Replacement expenditure: major projects

Negotiating Position for the Customer Forum

1. Negotiation Scope

The replacement expenditure (repex) for major projects is within the scope of the proposed expenditure negotiations between AusNet Services and the Customer Forum. However, it is outside the scope of negotiation that will be oversighted by the Australian Energy Regulator (AER).

AusNet Services is seeking to negotiate with the Customer Forum on six alternative portfolios of major repex projects that provide differing price-service trade-offs for customers, including:

- a preferred zone substation refurbishment portfolio consisting of ten refurbishment projects over the 2021-25 period;
- a range of refurbishment portfolios that alter the timing of the refurbishment projects, including project deferrals; and
- a portfolio that combines project deferrals with supply risk mitigation using a non-network solution (diesel generation).

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 repex 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?

2. Repex Major Projects in Scope

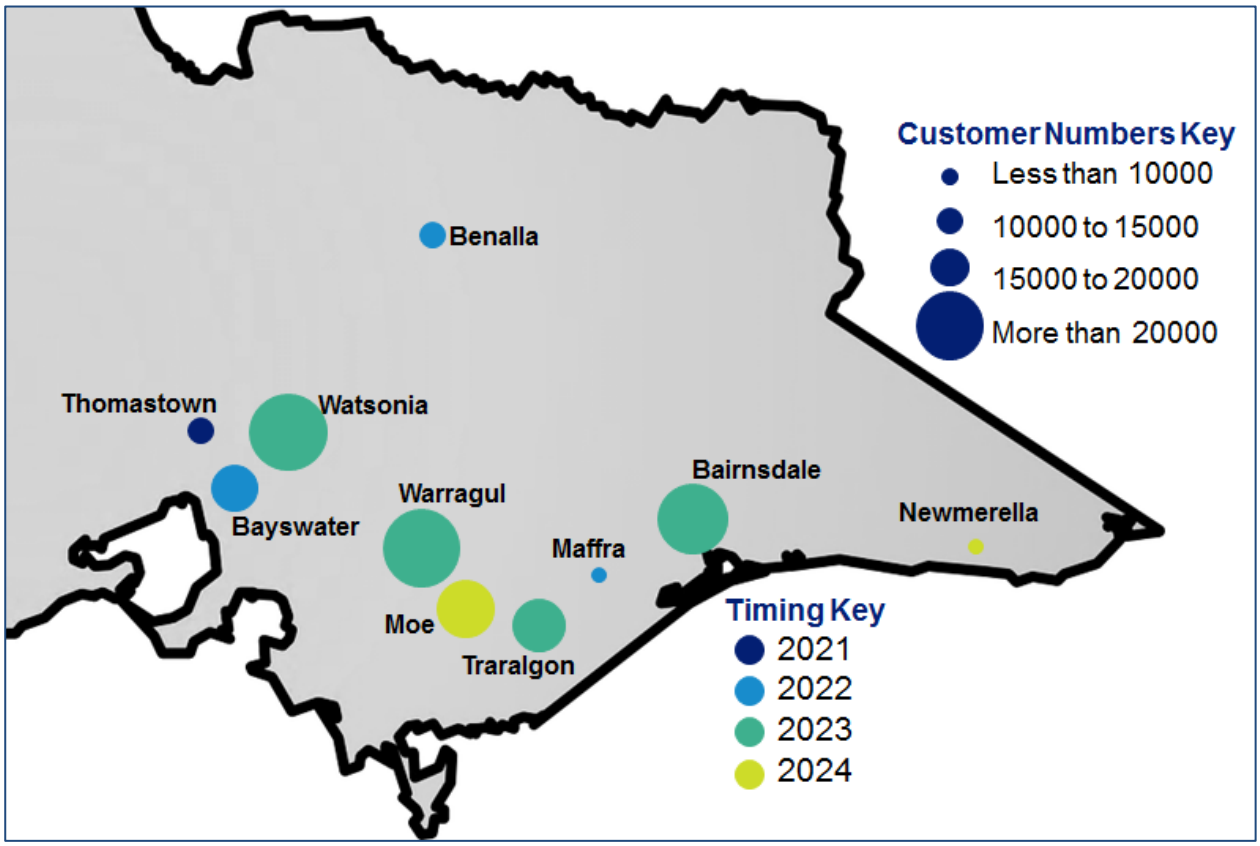
Zone substation major refurbishment projects target the replacement of deteriorated plant in zone substations. The projects typically include the replacement of major plant such as transformers, circuit breakers and ancillary equipment such as protection systems or panels containing asbestos. The scope of each project is determined through economic analysis of options.

At each site, a range of options have been considered to replace deteriorated assets in whole or in part. The proposed refurbishment projects have been designed to provide the optimal combination of asset replacement

that balances the benefits (reduction of probability of asset failure and associated consequences) with the costs of the replaced assets.

AusNet Services' preferred portfolio of major repex projects consists of ten zone substation rebuilds that would be undertaken over the 2021-25 period. Ranked from the highest to lowest priority, the zone substation refurbishment projects are at the Thomastown, Benalla, Bayswater, Maffra, Traralgon (Stage 2), Watsonia, Bairnsdale, Warragul, Moe and Newmerella zone substations as shown on the map below. In 2017 there were 157,473 customers connected to these stations (accounting for 22% of total AusNet Services customers) and consuming a total of 1,680GWh (22% of total consumption).

Figure 1: Location of replacement expenditure major projects (zone substation refurbishments)



3. Repex Major Project Portfolio Options

AusNet Services has developed six repex major project portfolio options for consideration by the Customer Forum. The six options are defined in Table 1.

Should the Customer Forum suggest further portfolio options, these could be assessed by AusNet Services and considered during the negotiation process.

