Jemena Electricity Networks (Vic) Ltd

IT Investment Brief – Voltage & PQ Management Program

Non-recurrent

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Glossary

ADMS	Advanced Distribution Management System
AEMO	Australian Energy Market Operator
AMI	Advanced metering infrastructure
Capex	Capital Expenditure
CER	Customer energy resources
Current regulatory period	The period covering 1 July 2021 to 30 June 2026
DER	Distributed energy resources
DERMS	DER management system
DNSP	Distribution Network Service Provider
DPV	distributed solar photovoltaic
DR	Demand response
DVM	Dynamic Voltage Management
EDCOP	Electricity Distribution Code of Practice
ESC	Essential services commissions
EV	Electric vehicle
EWOV	Energy and Water Ombudsman Victoria
FNS	Future network strategy
FTE	Full time equivalent
HV	High voltage
ICT	Information and Communications Technology
Jemena	Refers to the parent company of Jemena Electricity Network
JEN	Jemena Electricity Network
kV	Kilovolt
LV	Low voltage
MW	Megawatts
Next regulatory period	The period covering 1 July 2026 to 30 June 2031
NPV	Net Present Value
OLTC	On-load tap changer
opex	Operating Expenditure
PM	Project manager
PQ	Power quality
PV	photovoltaic
RTU	Remote terminal unit
RYxx	Regulatory year covering the 12 months to 30 June of year 20xx for years in the Next Regulatory Period. For example, RY25 covers 1 July 2024 to 30 June 2025
SME	Subject matter experts
totex	Total Expenditure
V	Volts

VCC	Volt-VAr Control

Voltage & PQ Management Program

Objectives and description	This Voltage and PQ Management Program addresses the need for a voltage and power quality management program, to strategically respond to the network voltage and quality of supply compliance challenges associated with increasing numbers of DER, the substitution of gas and transport sectors within the economy and non-synchronous generation – all important in achieving legislated emission reductions targets and maintaining system security. It specifically aims to: • ensure voltage and power quality compliance for our customers across the distribution network • reduce both the safety risk and the elevated energy consumption of customer appliances that are exposed to high network operating voltages • reduce the amount of voltage-induced DER curtailment of customer inverters that are exposed to high network operating voltages • enable greater levels of customer DER exporting, by alleviating over-voltage limitations within the network • enable greater levels of customer imports and reduce the risk of customer appliances from damage, by alleviating under-voltage limitations within the network. The program Implement a Voltage & PQ Management Program across the Jemena Electricity Network's (JEN's) distribution network. The program includes: a centralised DVM (Dynamic Voltage Management)/VVC (Volt-VAr Control), reactors, VAr controllers, and traditional investments to manage voltage spread.		
Non-recurrent ICT sub-categorisation	☒ Maintaining existing services, functionalities, capability, and/or market benefits	☐ Complying with new/altered regulatory obligations/requirements	☐ New or expanded ICT capability, functions, and services
Background and key drivers	This Voltage and Power Quality (PQ) Management forms part of JEN's Future Network Strategy. It supports JEN's strategic objective of connecting its customers to a renewable energy future, by facilitating the integration of Distributed Energy Resources (DER) into the electricity distribution network, and facilitating the electrification of the economy. There are a number of factors driving the need for this investment. **A changing energy landscape** JEN is faced with operating in a rapidly changing energy landscape. DERs continue to increase in numbers and will ultimately become a crucial resource to support, manage and utilise within the distribution network. Already JEN has seen strong growth in network-connected, passive distributed solar photovoltaic (DPV) system installations by its customers, and this is likely to continue well into the future. With this comes an increasing proportion of the overall power system generation being located within the distribution networks. Hence, voltage and PQ management will become increasingly more important and complex for JEN to manage. **Non-compliant Voltage Performance for some of our customers**		

While JEN has remained functionally compliant with the Electricity Distribution Code of Practice (EDCOP), there remains up to 3.9 per cent of customers who are experiencing non-compliant over-voltages, and 3.6 per cent of customers who are experiencing non-compliant under-voltages. These periods of non-compliance are greatest in the spring and summer periods for over-voltage when solar PV systems are operating at their maximum output, causing voltages to rise across the network, and during summer hot weather for under-voltages when demand for electricity from the grid is at its greatest.

