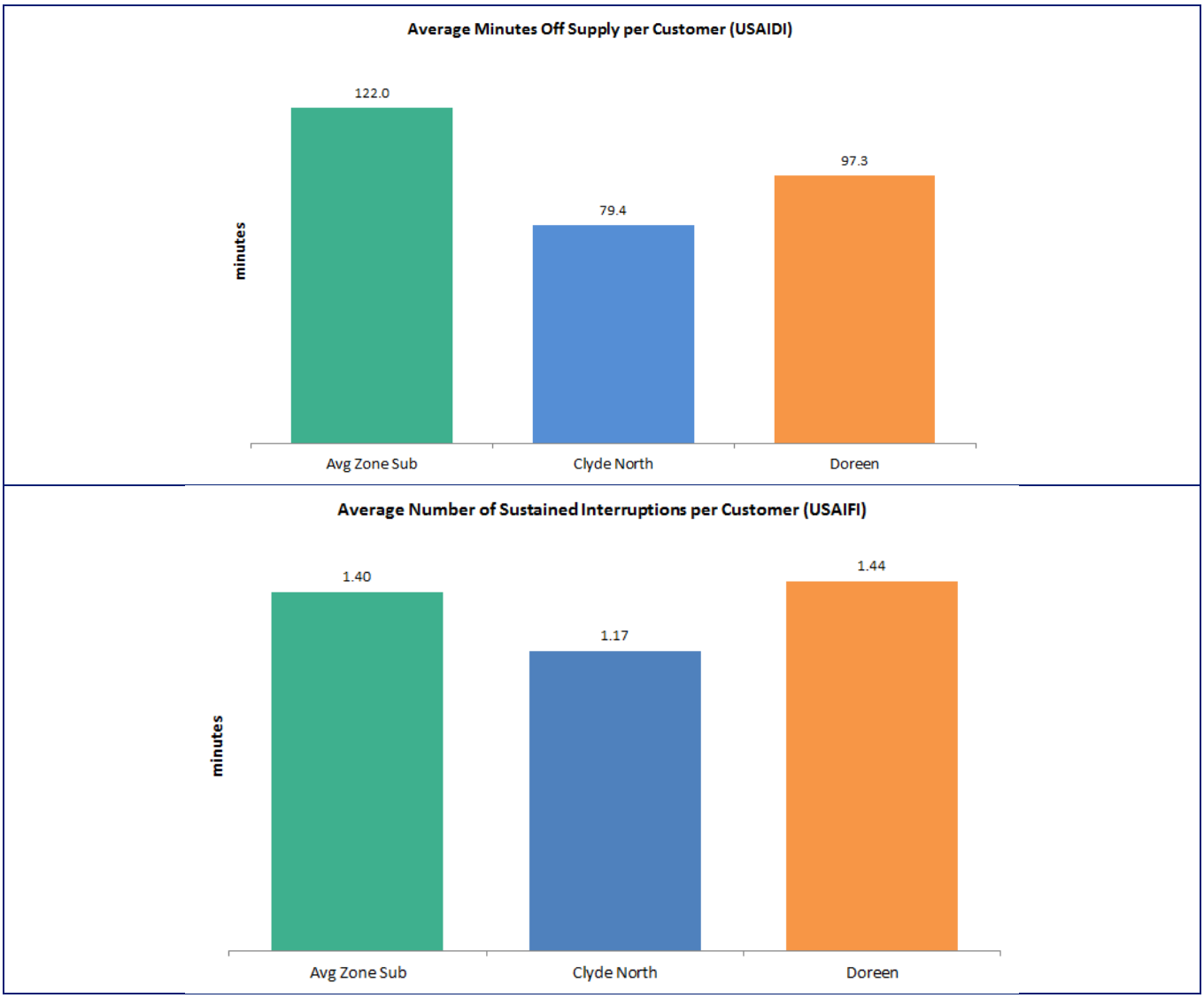
Figure 1: Melbourne's population growth



Source: SGS Economics and Planning 2016

Historical reliability performance at the Clyde North and Doreen zone substations in terms of outage duration and frequency, compared to the average across urban zone substations, is shown in Figure 2. While customers at Clyde North and Doreen have experienced relatively good reliability over 2013-17 compared to customers at other urban zone sub-stations, the augmentation projects are required due to the rapid population increase that is occurring in these areas, impacting the consequence of an outage (i.e. the amount of lost load).

Figure 2: Average Outage Duration (mins) and average outage frequency (no.): 2013-2017 average



2.1 Clyde North

Requirement for augmentation

The existing zone substation at Clyde North was commissioned in 2005 to meet load growth in the South-Eastern growth corridor of metropolitan Melbourne. The station was constructed with two 66/22 kV transformers to meet demand at that time, with room for a third transformation installation in the future. Demand at the station is growing at rate above 4 Mega Volt Amps (MVA) per annum, reaching the firm capacity of the station. As shown in Figures 2 to 4, this trend is expected to continue.

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Figure 3 shows that the customer growth at Clyde North has been substantially higher than on average across our network.

Figure 3: Clyde North customer growth 2012-17

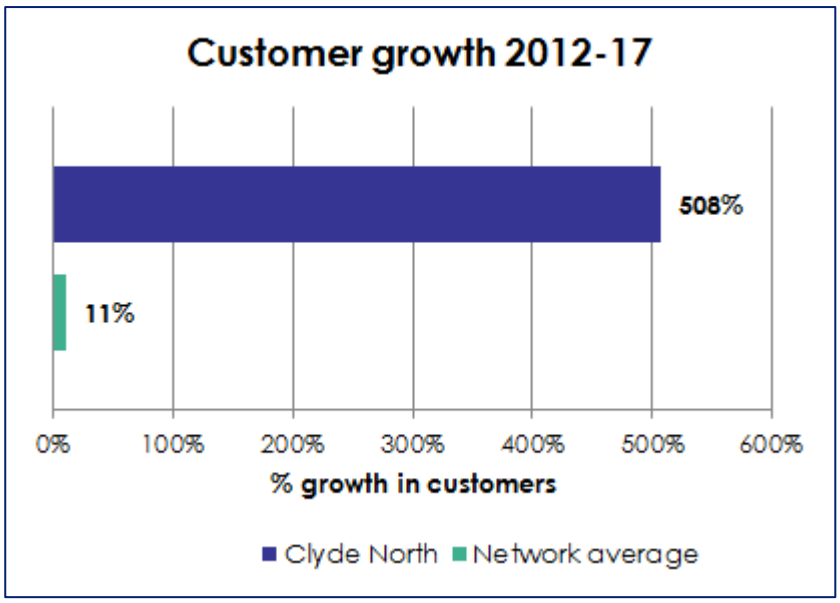


Figure 4 shows that the high growth is expected to continue, driving increasing demand growth. Figure 3 provides two demand forecasts:

- 50 POE: This demand forecast has a 50% probability of exceedance. That is, it is expected to be exceeded on average, 5 years in 10. This means this is a lower, more conservative forecast;
- 10 POE: This demand forecast has a 10% probability of exceedance. That is, it is expected to be exceeded on average, 1 year in 10. This means this is a higher, more aggressive forecast that is less likely to be exceeded.