Table 1: Description of the Six Repex Major Project Portfolio Options

<table>
<tr><th>Option</th><th>Name</th><th>Description</th></tr>
<tr><td>1</td><td>All projects commence 2021</td><td>The 10 repex major projects all commence construction in 2021</td></tr>
<tr><td>2</td><td>Proposed timing</td><td>The proposed project timings are:
<table>
<tr><th>Project</th><th>Timing</th></tr>
<tr><td>Thomastown</td><td>2021</td></tr>
<tr><td>Benalla</td><td>2022</td></tr>
<tr><td>Bayswater</td><td>2022</td></tr>
<tr><td>Maffra</td><td>2022</td></tr>
<tr><td>Traralgon Stage 2</td><td>2023</td></tr>
<tr><td>Watsonia</td><td>2023</td></tr>
<tr><td>Bairnsdale</td><td>2023</td></tr>
<tr><td>Warragul</td><td>2023</td></tr>
<tr><td>Moe</td><td>2024</td></tr>
<tr><td>Newmerella</td><td>2024</td></tr>
</table></td></tr>
<tr><td>3</td><td>Four lowest risk projects after 2025 + diesel generation</td><td>The following four project are delayed after 2025:
Bairnsdale
Moe
Newmerella
Warragul
45MW of diesel generation is also installed to manage supply risk</td></tr>
<tr><td>4</td><td>Four lowest risk projects after 2025</td><td>The following four project are delayed after 2025:
Bairnsdale
Moe
Newmerella
Warragul</td></tr>
<tr><td>5</td><td>Defer all projects by 1 year</td><td>All timings shown in Option 2 delayed by one year.</td></tr>
<tr><td>6</td><td>Deferral all projects beyond 2025</td><td>All projects are deferred after 2025 and are assumed to commence in 2026.</td></tr>
</table>

Details of the individual projects, including the number and type of connected customers, are included in Attachment 1.

4. Price-Reliability Trade-Off between Repex Portfolio Options

The price and reliability outcomes associated with each of the six repex portfolios are presented in this section. Table 2 shows:

- the project cost for each portfolio;
- the cost that will be recovered from customers over the life of the assets and in the 2021-25 period; and
- the reliability outcomes associated with each portfolio expressed in terms of the expected number and duration of outages.

The comparisons below are across all AusNet Services' customers. In order to show the locational cost of the repex portfolio, the cost impact per customer connected to the zone substations is provided in Attachment 2.

Replacement Expenditure: Major Projects

Table 2: Comparison of Repex Options – per total AusNet Services Customers

Option	Description	Capital Cost $M ($2020)	Present Value (PV) Project Cost $M	PV cost over 50 year asset life/ customer [3]	Average annual cost/ customer [2] 2021-25 ($2020)	Total expected no of outages (2021-25) [4]	Total expected outage duration (minutes) (2021-25) [4]
1	All projects commence 2021	$108.8	$95.7	$111.39	$5.29	1.80	72
2	Proposed timing	$112.8	$93.6	$104.94	$3.10	2.19	88
3	Four lowest risk projects after 2025 + diesel generation[1]	$169.5	$137.5	$185.24	$4.76	2.19	88
4	Four lowest risk projects after 2025	$113.5	$91.9	$104.71	$2.71	2.29	91
5	Defer all projects by 1 year	$112.1	$89.2	$101.53	$1.70	2.56	102
6	Deferral all projects beyond 2025	$113.8	$81.2	$100.00	$0.00	3.76	151

Notes:

1. There will be an additional small operational cost for maintenance and testing of installed generators which has not been included in the cost approximations above.
2. 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.
3. 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. The present value is the present day value of a future stream of payments. It relies on the idea of the time value of money – that one dollar in the present day is worth more than the same dollar at a future date.
4. These outages are will only be experienced by customers connected to these stations.

The cost of the six portfolios varies in present value (PV) terms from $81m (Option 6) to $138m (Option 3). The PV project cost of the preferred portfolio (Option 2) is $94m. However, the six portfolio options would have quite different reliability outcomes for customers.

The cost and reliability outcomes associated with each portfolio are plotted in order to readily compare between the options. Outage duration and costs for customers are plotted both for the short term (2021-25) and the long term (over the life of the assets).

Short Term

Figure 2: Price-Reliability Trade-Off of Repex Portfolio Options (cost versus outage duration) – Short Term 2021-25