Need to proactively maintain service to avoid complaints

JEN currently has a recurrent program that aims to resolve power supply issues raised by customers. This is predominantly a reactive program (mainly triggered by the urgency of customer complaints due to the lack of permanently installed quality of supply metering across the network[1]), to address quality of supply issues. Since 2020, the number of over-voltage complaints has significantly reduced due to active actions by JEN to reduce voltages across the distribution network. We intend to maintain this improved voltage performance through our planned proactive programs (particularly those that can be identified with AMI meters). Failing to respond to and resolve customer complaints on power quality to the satisfaction of our customers, risks an escalation of their complaints to Energy and Water Ombudsman Victoria (EWOV).

Growth in residential solar leading to voltage fluctuations

JEN has comparatively low levels of solar PV installations in our network compared to other DNSPs around Australia, with installed DPV capacity in 2023 being 322 MW across 16% of our customer base. Nevertheless, the growth in unconstrained solar PV on our network is expected to continue. We have consistently increased our forecast for solar PV installations year-by-year, in response to actual uptake exceeding expectations due to increasing system sizes, rapidly reducing system costs, and heavy subsidies and rebates (including the Victorian Government's Solar Homes Program[2] administered through Solar Victoria). With each re-forecast, this risks around managing voltages comes sooner, meaning we must act with an ever-increasing pace. The bulk of the systems and the absolute growth in those systems over a five- and ten- year period are located in the outer urban growth corridors in the new underground residential estates. Increased solar penetration, while beneficial for customers and the environment, can also cause problems to the network. One of the biggest problems is that it can cause voltage fluctuations and overvoltage. Prolonged and frequent overvoltage can lead to the network exceeding regulatory limits, decreasing life span of household electronic appliances and network's equipment such as line voltage regulators and on-load tap chargers.

Underground cabling growth resulting in elevated network voltages

JEN is forecasting a significant growth in underground HV cables in the network consistent with forecast growth in new residential estates. These cables are a significant contributor to elevated network voltages. The locations forecasted to have the highest level of growth in underground cables, are also estimated to have high levels of solar growth, compounding this issue.

Elevated voltages resulting in increased energy consumption, safety concerns, and environmental issues

JEN can use distribution and zone substation transformers to control voltage levels when required by buck tapping. However, three of our zone substations are reaching the point of no longer being able to satisfactorily regulate voltage (i.e. reaching end of buck tapping

[1] While JEN uses AMI to measure steady-state voltage, it can only measure other power quality parameters at a limited scale—at the zone substation bus and at the end of the longest feeder of each zone substation. Customer complaints generally trigger JEN to temporarily install portable power quality meters at or near the customer's point of supply to confirm the issue and identify remedial action.
[2] https://www.solar.vic.gov.au/

	range). The locations with the greatest of risk of not being capable of regulating voltage with the transformers are the same areas identified as at risk due to solar and underground cable growth. This is an issue as over-voltages cause increased energy consumption by customers. In addition, we are anticipating that more solar customers will experience over-voltages and for longer, as the amount of solar PV and 22kV cables increase, which will result in an increase in solar PV curtailment. Voltages outside of EDCOP limits may cause customer equipment damage and reduced appliance lifespans, a potential safety risk for appliances overheating and catching on fire. The safety of the network is of the utmost importance to JEN, and we must act to reduce this risk. JEN (as well as the other Victorian DNSPs) is already operating towards the top end of the allowance EDCOP voltage range. Moreover, solar curtailment combined with this increase in energy consumption may inhibit JEN's efforts to comply with emissions reduction targets, such as the Victorian Government's Net Zero targets (as fossil fuel generation may need to be dispatches to meet demand).
Customer Importance	**Our customers' expectations** Our customers want electricity prices to be affordable. They want us to prioritise network reliability, resilience and power quality. Many of our customers also expect us to operate sustainably and to support decarbonisation and renewable energy transition.[3] Here are some examples of recommendations that we have received during our customer engagement from 2023 to mid-2024: • Our People's Panel wants JEN to prioritise investing in reliability by assessing, building and maintaining the network to meet changes in operating conditions and withstand network failures. • The Young people customer voice group wants us to ensure the electricity network is able to handle the shift to 'green' energy and we can help incentivise and drive EV, solar and battery use by customers. • Our small and medium customers expressed strong interest in transitioning to renewable energy sources and the role JEN could play in empowering businesses to achieve their sustainability and energy goals. • Network reliability and power quality is a high priority to local councils to ensure stability of community services and critical infrastructure severely impacted by power outages. In response to our Draft Plan released in August 2024, customer respondents reiterated their concerns about affordable prices and their support for network reliability and our future network strategy.[4] **How we've addresses our customers' expectations** The Program will help address our customers' expectations and priorities. It will facilitate more DER penetration, reduce solar curtailment and maintain power reliability and quality because voltage level is able to be managed within safe levels. The Dynamic Voltage Management (DVM) system which achieves near real-time, optimised control of network voltage and reactive power flow for the delivery of compliant