Even the lower 50 POE forecast shows strong expected demand growth over the period to 2025 and beyond.

Figure 4: Clyde North forecast maximum demand– Actual, 10 and 50 POE

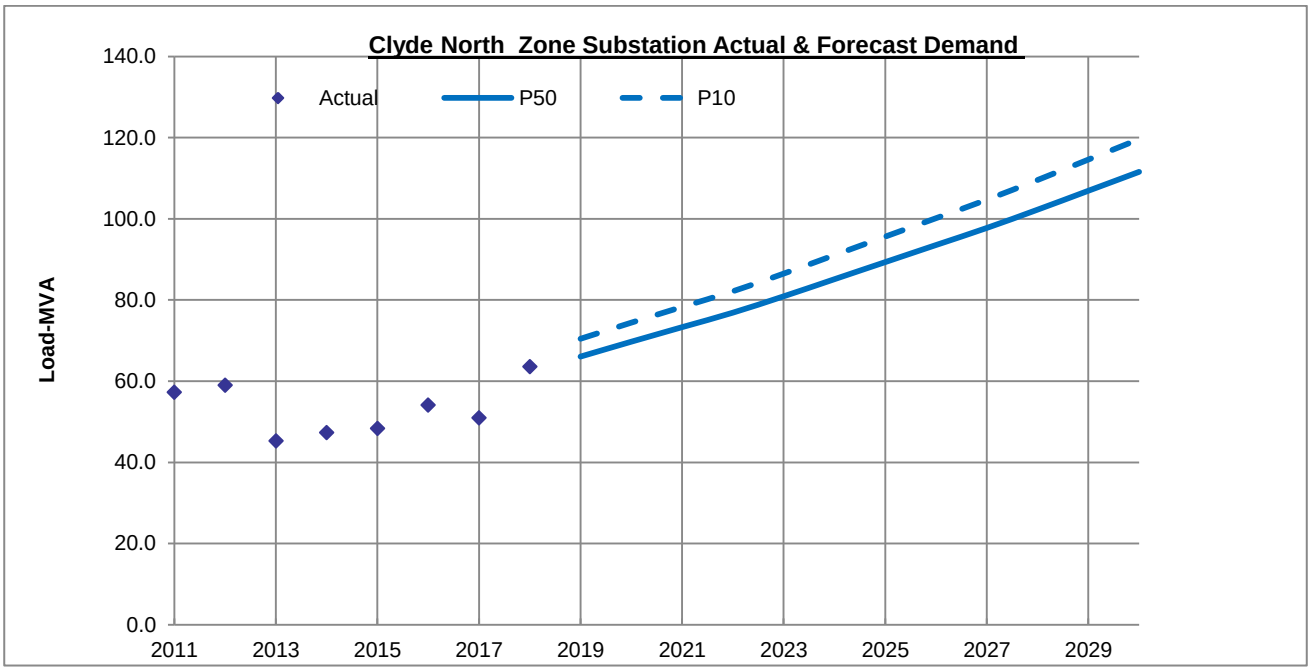


Figure 5 shows the amount of energy demanded by customers that may not be supplied. This is shown from 2018 to 2027.

In the figure, the energy at risk (EAR) represents the energy that would not be supplied if one transformer was out of service for the entire year. By 2025, this reaches 7,834 MWh (if no investment is made to increase the capacity of the zone substation).

If an outage did occur due to a transformer failure, it would take 9 months to replace the transformer. The customers off supply would be cycled to reduce the impact, and it is likely that emergency temporary generation would be put in place (at a high cost – it would not be prudent to plan to be reactive).

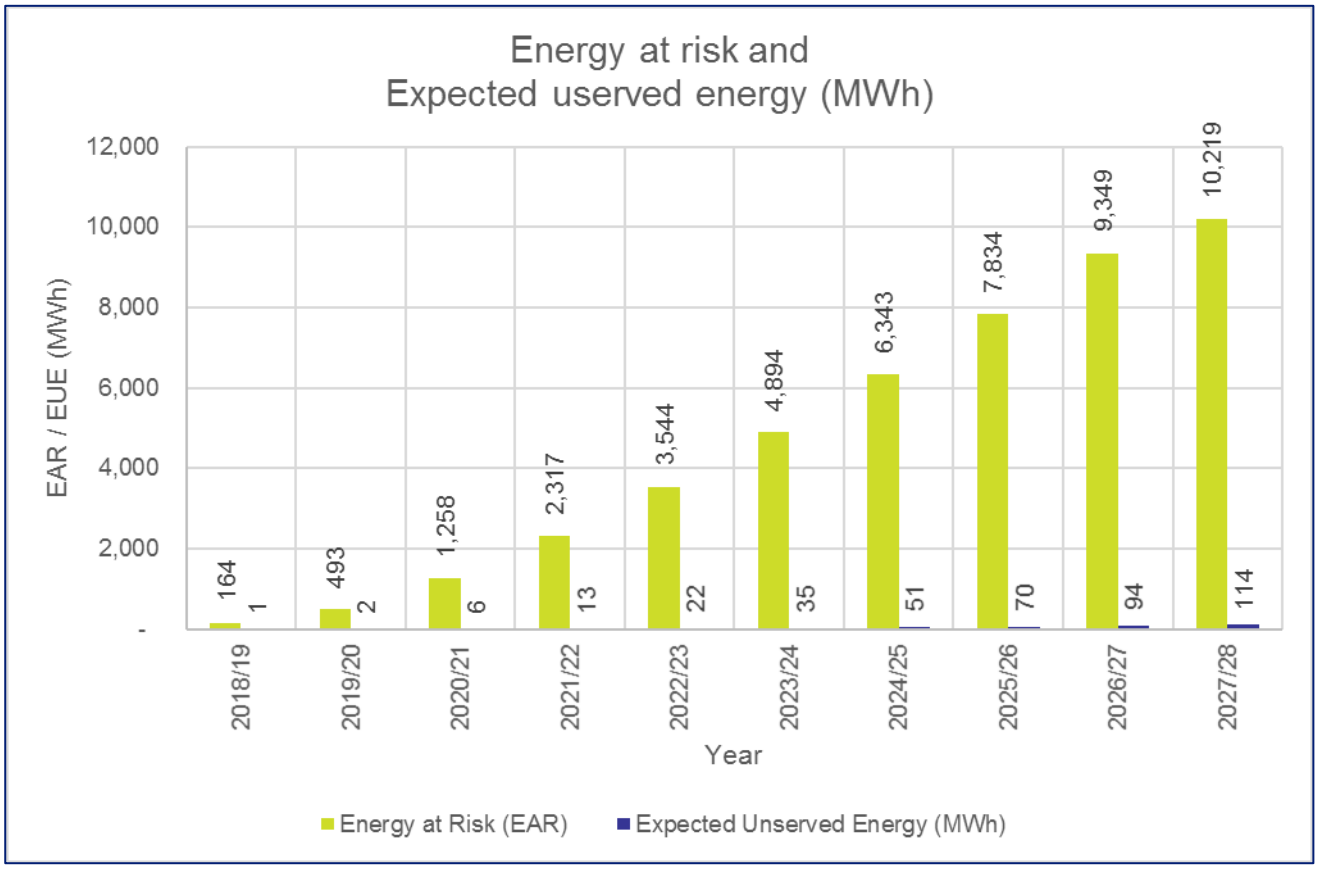
However, when planning for investments to augment the zone substations, the likelihood or probably of this kind of transformer failure is also considered. The probability weighted expected unserved energy (EUE) is much lower due to the low probability of a transformer being unavailable for service.