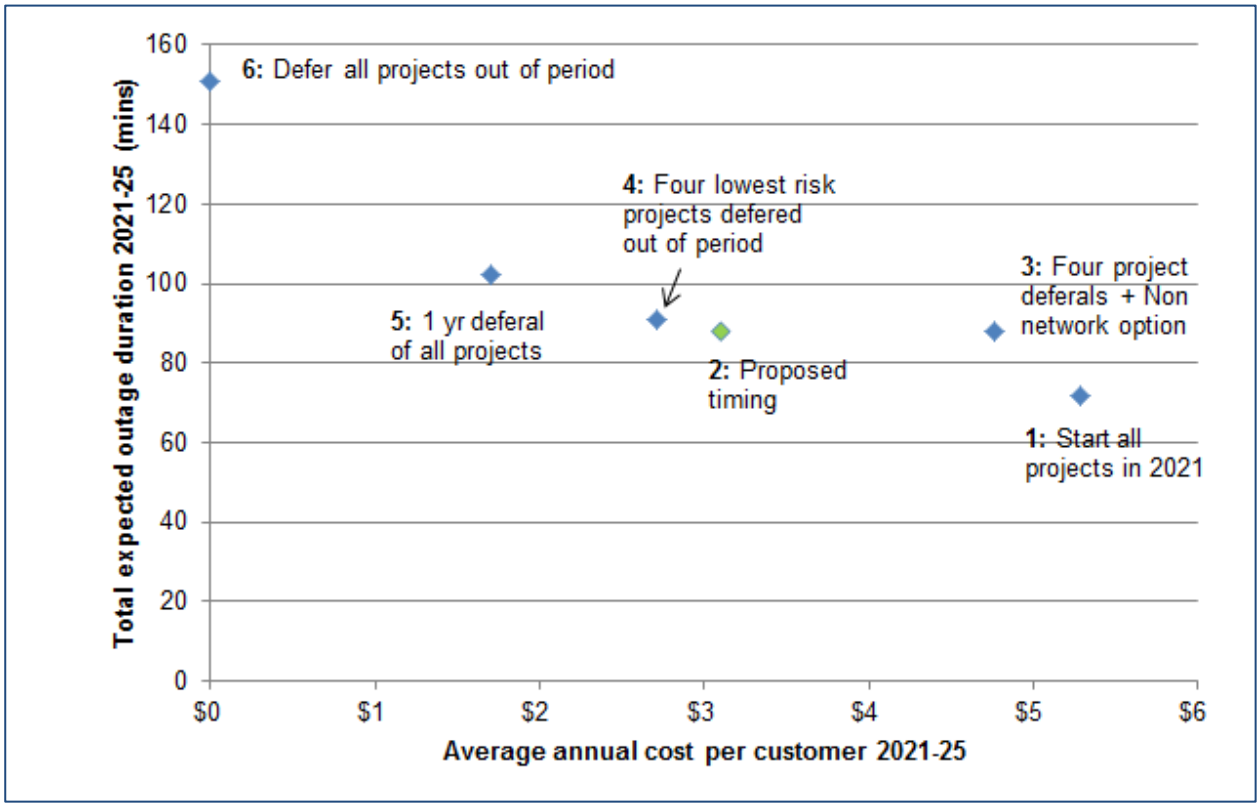


Figure 2, which plots the cost and outage duration for 2021-25 shows that:

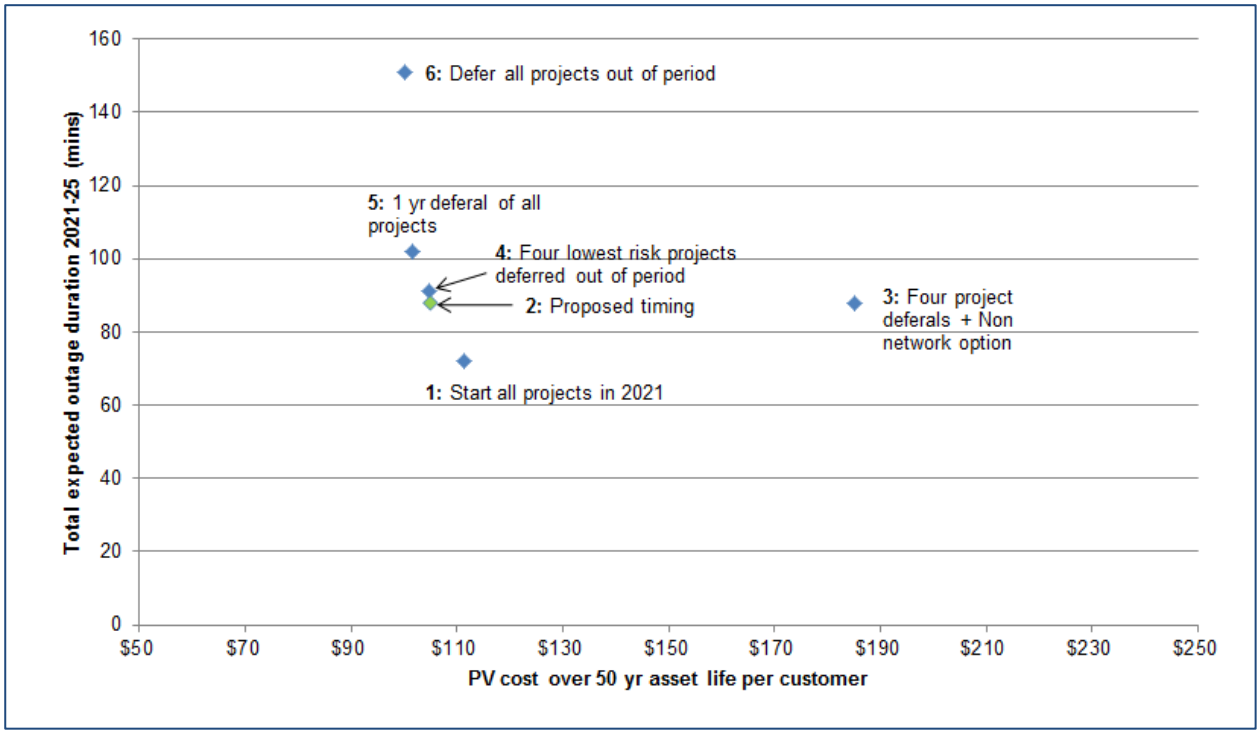
- The best reliability outcome is achieved by commencing all projects in 2021 (Option 1). However, this option would have a 70% higher average annual bill impact over 2021-25 relative to the optimal project timings (Option 2);
- Option 4 produces an outcome closest to that of the preferred portfolio (Option 2). The annual average cost of Option 4 is 13% lower, but this option results in a lower reliability outcome (91 minutes versus 88 minutes outage duration over 2021-25);
- Option 3 is capable of providing the same reliability outcome to the preferred portfolio (Option 2), but at a 54% higher cost.

Long Term

Figure 3, which plots the long term cost and outage duration for 2021-25, shows that:

- Option 3 that defers the four lowest risk projects out of the 2021-25 period and uses diesel generators to maintain supply to customers has the highest cost over the long term; and
- Portfolio options that defer the major projects have a relatively modest impact in terms of lower reliability, particularly the option that defers the 4 lowest risk projects out of the 2021-25 period (Option 4).