[3] JEN, 2026-31 Draft Plan, August 2024, chapter 2.
[4] JEN, Feedback on 2026-31 Draft proposal, September 2024.

	voltages will reduce DER curtailment and avoid the need to limit electricity being exported to the distribution network. Our preferred approach is prudent and efficient. It is the option that generates the highest net present value for our customers over the long term. Moreover, through the use of enhanced form of Volt-Var control integrated with JEN's existing Advanced Metering Infrastructure, the DVM will minimise expenditure on more expensive forms of traditional network voltage and quality of supply investments. Doing nothing or delaying the implementation of the Voltage and PQ Management Program will not address our customers' service level expectations. See for more details below about the risks of doing nothing. On balance, we consider that our proposed program has addressed our customers' competing expectations discussed above.
Key Considerations	In exploring options to address the above, JEN has aimed to develop a solution that will: • ensure voltage and power quality compliance for our customers across the distribution network; • reduce both the safety risk and the elevated energy consumption of customer appliances that are exposed to high network operating voltages; • reduce the amount of voltage-induced DER curtailment of customer inverters that are exposed to high network operating voltages; • enable greater levels of customer DER exporting, by alleviating over-voltage limitations within the network; • enable greater levels of customer imports and reduce the risk of customer appliances from damage, by alleviating under-voltage limitations within the network; • ensure voltage and power quality compliance for our customers across the distribution network; • reduce both the safety risk and the elevated energy consumption of customer appliances that are exposed to high network operating voltages; • reduce the amount of voltage-induced DER curtailment of customer inverters that are exposed to high network operating voltages; • enable greater levels of customer DER exporting, by alleviating over-voltage limitations within the network; • enable greater levels of customer imports and reduce the risk of customer appliances from damage, by alleviating under-voltage limitations within the network; • optimise the blend of centralised and distributed solutions and the sequence of investment, to provide the highest net present value benefit, consider risk, performance, cost, timing and uncertainty - based on the emerging network need; • complement and support other Future Network initiatives and programs; • be scalable for the future; and

	• ensure the total lifecycle costs of the risk and investment is prudent and efficient in the long term. **Timing considerations** The optimum in-service timing of deploying the centralised DVM solution across the network is determined by the economic viability at each zone substation, which is driven by the size of the DER enablement and voltage compliance customer benefits at each site. The optimum in-service timing of the distributed solutions applied at each network location is determined by the economic viability of the residual DER enablement and voltage compliance customer benefits after DVM has been applied.
Options	JEN has considered 4 alternatives to deliver the capability articulated above: • Do nothing • Centralised DVM program • Distributed Voltage & PQ Management program • Centralised DVM & Distributed Voltage & PQ Management Programs (preferred) • Non-network voltage and power quality management solutions (not feasible) **Option 1: Do nothing** **Description** No additional capital works are considered under this option. (i.e., continue as per status quo). **Benefits** • There are no benefits associated with this option. **Risks** The inherent Voltage and PQ Management risks under the status-quo include: • Exporting of power at customer connection points (from installed DER) and installation of HV underground cable (particularly 22 kV cable) causes voltages to rise in the network, more so at locations furthest from the HV voltage regulation point and at customer connection points where the exporting is occurring. • HV voltage regulation equipment installed higher up in the network may not be able to detect such voltage rises (as they are designed to regulate the voltage on their local HV busbars, rather than the customer connection points). Hence, customer voltages may rise above the acceptable regulated voltage limits within the EDCOP. • Whilst greater levels of export and/or cable charging, means this voltage rise can propagate further up into the network and ultimately be detected by the HV voltage regulation equipment, the OLTC transformers may not be able to bring down the voltage down to within regulatory limits if they run out of available taps (particularly as many legacy transformers have limited buck tap capability). • Voltages above the EDCOP limit of 253 V (i.e., over-voltages), can trigger an increase in customer complaints and appliance damage or maloperation (due to accelerated loss-of-life from either the increase in energy consumption causing excessive internal heating, or from the over-voltage causing insulation deterioration).