The expected unserved energy per year is forecast to increase from around 1 MWh in 2018/19 to 114 MWh in 2027/28. This represents approximately 7,600 customers off supply for an entire day in that year – however, in reality, either the extended outage would occur (as described above) or no outage would occur.

Based on the timing and extent of demand growth and risk to customer supply reliability, investment to expand the capacity of the zone substation is justified by 2023. A third and final 66/22 kV power transformer is proposed for the zone substation to increase capacity and address the reliability risk to customers.

Augmentation expenditure: major projects

Figure 5: Base Case- Clyde North energy at risk and expected unserved energy



Peak Partners

Over the 2017-18 summer, AusNet Services undertook a demand management trial in Clyde North. This was funded by the Demand Management Innovation Allowance. The following demand management offerings were tested:

- Behavioural response to a Critical Peak Rebate incentive, with AMI data portal (delayed data);
- Behavioural response to a Critical Peak Rebate incentive, with real-time data portal;
- Air conditioning load control (marketed as 'Autopilot) via Demand Response Enabling Device;
- Supply Capacity Control (marketed as 'Essential Power') via the AMI smart meter.

Overall, 82 customers were enrolled across the four offerings, sourced from a local primary school, a letter-drop and emails to myHomeEnergy customers.

The results from the Critical Peak Rebate trial were strong and averaged a 40% reduction in demand across the 72 customers enrolled for the Critical Peak Rebate on the 3 hottest days of the project. The incentive rate was set to $5/kWh, and payments to customers varied widely from around $5 to $30 per event.

Only 5 customers were enrolled in the AutoPilot and Essential Power offerings respectively, which was too small a sample to draw robust conclusions around the degree of response. Technical learnings were achieved.

AusNet Services is currently assessing potential demand response initiatives for this summer. A key information gap is the degree to which customers' response will be sustained if the program is repeated over time.

Augmentation expenditure: major projects

Augmentation options

AusNet Services, preferred network augment option is to install the third transformer in 2023. Additional options, with different price-reliability trade-offs are presented for consideration by the Customer Forum. The alternative options are to:

- Defer the transformer project by:
  - one year; or
  - by two years;
- Use non-network solutions:
  - embedded generation (diesel generation);
  - large scale storage (batteries); and
- A hybrid network/non-network option that uses demand response and behind the meter batteries from 2021 to 2025 to manage the risk of an outage, deferring the 3rd transformer out of the regulatory period to 2026.

The options are shown in Table 1.

Table 1: Clyde North augmentation options

	Description
Network options	
Preferred option: Install 3rd 20/33 MVA transformer by 2023	Install a 3rd transformer at Clyde North Zone substation Works over 2021-2023, commissioned in 2023
Install 3rd 20/33 MVA transformer by 2024	1-year deferral Works over 2022-2024, commissioned in 2024
Install 3rd 20/33 MVA transformer by 2025	2-year deferral Works over 2023-2025, commissioned in 2025
Non-network options	
Embedded generation	20 MW diesel generation Assumed cost: CAPEX - $0.5M/MW OPEX - $0.5 MW for fuel costs etc.

Augmentation expenditure: major projects

	Description
Energy storage (battery)	20 MWh Assumed cost: $4M/MWh (based on previous experience with grid scale energy storage) Note: this assumes 20 MW available for 1 hour. However peak lasts for ~4hrs so this will not address all risk
Hybrid Network/Non-network option	
Demand response and behind the meter batteries from 2021 and 3rd transformer deferred 2026	10% of customers deliver a 40% demand reduction $5k/MW of demand reduction capacity 2 MW / 8 MWh of behind the meter battery Assumed cost: $20k/MW (based on previous experience with grid scale energy storage) Delay installation of 3rd transformer at Clyde North Zone substation to 2026

Augmentation expenditure: major projects

As shown in Table 2, the options for Clyde North have varying impacts on both cost to customers (over the short and long term) and reliability impacts. These trade-offs are plotted in the charts below, so the options can be readily compared.

Table 2: Comparison of Clyde North augmentation options

	Option (real $2020)	Capital cost ($M)	OPEX ($M / annum)	Present Value (PV) Project Cost ($M)	PV cost over 50 year asset life/ customer [2]	Average annual cost/ customer [1] (2021-25)	Total expected outage duration 2021-25 (minutes)
	Network options						
1	Preferred option: Transformer by 2023	13.05		10.99	$14.15	$0.43	224
2	1 year deferral (2024)	13.19		10.36	$13.74	$0.25	379
3	2 year (2025)	13.31		10.31	$13.45	$1.17	556
	Non-network options						
4	Embedded generation	10.78	0.5	11.44	$16.23	$0.75	224
5	Energy storage (battery)	86.23	0.5	73.82	$107.34	$2.93	224
	Hybrid Network/Non-network option						
6	Demand response and behind the meter batteries from 2021 and 3rd transformer deferred to 2026	9.42	0.08	7.25	$10.84	$0.12	761

Notes:

1. The average annual cost per customer represents the revenue associated with the projects (i.e. opex and return on and return of capital) and is an annual average over 2021-25.
2. The PV of cost over the 50 year asset life represents the revenue associated with the projects (i.e. opex and return on and return of capital), in present value terms.