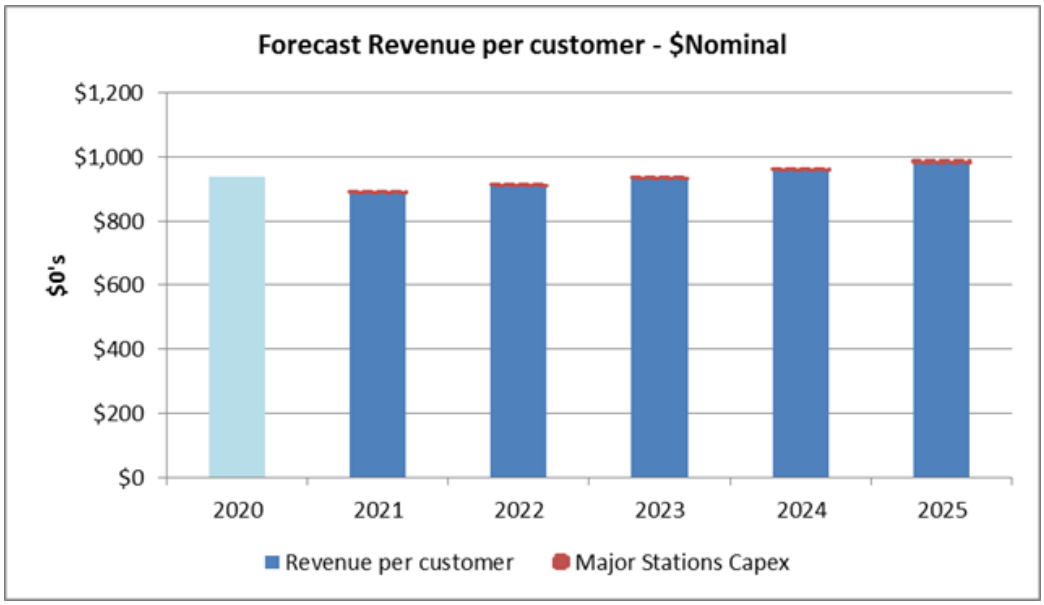
Figure 3: Price-Reliability Trade-Off of Repex Portfolio Options - Long Term Life of Assets



5. Bill Impact of Preferred Expenditure Portfolio (Option 2)

Figure 4 and Table 3 show the bill impact of the preferred portfolio of repex projects in the context of the total revenue per customer. The preferred portfolio of major repex projects account for a small portion of the total cost per customer. Ranging between $0.06 per customer in 2021 and $6.29 in 2025, the revenue associated with the preferred repex portfolio would account for less than 1% of total revenue over the period.

Figure 4: Forecast Revenue Associated with the Repex Expenditure per AusNet Services Customer (2021-25) – nominal dollars



Note: Nominal dollars is the dollars of the day.

Table 3: Revenue Associated with the Repex Expenditure per AusNet Services Customer 2021-25) – nominal dollars

	2021	2022	2023	2024	2025
Revenue	$0.06	$1.51	$3.02	$4.62	$6.29
% to total	0.01%	0.17%	0.32%	0.48%	0.64%

6. Customer Research

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 4: Customer Research Insights

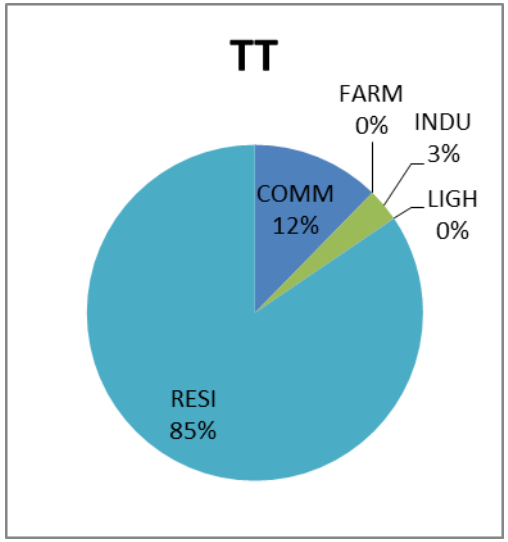
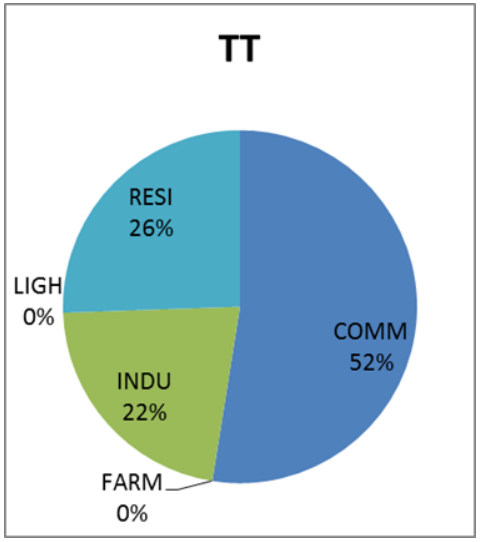
Small to Medium Businesses (AusNet Services' Survey)	Households (RMIT Survey)
Price/affordability • The issue of electricity affordability as a result of recent and significant prices increases was voiced as a major, if not the most salient, concern for all stakeholders. **Reliability** • Reliability 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.

Replacement Expenditure: Major Projects

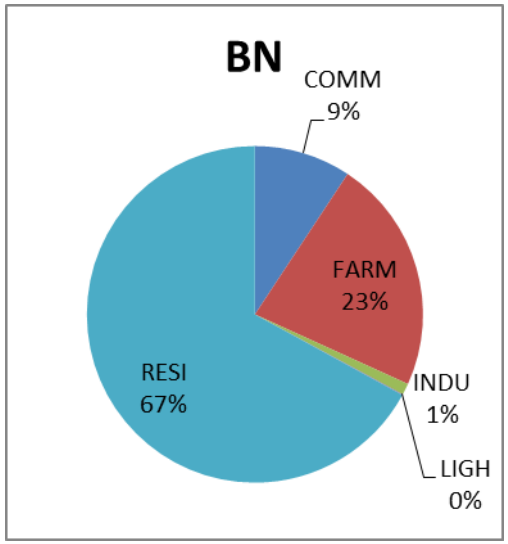
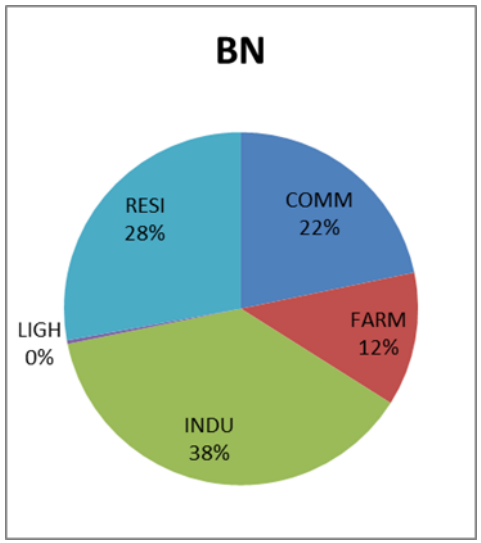
Attachment 1: Repex zone substation project information and customer profiles

Table 6 provides detail on each project including: the risks identified at each station, the proposed refurbishment works, the preferred timing of the refurbishment works, and customer profiles at each station.