- JEN measures and reports on its EDCOP steady-state voltage compliance to the ESC each quarter. While JEN is functionally compliant with the EDCOP, a residual level of non-compliance remains, requiring a proactive investment program to address this network compliance need.
- JEN also receives and acts on complaints relating to other power quality measures within the EDCOP that are not directly attributable to solar PV and cable charging issues (such as harmonics, flicker, under-voltage, etc.), which generally forms part of a recurrent reactive program of works each year to avoid customer complaints remaining unresolved and being escalated to the EWOV.
- Over-voltages in the proximity of DER, can cause DER inverters to either trip[5], curtail power output[6], or absorb reactive power[7] in response to those high LV network voltages. This can directly impact DER customers' bills, potentially increasing consumption costs and/or lower feed-in tariff payments and triggering an increase in DER customer complaints.
- JEN uses a 'solar reliability' measure to quantify and monitor solar PV curtailments. There remains material levels of over-voltage-induced curtailment and export limiting, and given the expected growth in solar PV connections, a proactive investment program is required to address this network limitation need.

Option 2: Centralised DVM Program

Description

Proactive centralised Voltage and PQ Management investment (including DVM only) to meet compliance requirements and to enable DER.

This solution would utilise DVM capabilities, which will incorporate the near-real-time voltage information from smart meters into our Advanced Distribution Management System (ADMS) to provide more advanced centralised voltage regulation solutions. JEN is currently trialling this capability at two of our zone substations.

The solution also includes a reactive quality of supply recurrent program to resolve residual customer complaints.

Direct Escalated Costs

JEN's costs ($M) for this option is outlined in the table below.

$2024M		RY27	RY28	RY29	RY30	RY31
Capex	Digital	$0.1				
	Asset	$10.4	$10.3	$7.7	$3.3	$3.3
Opex	Digital Nonrecurrent					
	Digital Recurrent Step	$0.6	$0.6	$0.6	$0.6	$0.6
	Asset	$0.2	$0.2	$0.2	$0.2	$0.2
Total		**$11.3**	**$11.1**	**$8.5**	**$4.1**	**$4.1**

Benefits

5 255V trip for legacy inverters, 258V for smart inverters.
6 Output curtailed above 253V.
7 Reactive power absorption commences above 241V for smart inverters only.

- Regulatory compliance – improved appliance safety and reduced consumption by maintaining voltages and other quality of supply metrics within regulatory limits. This will allow JEN to maintain our functional compliance obligations with the EDCOP.
- DER enablement – improved export capability and reduced over-voltage-induced DER curtailment, by achieving an optimal balance between the value of DER to the market and the cost of reinforcing the network to enable DER.
- Meeting customer expectations – reduce customer solar-related complaints by managing supply voltages to enable more solar exports and reducing all other quality of supply related complaints by addressing quality of supply issues for our worst-served customers.
- Emissions reduction – emissions reduction from reduced consumption and increased renewable generation through reduced over-voltage-induced DER curtailment[8].
- We estimate the present value of quantified benefits to be $16.6M.

Risks

- While this option maintains our EDCOP compliance, it only addresses issues for our worst served customers if they make a complaint rather than proactively addressing the emerging voltage issues identified in our key driver's section.
- Delivery risks – Dependency on availability of key resources (SMEs and field resources) is a risk. The mitigation is to have appropriate resourcing contingency and skills development plan in place, and to ensure that the project schedule is aligned with realistic resources availability;
- Delivery risks - Delays particularly due to complexities of implementing new technologies such as DVM. The mitigation is to derisk by undertaking proof-of-concept testing early in the project life-cycle to allow time to fix issues and minimise their impact on the overall project delivery timing. As such, the current trial at Coburg South and Airport West zone substations will feed important information into the future stages and mitigate this risk.

Option 3: Distributed Voltage and PQ Management

Description

Proactive distributed (i.e. localised) Voltage and PQ Management investment, which includes a combination of 17 solutions (eg. traditional augmentations solutions, capacitor controllers, and reactor installations) to meet compliance requirements and to enable DER.

The solution also includes a reactive quality of supply recurrent program to resolve residual customer complaints.

Direct Escalated Costs

JEN's costs ($M) for this option is outlined in the table below.

$2024M		RY27	RY28	RY29	RY30	RY31
Capex	Digital					
	Asset	$9.9	$11.5	$9.3	$7.4	$11.1
Opex	Digital Nonrecurrent					

8 Refer to 'Valuing Emissions Reduction, AER draft guidance'.

	Digital Recurrent Step					
	Asset					
Total		**$9.9**	**$11.5**	**$9.3**	**$7.4**	**$11.1**

Period total $49.2

Benefits

- This delivers the same benefits as option 2, however on a larger scale as more customers will receive the benefits.
- We estimate the present value of quantified benefits to be $33.6M.