Figure 6 plots the cost and reliability impact for customers during 2021-25. Note that the cost impact affects all customers, while the reliability impacts are only experienced by the 27,310 customers (99% residential) connected to Clyde North zone substation.

The figure shows that:

- The best reliability outcome is achieved by installing the 3rd transformer by 2025 (Option 1). This is the preferred option.
- While Option 2, the two year deferral, has a lower short term cost than Option 1, the reliability impacts on the connected customers are relatively high.
- The non-network options have either far higher short term cost impacts (Options 3 and 4), or far worse reliability impacts (Option 5).

Figure 6: Price reliability trade-off – Clyde North - Short term

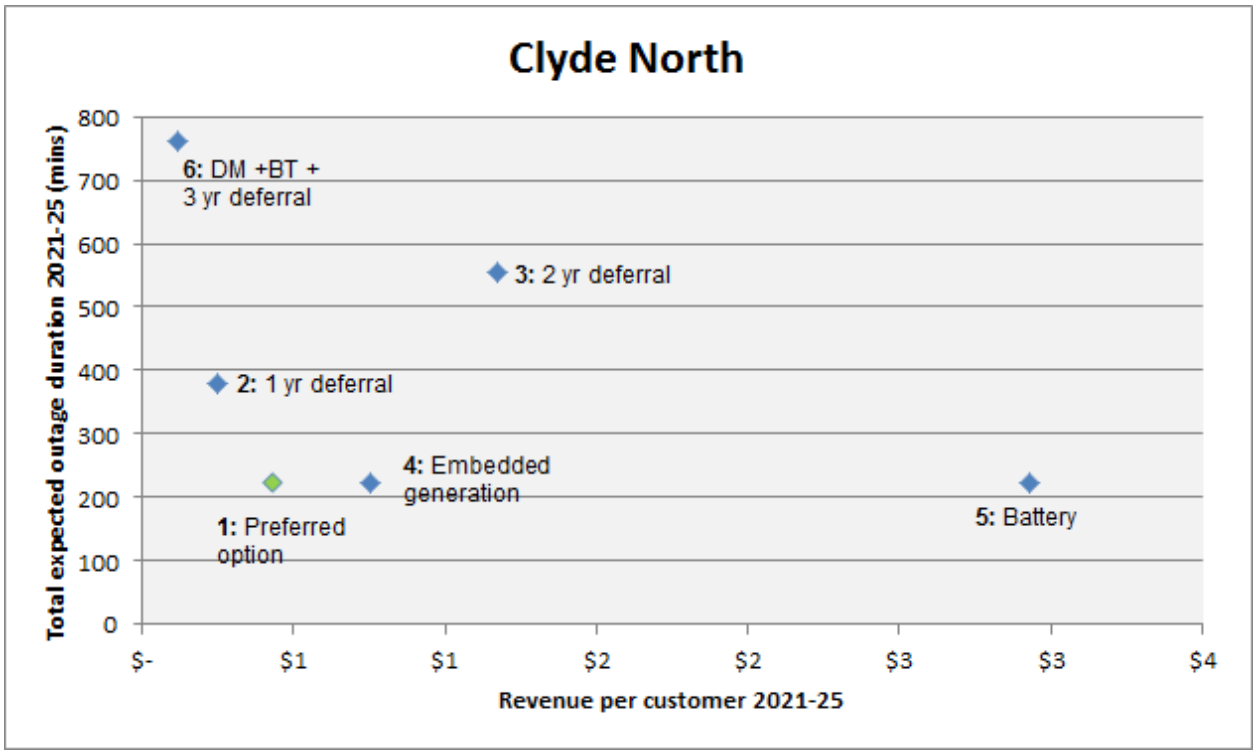
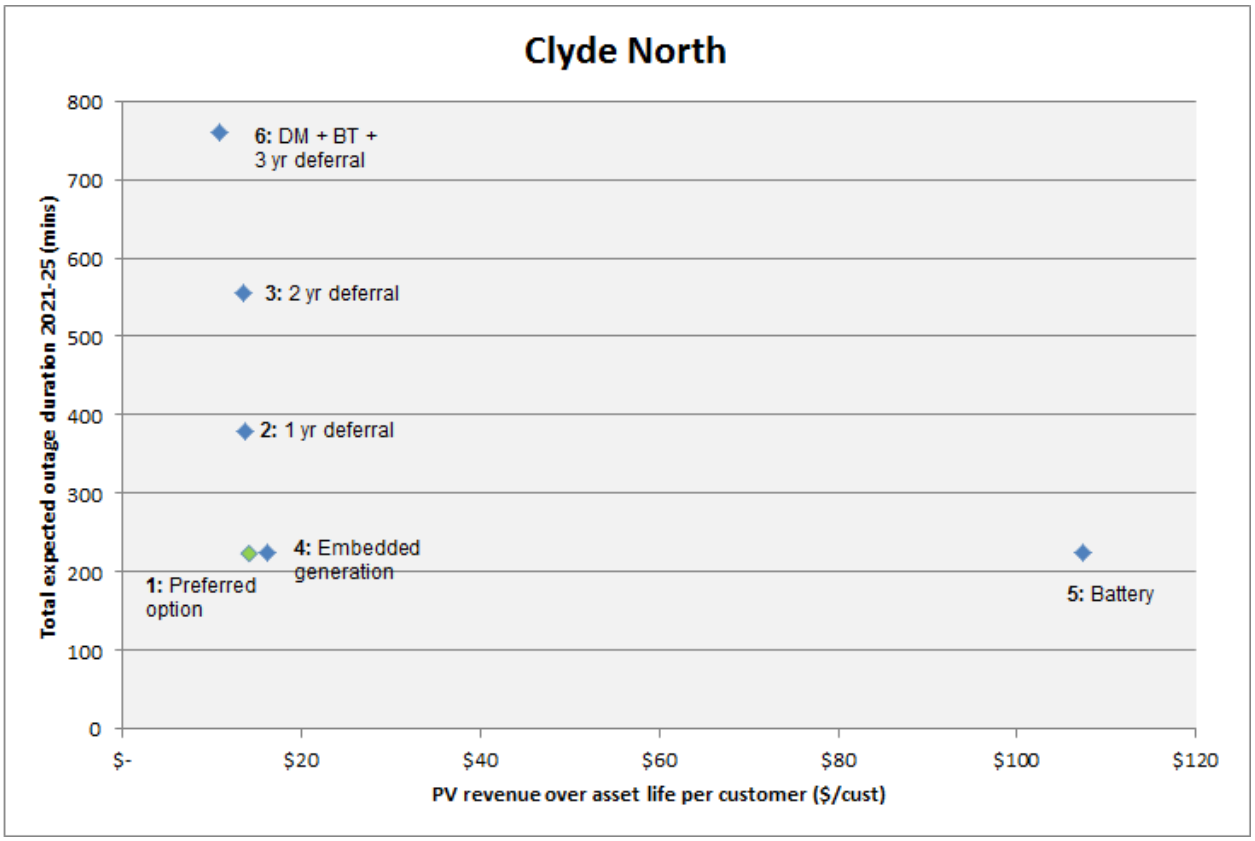


Figure 7 plots the long-term cost and reliability impacts of the various options for Clyde North. This shows that:

- Over the long term, Option 1 is the lowest cost to customers and equal first (with Options 4 and 5) for reliability.
- The one or two year deferral options (Options 2 and 3 respectively) has a very similar cost to customers over the long term as Option 1, but are far worse for reliability.
- Non-network options are either have higher long-term cost impacts (Options 4 and 5) or far worse reliability impacts (Option 6).