Table 5: Repex Preferred Major Projects (zone sub-station refurbishment projects) – Ranked by Priority: Highest to Lowest

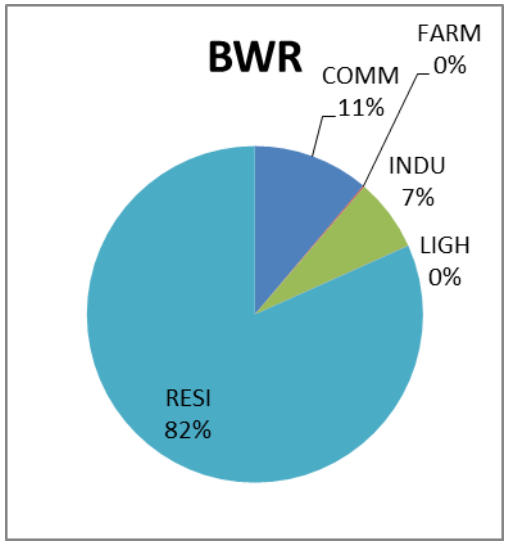
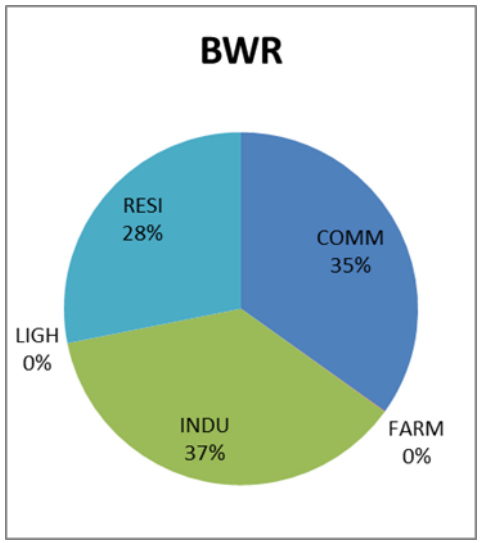
Project (ranked by priority: highest to lowest) $s in real 2020	Description	Customer Types (%)	Consumption by Customer Type (%)
Thomastown **$14.5m** **(capital cost)**	**Risks:** Explosive failure risk from: • High Voltage (HV) bushings on the three power transformers • 66kV circuit breakers • 22kV circuit breakers **Proposal:** Replace: • Two 66kV circuit breakers • Three 22kV switchboards This option addresses only the asset failure risks posed by the 66kV and 22kV switchgear. The asset failure risks posed by transformers are not addressed. **Timing: 2021**	 Total customers (2017): 14,163	 Total consumption (2017): 179 GWh

Replacement Expenditure: Major Projects

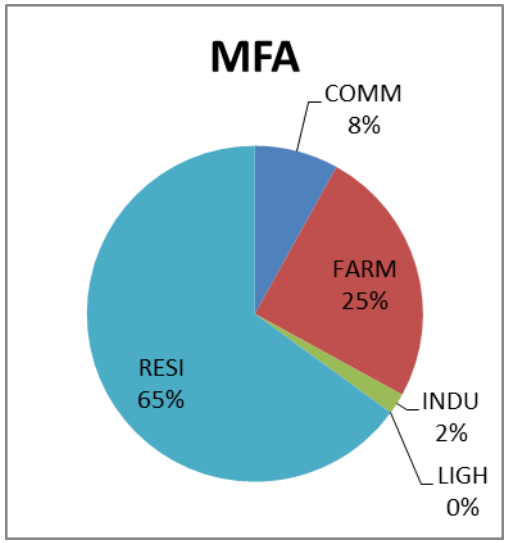
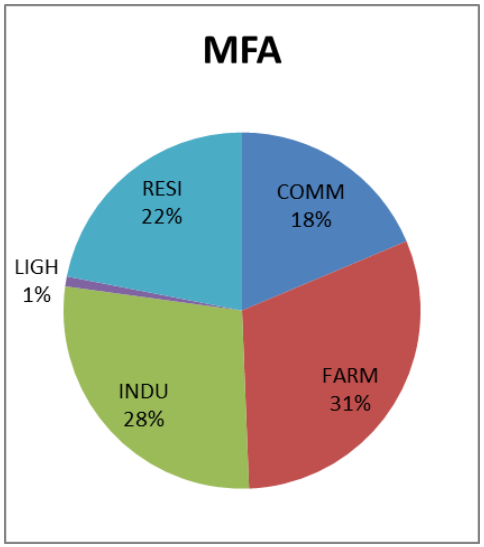
Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Benalla **$22.5m** **(capital cost)**	**Risks:** Explosive failure risk from: • Six 66kV bulk oil circuit breakers • Five 22kV circuit breakers. Some equipment panels pose a potential health risk due to the presence of asbestos containing materials. Exposed live panels at the rear of the secondary panels in the control room pose a safety risk from electric shock. Energy at risk is low under N-1* conditions in summer and moderate levels of energy at risk under N-2 conditions. Any failure of 66 kV bus will cause loss of supply to both Mansfield zone substation (ZS) & Merrijig ZS. **Proposal:** Replace: • 66kV circuit breakers • 66kV line switches • 66kV Transformer No 1 and 2 switches • 66kV transformer neutral isolators Install 22kV indoor switchboard and retire existing 22kV switchyard and also replace 3 x 10/13.5 MVA transformers with 2 x 20/33 MVA transformers. **Timing: 2022**	 Total customers (2017): 12,183	 Total consumption (2017): 143 GWh

*Note: N-1 = station capacity after the loss of one transformer.