Risks

- This program has the highest cost.
- Delivery risks – Dependency on availability of key resources (SMEs and field resources) is a risk. The mitigation is to have appropriate resourcing contingency and skills development plan in place, and to ensure that the project schedule is aligned with realistic resources availability;
- Delivery risks - Delays particularly due to complexities of implementing new technologies such as DVM. The mitigation is to derisk by undertaking proof-of-concept testing early in the project life-cycle to allow time to fix issues and minimise their impact on the overall project delivery timing. As such, the current trial at Coburg South and Airport West zone substations will feed important information into the future stages and mitigate this risk.

Option 4: Centralised DVM & Distributed Voltage & PQ Management Programs (preferred)

Description

An economically optimum blend of the option 2 and 3 proactive investments. A selection of projects from option 2 and 3 that allow benefits to be maximised at minimum cost.

This includes:

- a set of three network-wide holistic solutions (operational technology overlay, bridging network solutions, longer-term DER solutions) which leverage capabilities to minimise the growth in traditional expenditure associated voltage and power quality management, and to realise new and additional revenue opportunities.
- An ongoing baseline of localised network upgrades and adjustments that can be used to assist the network-wide holistic solutions, to maintain their level of flexibility and effectiveness over time and address the worst-performing sites on the JEN network. These include a mix of traditional voltage and power quality network augmentation and reconfiguration solutions.

The solution also includes a reactive quality of supply recurrent program to resolve residual customer complaints.

Direct Escalated Costs

JEN's costs ($M) for this option is outlined in the table below.

$2024M	RY27	RY28	RY29	RY30	RY31

Capex	Digital	$0.1				
	Asset	$9.5	$11.3	$9.5	$5.2	$7.1
Opex	Digital Nonrecurrent					
	Digital Recurrent Step	$0.6	$0.6	$0.6	$0.6	$0.6
	Asset	$0.2	$0.2	$0.2	$0.2	$0.2
Total		**$10.4**	**$12.1**	**$10.2**	**$6.0**	**$7.9**

Period total $46.6

Benefits

- This delivers the same benefits as, and on the same scale, as option 3 but at a lower cost.
- We estimate the present value of quantified benefits to be $33.6M.

Risks

- Delivery risks – Dependency on availability of key resources (SMEs and field resources) is a risk. The mitigation is to have appropriate resourcing contingency and skills development plan in place, and to ensure that the project schedule is aligned with realistic resources availability;
- Delivery risks - Delays particularly due to complexities of implementing new technologies such as DVM. The mitigation is to derisk by undertaking proof-of-concept testing early in the project life-cycle to allow time to fix issues and minimise their impact on the overall project delivery timing. As such, the current trial at Coburg South and Airport West zone substations will feed important information into the future stages and mitigate this risk.

Option 5: Non-network voltage and power quality management solutions (not feasible)

Description

This option relies on third-party DER and demand response (DR) solutions to resolve the risks and take advantage of the opportunities, with benefits realised through contracting of non-network solutions. This option can open up a range of benefits not available from the other options and requires additional investments by JEN in DERMS and dynamic operating envelopes.

This option is not technically feasible to realise benefits for the short to medium term until the penetration of controllable storage and DR resources significantly increases in the JEN distribution network. Therefore, it has not been considered any further.

Quantitative Analysis

The table below summarises the quantitative and qualitative differences between the analysed options.

	Capex ($2024M)		Opex ($2024M)		Totex ($2024M)		NPV
	Asset	Digital	Asset	Digital	Asset	Digital	
Option 1	-	-	-	-	-	-	-
Option 2	$35.2	$0.1	$1.0	$3.0	$39.1		($3.0)

Option 3	$49.2				$49.2		$2.0
Option 4	$42.6	$0.1	$1.0	$3.0	$43.6	$3.1	$2.2

Options Summary

Option 1

The do-nothing option provides no immediate costs to customers, it reduces our ability to comply with our regulatory obligations with the EDCOP and doesn't provide our customers to export electricity from their DER. Therefore, JEN does not consider this option viable.

Option 2

Options provides proactive and centralised voltage and PQ management. While this program would enable compliance for JEN, it does not proactively address issues in our network which will result in less efficient management in the long term.

Option 3

Option 3 provides proactive distributed voltage and PQ management. While this option proactively manages our emerging distributed voltage risk, it does so at the highest costs.