Figure 7: Price reliability trade-off – Clyde North - Long term



2.2 Doreen

Requirement for augmentation

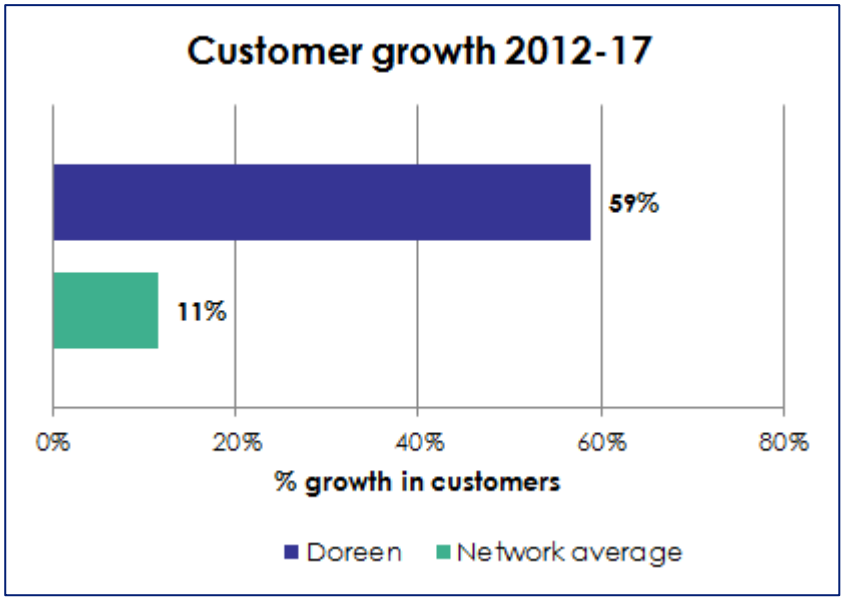
The Doreen Zone Substation, similar to the Clyde North Zone Substation, was constructed in 2006 to address residential population growth in the Northern Growth Corridor of Metropolitan Melbourne. The station was constructed with only two of the ultimate three 66/22 kV power transformers, as required by the demand experienced at the time.

Demand at the station is growing at rate of 2 MVA per annum reaching the firm capacity of the station. As shown in the following figures, this trend is expected to continue.

Figure 8 shows that the customer growth at Doreen has been substantially higher than on average across our network, though the growth is not as high as at Clyde North.

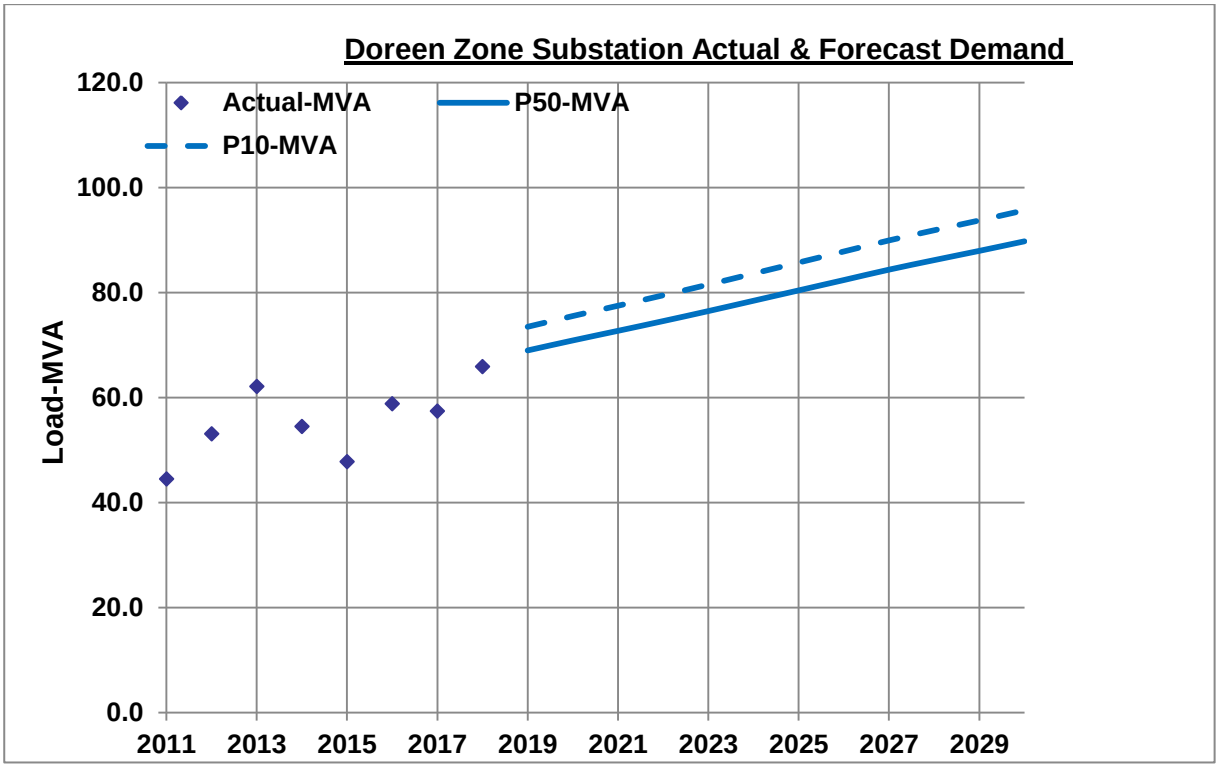
Augmentation expenditure: major projects

Figure 8: Doreen customer growth 2012-17



As shown in Figure 9, the high growth is expected to continue, driving increasing demand growth over the period to 2025 and beyond.