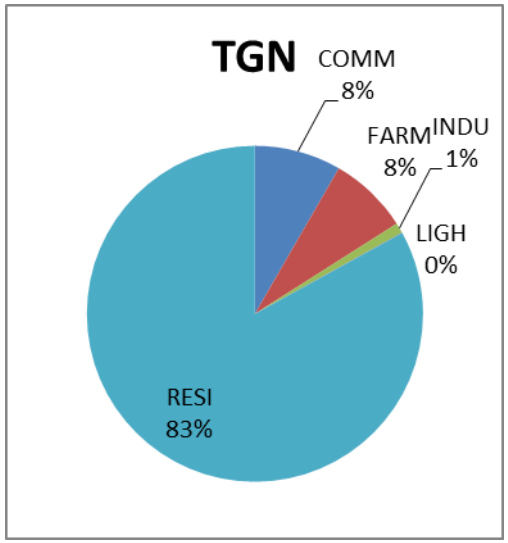
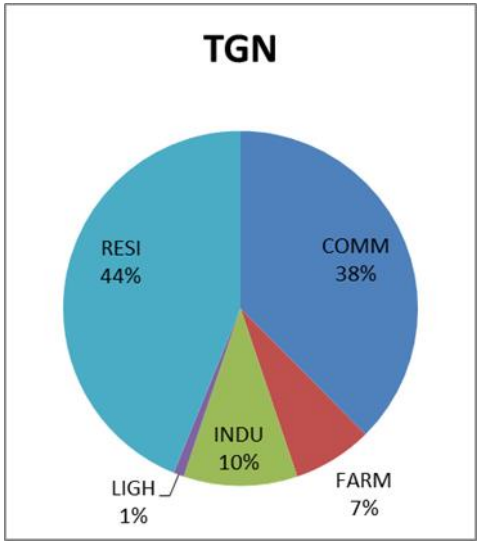
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Bayswater **$14.1m** **(capital cost)**	**Risks:** Explosive failure risk from: • 22kV bulk oil circuit breakers (CB) • The HV bushings on the 66/22kV transformers • Bulk oil 22 kV CTs and VTs Some equipment panels pose a potential health risk due to the presence of asbestos containing materials. Exposed live panels at the rear of the secondary panels in the control room pose a safety risk from electric shock. The transformers have a history of oil related issues. **Proposal:** Replace: • All 22kV CBs (excluding BWR32) with three new indoor eight CB bus modules • 66kV Transformer No. 1 Current Transformer • 66kV Transformer No1. & No.2 Neutral Current Transformer • 22kV Transformer No1. & No.2 Neutral Current Transformer • BRA 66kV line Current Voltage Transformer • Build a new control room. **Timing: 2022**	 Total customers (2017): 17,050	 Total consumption (2017): 234 GWh

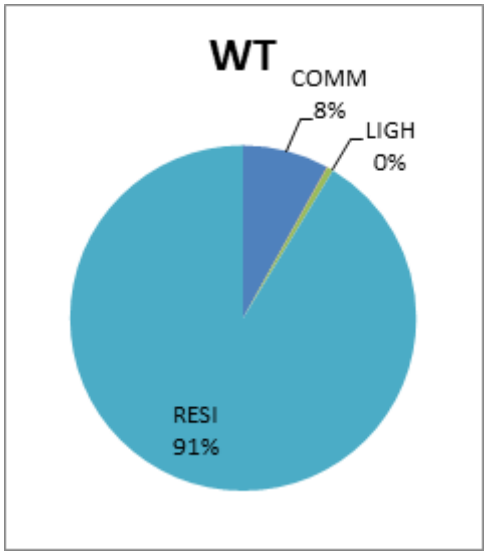
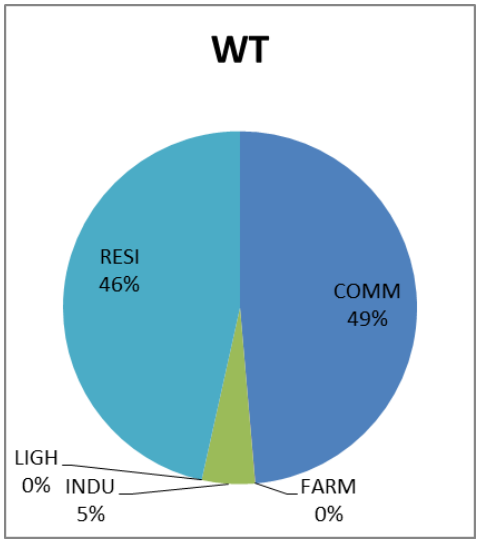
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Maffra **$10.7m** **(capital cost)**	**Risks:** Explosive failure risk from: • HV bushings on power transformers • Current transformers and voltage transformers • 66 kV circuit breakers Some equipment panels pose a potential health risk due to the presence of asbestos containing materials. Exposed live panels at the rear of the secondary panels in pose a safety risk from electric shock. There is very low energy at risk under N-1 conditions but significant levels of energy at risk under N-2. Maffra zone substation is a 'partially switched' configuration and any primary equipment fault results in loss of supply of the whole substation. **Proposal:** Replace five existing 66 kV circuit breakers in situ and the 22 kV capacitor bank is also replaced **Timing: 2022**	 Total customers (2017): 8,417	 Total consumption (2017): 131 GWh