Option 4 (preferred)

Option 4 creates a blend of options 2 and 3 which provides the maximum benefits for our customers. It creates an economically efficient mix of solutions to manage voltage levels in the network.

What We Are Recommending

Option 4 – "Centralised DVM & Optimised Distributed Voltage & PQ Management Programs" is prudent and efficient and is our preferred option. It maximises the present value of net benefits for our customers over the long term and is, therefore, the recommended development path.

Our preferred approach is prudent and efficient. It is the option that generates the highest net present value for our customers over the long term.

Doing nothing or delaying the implementation of the Voltage and PQ Management Program will not address our customers' expectations. See for more details below about the risks of doing nothing.

Moreover, through the use of enhanced form of Volt-Var control integrated with JEN's existing Advanced Metering Infrastructure, the DVM will minimise expenditure on more expensive forms of traditional network voltage and quality of supply investments.

We do not recommend the other options for the following reasons:

- Option 1 reduces our ability to comply with our regulatory obligations with the EDCOP and doesn't provide our customers to export electricity from their DER
- Option 2 would enable compliance for JEN but it does not proactively address issues in our network which will result in less efficient management in the long term. Therefore, JEN does not recommend this option.
- Option 3 is the highest cost option.

Risks of not undertaking the program in the next regulatory period

The risks of not implementing the program are high as outlined in the 'Do nothing option' above and could potentially lead to non-compliance with our compliance obligations under the EDCOP. Recent AEMO notices have also already demonstrated the network security risks associated with increased solar export and minimum demand in Victoria. In the first two weeks of November 2024 alone, AEMO has issued a number of notices about elevated risk of insufficient demand to maintain a secure operating state in the Victorian region. Given this, we do not consider it to be prudent and responsible to defer the implementation of this program into the 2031-36 regulatory period.

The DVM system which achieves near real-time, optimised control of network voltage and reactive power flow for the delivery of compliant voltages will reduce DER curtailment and avoid the need to limit electricity being exported to the distribution network. Hence, implementing the program in the next regulatory period will also ensure that we can accommodate more CER consistent with our FNS and the Victorian Government's renewable energy target of 65% and emissions reduction target of 45-50% by 2030.

Cost Estimation

A VVC trial was undertaken in 2024; this provided us with an in-depth understanding of key requirements and future design to inform the costs required to fully rollout VVC. Capex costs for digital covers licensing and patching during implementation and project delivery resources (project manager, testing architecture, analyst). Recurrent step opex costs for digital are incremental licensing costs following the new system implementation; there are also opex costs for ongoing monitoring, support and storage that will, in subsequent regulatory control periods, be considered recurrent opex. Network capex is for field equipment (VRRs/RTUs) and associated engineering costs. Network opex is for additional human resource support.

A bottom-up build was used to estimate costs for our preferred option, the details of which are below. To verify these costs we used a proxy approach to previous projects that have been successfully completed by JEN.

Cost ($2024M)	26-27	27-28	28-29	29-30	30-31
Network Capex					
Install reactors at COO - 2 x 4MVAr	-	-	0.7	1.3	0.7
Reactors at BD - 4 x 4MVAr reactors, two of 2 x 4MVAr cap banks	-	-	-	-	2.4
Install reactors at ST - 2 x 4MVAr	-	-	-	0.7	1.5
Install reactors at SBY - 2 x 4MVAr	0.6	1.2	0.6	-	-
Install reactors at SHM - 2 x 4MVAr	-	0.6	1.3	0.7	-
Interlocked VAr controllers on 14 existing capacitor banks	0.3	0.6	0.7	0.7	0.7
VVC Roll-Out	7.1	7.0	4.4	-	-
Distribution substation augmentation - supply quality	1.4	1.7	1.7	1.7	1.8
Future Grid - Hosting Capacity (LV Network)	0.1	0.1	0.1	0.1	0.1
Network Opex					
Opex step change (Networks)	0.2	0.2	0.2	0.2	0.2
Digital Capex					
FN - VVC (Volt Var Control) rollout	0.1	-	-	-	-
Digital Opex					

	Opex step change (Digital)	0.6	0.6	0.6	0.6	0.6
	Total	**10.4**	**12.1**	**10.2**	**6.0**	**7.9**
					Period total 46.6	
Dependencies on other Investment Briefs	• Data Visibility and Analytics Program					
Relationship to ICT Capital Forecast	For ICT capital forecast, refer to detailed “Voltage and PQ Management Program” justification paper and “Voltage and PQ Management Program - CBA Model.xlsb”.					