Figure 9: Doreen forecast maximum demand (zone sub coincident peak demand?) – 10 and 50 POE



Note: 50 POE: This demand forecast has a 50% probability of exceedance. 10 POE: This demand forecast has a 10% probability of exceedance.

Augmentation expenditure: major projects

Figure 10 shows the amount of energy demanded by customers that may not be supplied. This is shown from 2018 to 2027.

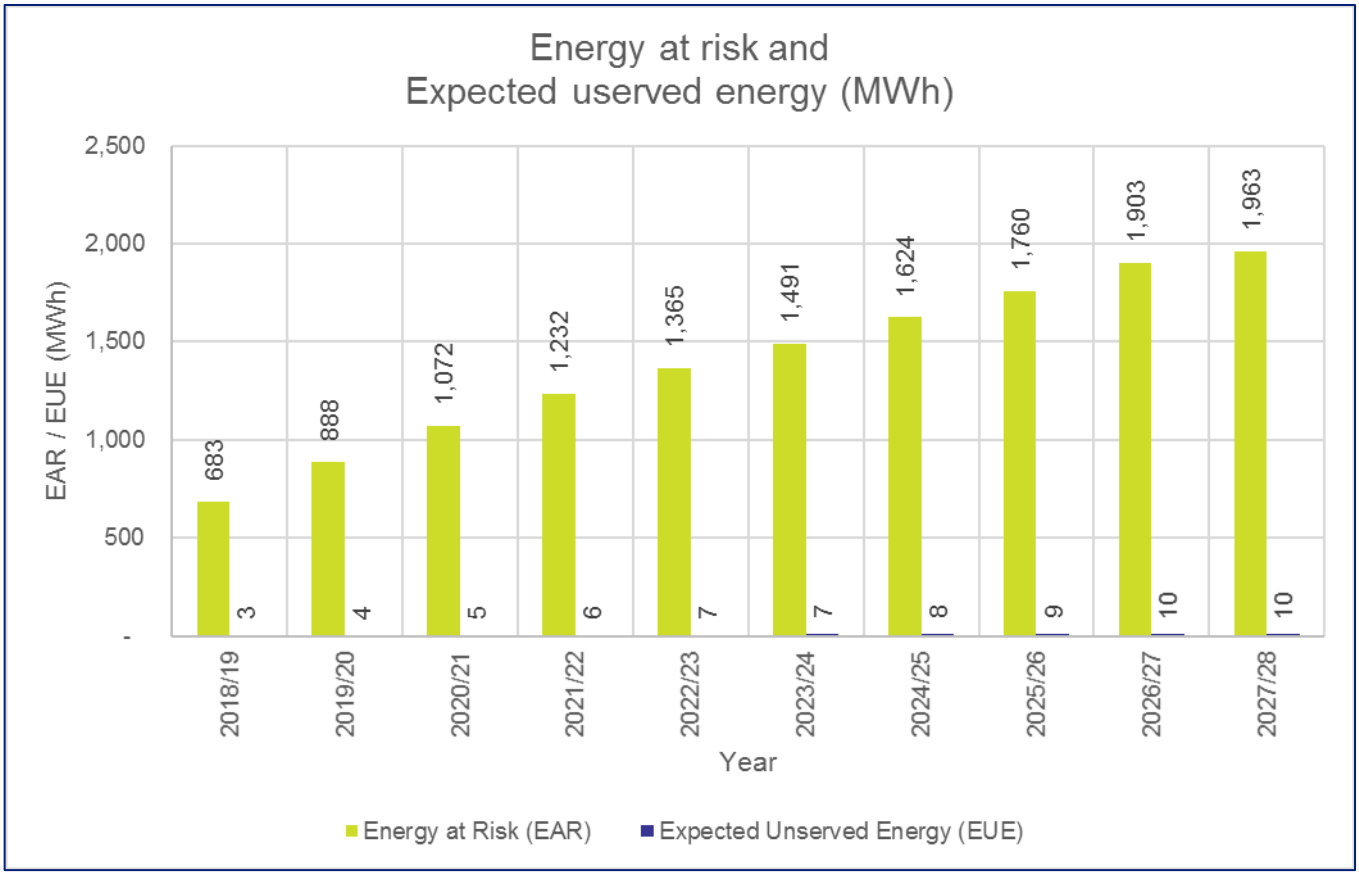
In the figure, the energy at risk (EAR) represents the energy that we would not able to supply if one transformer was out of service for the entire year. By 2025, this reaches 1,760 MWh (if no investment is made to increase the capacity of the zone substation). As with Clyde North, if a transformer did fail, an extended outage would occur, which need to be managed reactively at a high cost.

However, when planning for investments to augment the zone substations, the likelihood or probably of this kind of transformer failure is also considered. The probability weighted expected unserved energy (EUE) is much lower due to the low probability of a transformer being unavailable for service.

The expected unserved energy per year is forecast to increase from around 3 MWh in 2018/19 to 10 MWh in 2027/28. This represents approximately 670 customers off supply for an entire day in that year (although, as above, this scenario is not particularly meaningful as either the extended outage, or no outage, would occur).

Based on the timing and extent of demand growth and risk to customer supply reliability, investment to expand the capacity of the zone substation is justified by 2023. A third and final 66/22 kV power transformer is proposed for the zone substation to increase capacity and address the reliability risk to customers.

Figure 10: Base Case- Doreen energy at risk and expected unserved energy



Augmentation expenditure: major projects

Augmentation options

AusNet Services' preferred network augment option is to install the third transformer in 2023. Additional options, with different price-reliability trade-offs are presented for consideration by the Customer Forum. The alternative options are to:

- Defer the transformer project by two years;
- Use non-network solutions:
  - embedded generation (diesel generation);
  - large scale storage (batteries); and
- A hybrid network/non-network option that uses demand response and behind the meter batteries from 2021 to 2025 to manage the risk of an outage, deferring the 3rd transformer out of the regulatory period to 2026.

The options are shown in Table 3.

Table 3: Doreen augmentation options

	Description
Network options	
Preferred option: Install 3rd 20/33 MVA transformer by 2025	Install a 3rd transformer at Doreen Zone substation Works over 2024-2025, commissioned in 2025
Install 3rd 20/33 MVA transformer by 2027 (2 year deferral out of period)	2-year deferral Works over 2026-2027, commissioned in 2027
Non-network options	
Embedded generation	20 MW diesel generation Assumed cost: CAPEX - $0.5M/MW OPEX - $0.5 MW for fuel costs etc.
Energy storage (battery)	20 MWh Assumed cost: $4M/MWh (based on previous experience with grid scale energy storage) Note: this assumes 20 MW available for 1 hour. However peak lasts for ~4hrs so this will not address all risk

Augmentation expenditure: major projects

	Description
Hybrid Network/Non-network options	
Demand response and behind the meter batteries from 2021 and 3rd transformer deferred to 2026	10% of customers deliver a 40% demand reduction $5k/MW of demand reduction capacity 2 MW / 8 MWh of behind the meter battery Assumed cost: $20k/MW (based on previous experience with grid scale energy storage) Delay installation of 3rd transformer at Doreen Zone substation to 2026

As shown in Table 4, the options for Doreen have varying impacts on both cost to customers (over the short and long term) and reliability impacts. These trade-offs are plotted in the charts below, so the options can be readily compared.