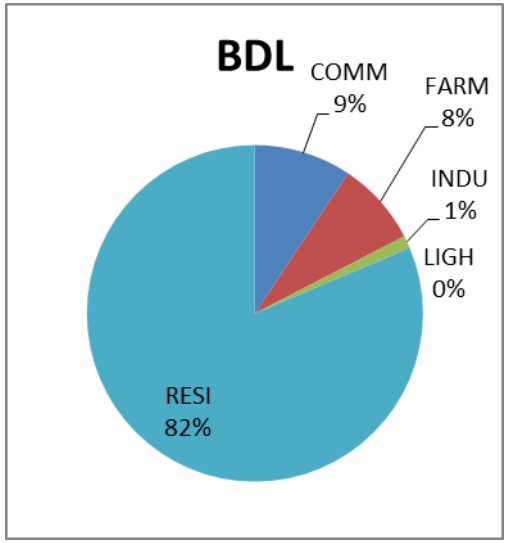
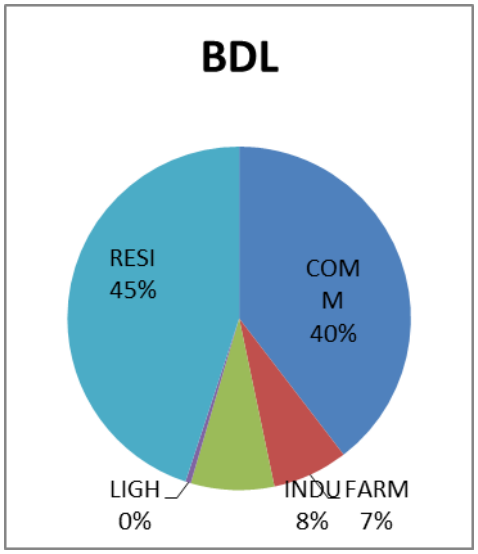
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Traralgon **$8.6m** **(capital cost)**	**Risks:** Explosive failure risk from: • HV bushings on the power transformers • Current transformers • Voltage transformers Exposed live panels at the rear of the secondary panels in the control room pose a safety risk from electric shock There is some energy at risk under N-1 conditions and significant energy at risk under N-2 conditions. The condition of the No. 2 10/13.5 MVA transformer is such that there are no options to extend the life of the transformer through refurbishment. **Proposal:** Replace: • No. 2 and No. 3 10/13.5 MVA transformers with a single 20/33 MVA transformer; • Two 66kV circuit breakers; • 22kV switchboard. **Timing: 2023**	 Total customers (2017): 17,471	 Total consumption (2017): 154 GWh

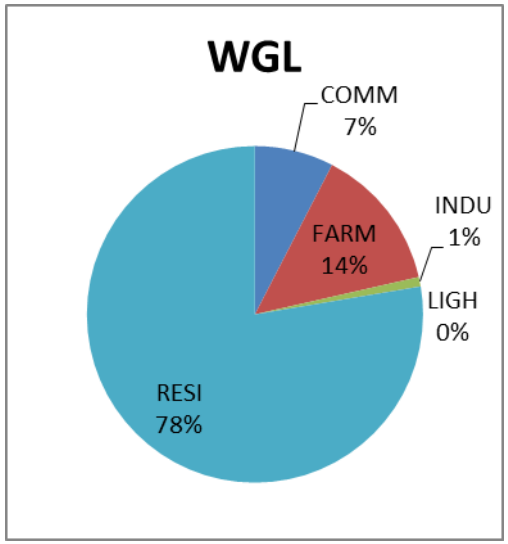
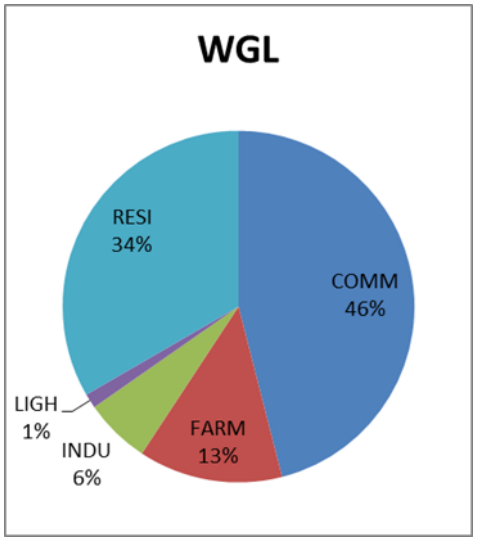
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Watsonia **$15.1m** **(capital cost)**	**Risks:** Explosive failure risk from: • HV bushings on the three power transformers • Circuit breakers • Surge arrestors • 22 kV CTs and VTs Watsonia has no energy at risk under N-1 conditions and minor energy at risk under N-2 conditions. Priority replacement of bulk oil circuit breakers of greater than 45 years' service life required**.** **Proposal:** Replace outdoor bulk oil circuit breaker **Timing: 2023**	 Total customers (2017): 23,647	 Total consumption (2017): 201 GWh

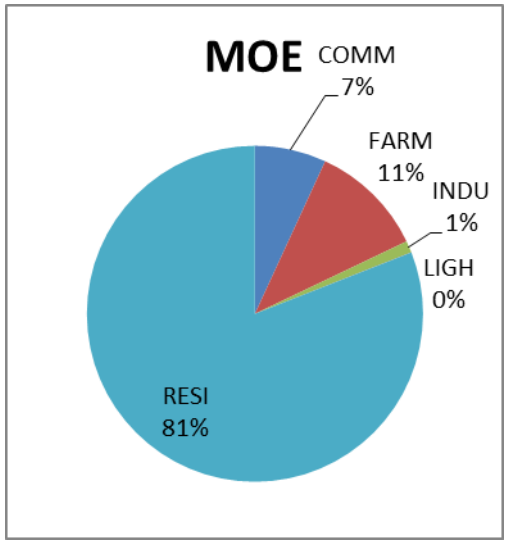
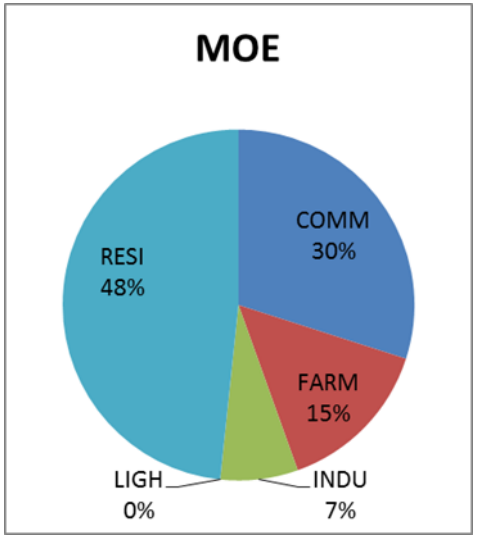
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Bairnsdale **$2.4m** **(capital cost)**	**Risks:** Explosive failure risk from: • 66 kV minimum oil circuit breakers • 66 kV bushings Energy at risk is low under N-1 conditions but significant at N-2 conditions. The zone substation has a 'partially-switched' configuration, so a fault on the 66kV CB 'A' results in loss of supply to the whole substation. **Proposal:** Replace: • 66kV CBs 'A' and 'C' • 66kV Circuit Transformers • Three 66kV capacitor voltage transformers: • Bus No. 4 (three single phase units) • Bus No. 7 (three single phase units) • NLA line (three single phase units) • Five 22kV circuit breakers • One 22kV transfer bus This option addresses the explosive failure safety risk posed by the 66-kV and 22-kV equipment. **Timing: 2023**	 Total customers (2017): 23,042	 Total consumption (2017): 226 GWh

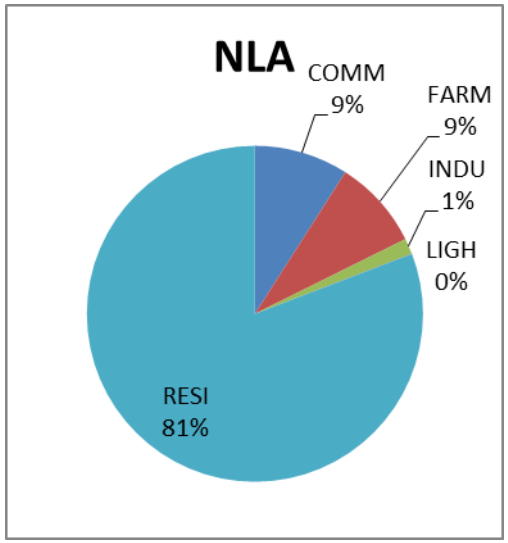
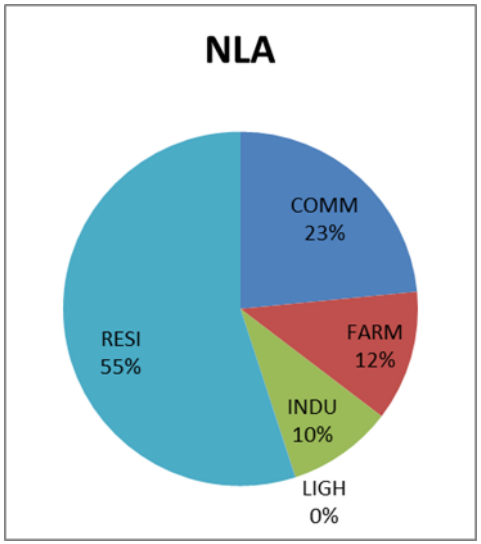
Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Warragul **$14.3m** **(capital cost)**	**Risks:** Safety risk associated with: • HV bushings on the four power transformers • Two three-phase current transformers • Two 66 kV circuit breakers • Two three-phase and two single-phase voltage transformers Some equipment panels pose a potential health risk due to the presence of asbestos containing materials Exposed live panels at the rear of the secondary panels in the control room pose a safety risk from electric shock Supply risks: The failure of one of the four poor condition transformers will mean loss of supply to all due to their configuration. The fifth transformer, which is 33 MVA, cannot carry the station load which had a peak of 66 MVA on the 28th of January 2018. There is energy at risk until it is safe to isolate the faulted transformer manually. **Proposal:** Replace: • Four transformers (No.1, No.2, No.3 and No.4) with two larger units • Two 66kV circuit breakers • Eight 66kV voltage transformers • One 22kV current transformer • Capacitor bank This solution addresses most of the safety and some of the supply risk. **Timing: 2023**	 Total customers (2017): 22,649	 Total consumption (2017): 262 GWh

Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Moe **$9.0m** **(capital cost)**	**Risks:** Explosive failure risk from: • HV bushings on power transformers • Seven 22kV bulk oil circuit breakers Some equipment panels pose a potential health risk due to the presence of asbestos containing materials. Exposed live panels at the rear of the secondary panels in the control room pose a safety risk from electric shock. **Proposal:** Replace No.1 Transformer in new location and 66kV and 22kV circuit breakers and station switch **Timing: 2024**	 Total customers (2017): 15,126	 Total consumption (2017): 121 GWh

Replacement Expenditure: Major Projects

Project	Description	Customer Types (%)	Consumption by Customer Type (%)
Newmeralla **$1.7m** **(capital cost)**	**Risks:** Explosive failure risk from: • HV bushings on the power transformers • 22kV circuit breakers There is some energy at risk under N-1 conditions and significant energy at risk under N-2 conditions. Newmeralla is a 'un-switched' rural configuration and any primary equipment failure will result in loss of supply to all customers. **Proposal:** Replace transformers and 22kV switchgear **Timing: 2024**	 Total customers (2017): 3,725	 Total consumption (2017): 29 GWh
Total **$112.8m** **(capital cost)**		**Total customers (2017): 157,473**	**Total consumption (2017): 1,680 GWh**

Replacement Expenditure: Major Projects

Attachment 2: Repex portfolio costs per connected customer

Table 7 presents the cost collected from customers over the life of the assets and over the 2021-25 period - per customer connected to the zone substations (rather than all AusNet Services customers). In 2021 there are 162,541 customers connected to the 10 zone substations and 754,031 total AusNet Services customers.

The table demonstrates the significantly higher locational costs to achieve the service reliability outcomes at the 10 zone substations. The PV cost to customers of the preferred Option 2 is $487 per customer compared to $105 per customer when shared across the total AusNet Services customer base.

Table 6: Comparison of Repex Options – cost per Customer Connected to the 10 Zone Substations

Option	Description	PV cost over 50 year asset life/ Connected customer	Average annual cost/ Connected customer 2021-25 ($2020)
1	All projects commence 2021	$516.76	$24.54
2	Proposed timing	$486.80	$14.38
3	Four lowest risk projects after 2025 + diesel generation	$859.34	$22.08
4	Four lowest risk projects after 2025	$485.77	$12.56
5	Defer all projects by 1 year	$471.00	$7.87
6	Deferral all projects beyond 2025	$463.89	$0