Table 4: Comparison of Doreen augmentation options

	Option	Capital cost ($M)	OPEX ($M / annum)	Present Value (PV) Project Cost ($M)	PV cost over 50 year asset life/ customer [2]	Average annual cost/ customer [1] (2021-25)	Total expected outage duration 2021-25 (minutes)
	Network options						
1	Preferred option: Transformer by 2025	$5.12	-	$3.96	$5.15	$0.03	24
2	2 year deferral out of period (2027)	$5.12	-	$3.64	$5.37	$0.00	78
	Non-network options						
3	Embedded generation	$10.78	$0.5	$9.82	$14.35	$0.14	24
4	Energy storage (battery)	$86.23	$0.5	$67.16	$99.79	$0.16	24
	Hybrid Network/Non-network options						
5	Demand response and behind the meter batteries from 2021 and 3rd transformer deferred to 2026	$5.70	$0.08	$4.54	$6.64	$0.12	138

Notes: 1.The average annual cost per customer represents the revenue associated with the projects (i.e. opex and return on and return of capital) and is an annual average over 2021-25. 2. The PV of cost over the 50 year asset life represents the revenue associated with the projects (i.e. opex and return on and return of capital), in present value terms.

Augmentation expenditure: major projects

Short Term

Figure 11: Price reliability trade-off – Doreen - Short term

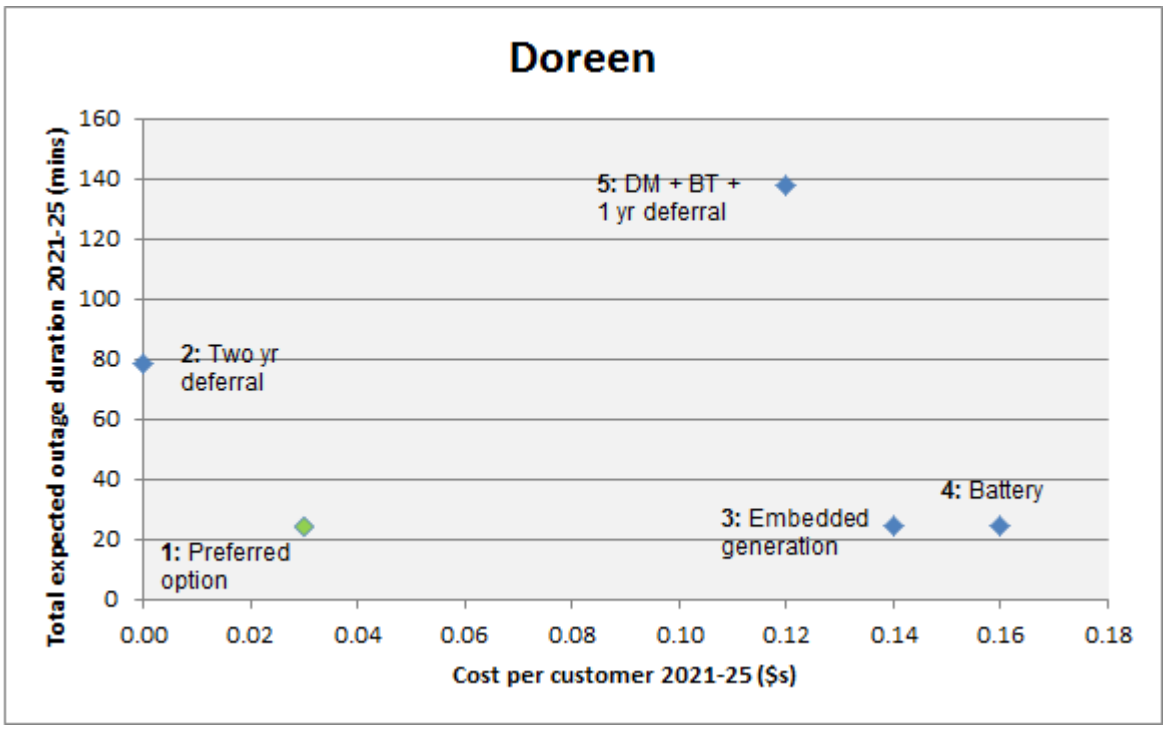


Figure 11 plots the cost and reliability impact for customers during 2021-25. Note that the cost impact affects all customers, while the reliability impacts are only experienced by the 27,970 customers (96% residential) connected to Doreen zone substation. The figure shows that:

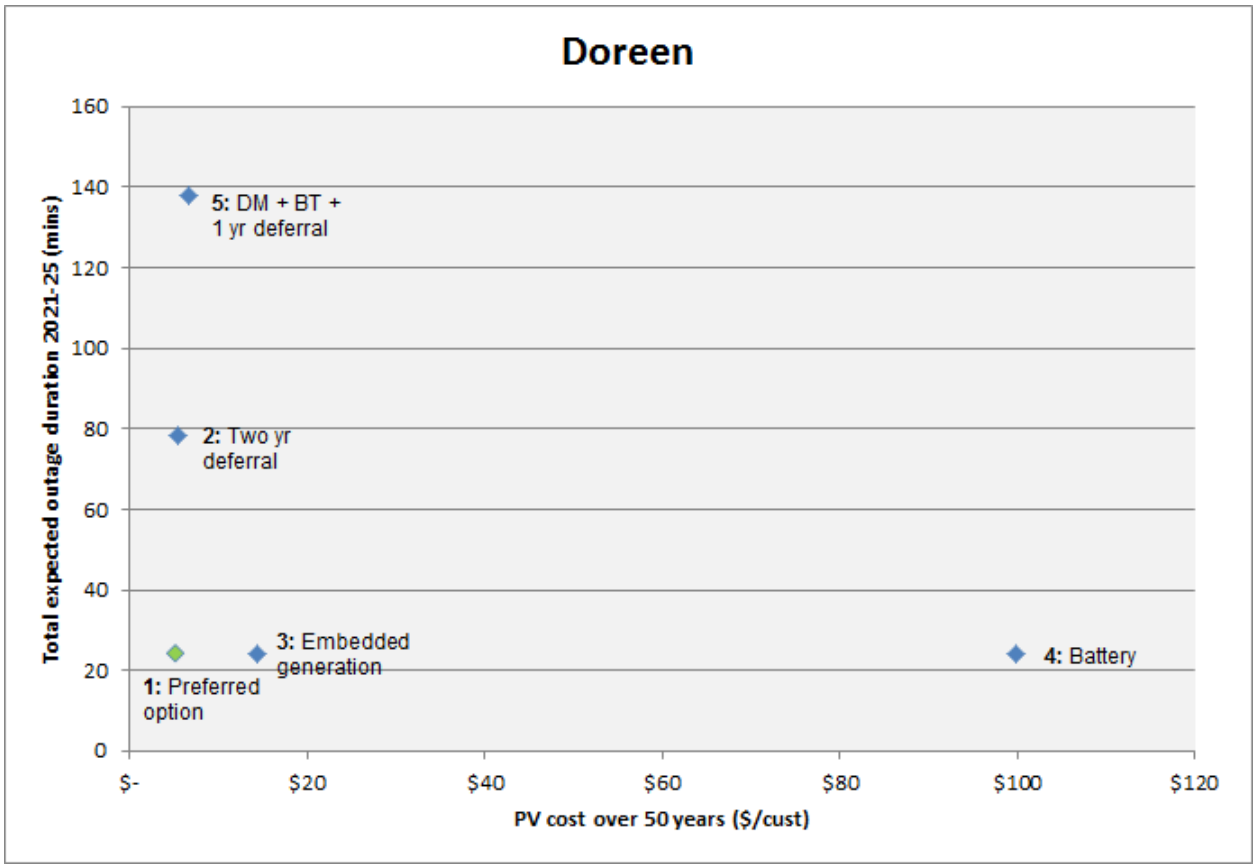
- The best reliability outcome is achieved by installing the 3rd transformer by 2025 (Option 1). This is the preferred option.
- While Option 2, the two year deferral, has a lower short term cost than Option 1, the reliability impacts on the connected customers are relatively high.
- The non-network options have either far higher short term cost impacts (Options 3 and 4), or far worse reliability impacts (Option 5).

Long Term

Figure 12 plots the long-term cost and reliability impacts of the various options for Doreen. This shows that:

- Over the long term, Option 1 is the lowest cost to customers and equal first (with Options 3 and 4) for reliability.
- The two year deferral (Option 2) has a very similar cost to customers over the long term as Option 1, but is far worse for reliability.
- Non-network options are either have far higher long-term cost impacts (Options 3 and 4) or far worse reliability impacts (Option 5).

Figure 12: Price reliability trade-off – Doreen - Long term



3. Customer research

Two areas of relevant customer research are provided below. The first is research concerning customer's price-reliability preference. The second is similar research that is specific to customers located in the Clyde North and Doreen growth corridors, where the augmentation projects are located.

Customer's preferences concerning price-reliability trade-offs

The following table summarises key messages from the customer research concerning customer's preferences on price-reliability trade-offs.

The research shows strong concern about affordability, but also that provision of reliable supply is strongly valued, particularly by small to medium businesses.

Table 5: Customer Research Insights

Small to Medium Businesses (AusNet Services' Survey)	Households (RMIT Survey)
Price/affordability • The issue of electricity affordability as a result of recent and significant prices increases was voiced as a major, if not the most salient, concern for all stakeholders. **Reliability** • Reliability is a priority concern for small to medium businesses.	**Price/affordability** • Nearly all households were concerned about electricity price rises and current costs. **Reliability** • The residential customers interviewed were satisfied with the current reliability of their electricity supply.
Residential and SME (Quantum Survey)	**Residential and SME (New Gate Research)**
Price/affordability • Around two-thirds of customers (67% residential and 64% SME) felt that their electricity bills have increased over the last 2 years. • More than a quarter feel that they have increased a lot (35% residential, 28% SME) • 31% of residential and 23% of SME consider that their electricity provided poor or very poor affordability. **Reliability** • An annual outage was considered acceptable by 63% of residential customers, but more frequent outages acceptable to only 31% of residential customers • For small to medium businesses, even an annual blackout was considered unacceptable by 38% of customers	**Price/affordability** • Costs and prices were "top of mind"; 37% rate value for money at 4 or less out of 10 • Providing a reliable, continuous supply was the most highly valued service. While the majority felt that supply was quite reliable, (58% rated this at 7+ out of 10), a fairly large portion, around one in five (22%) gave a low rating of 4 or less. **Reliability** • Most participants had a high level of tolerance for outages as long as they were well informed.

Clyde North and Doreen customer views

The sample of consumers taken from Clyde North and Doreen was entirely residential and did not include any small businesses, reflecting the high percentage of residential customers in these locations (99% and 96% respectively).

Value and affordability

Many customers worry about the value they are receiving and in Clyde North (CN) and Doreen around two-thirds of customers rated electricity as poor value for money. A majority felt that their electricity bills have increased noticeably over the past two years- 55% in CN and 67% in Doreen.

The top reasons for bill increases supplied by customers included profiteering by distributors and retailers, as well as the closure of power stations.

Reliability

Both areas felt they experienced a similar number of outages a year, with around 28% saying it was about once a year. Those in Clyde North felt this number of outages was more acceptable than in Doreen. About 27% of CN said that this was completely acceptable, whereas around 17% in Doreen said it was somewhat acceptable, with 0% saying it was completely acceptable.

About one-quarter of homes in the area had solar panels installed, however the remaining sample was not rushing to install solar panels in the near future. In Doreen, 31% were not very interested and another 31% were interested. In Clyde North, 44% of customers were not very interested, with 22% quite interested.

Solar PV and batteries

One customer across each area had invested in battery storage. None of the customers sampled had invested in an electric vehicle, and overwhelmingly around 80% of customers were not interested in electric vehicles. This lack of interest was not due to EVs being too expensive, but rather due to perceptions that the technology is not advanced enough yet. Despite this perception, those who are interested in EVs think that they will most likely get an EV in the next 3 to 7 years.

A majority (58%) of participants were not interested in going off the grid. Only one customer was interested in going off-grid, with the reason being to reduce their carbon footprint and not because of dissatisfaction with AusNet Services.

Demand management

Only 17% of participants would be willing to use less energy for a few hours as a form of demand management without an incentive to do so. Only 48% of customers sampled would be willing to lower their consumption if they were offered an incentive, and around 21% do not want to reduce their energy consumption. A slight majority of participants (55%) would be willing to allow their air conditions to be remotely controlled as a form of demand management, and of those the majority would want an incentive to do so.