Powercor
AUSTRALIA

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NORTHERN MURRAY HARMONICS

PAL RRP BUS 3.3.06 – PUBLIC
2026–31 REVISED PROPOSAL

Table of contents

1. Overview

This business case addendum sets out our response to the AER's draft decision on our Northern Murray harmonics program and describes the further work we have undertaken since our regulatory proposal.

In our regulatory proposal, we proposed to install active harmonic filters across seven feeders in the Northern Murray to reduce harmonic distortions in the area to within compliant limits as prescribed under the Victorian Electricity Distribution Code of Practice (EDCoP).

We were first alerted to non-compliance in 2022. Since this time, we have taken steps under our compliance plan (agreed with the Essential Services Commission) to measure and identify non-compliant sites, work with high emitting customers to bring their current emissions back within compliant limits and optimise our network. Our proposal is the final step to return to compliance, which we intend to achieve upon completion of works, by 2030.

The AER's draft decision did not accept our proposal on the basis that we had not demonstrated that our proposal addresses high emitting customers, as the root cause of the problem, had not considered alternatives such as notifying customers of compliance, network monitoring and optimisation, and that the EDCoP effectively allowed a small number of customers to remain non-compliant.

Our revised proposal sets out our response to the AER's draft decision. We clarify that we have been working with high emitting customers to reduce emissions since 2022 and are actively implementing, or have implemented, all of the alternative solutions suggested by the AER. Importantly, we also clarify that we are held to different obligations under the EDCoP than customers. Customers can return to compliance with their obligations while still emitting current that leaves us non-compliant at the feeder level. Consequently, our preferred option remains to install 13 harmonic filters across seven filters as we will not be able to return to compliance without it.

Our revised proposal forecast remains consistent with our regulatory proposal forecast, to install low voltage (LV) active filters on seven feeders. Expenditure to deliver this program is shown below in table 1.

TABLE 1 EXPENDITURE FORECAST FOR PREFERRED OPTION ($M, 2026)

PROJECT	FY27	FY28	FY29	FY30	FY31	TOTAL
Original proposal	2.4	2.8	2.4	-	-	7.7
Draft determination	-	-	-	-	-	-
Revised proposal	2.4	2.8	2.4	-	-	7.7

This addendum should be read in conjunction with our regulatory proposal business case and corresponding model.[1]

[1] PAL BUS 3.08 – Northern Murray Harmonics Management – Jan2025 – Public; and PAL MOD 3.02 – Northern Murray Harmonics Management – Jan2025 - Public

2. Background

Customers in the northern Murray region are receiving harmonic distortions in voltage that are non-compliant under the Victorian Electricity Distribution Code of Practice (EDCoP). Under the EDCoP, we are required to maintain total harmonic distortion in voltage (THDv) below 6.5 per cent.[2]

THDv has peaked at 22 per cent in the area. We were alerted to the non-compliance through analysis to understand and address customer complaints alongside data sharing from impacted customers. The distortion is being driven by the adoption of variable speed drive systems, which control the speed and torque of AC motors, such as those found in irrigation pumps. Voltage distortion can negatively impact the lifecycle and function of customer assets, which customers have reported to us can disrupt production, reduce appliance lifespan and increase labour costs.

A significant portion of industry within the northern Murray region relies on irrigation from pumping infrastructure that underpins farming and agriculture. The region is essential to Victorian agriculture, producing 53 per cent of Victoria's gross value of agricultural production.[3]

2.1 Our regulatory proposal

In our regulatory proposal, we included the installation of 13 low voltage active harmonic filters on seven feeders in the Northern Murray region. Those areas are supplied from the Merbein (MBN), Boundary Bend (BBD), and Wemen (WMN) zone substations.

Our proposed investment is the final step in our compliance remediation plan to achieve compliance by 2030. We proposed to deliver this investment alongside non-network solutions, including:

- working with non-compliant customers to return to compliance under the EDCoP
- optimising our existing pole top capacitor banks in the supply area
- installing harmonic monitoring equipment to monitor the effectiveness of non-network solutions.

To achieve compliance by 2030, we proposed to roll out harmonic filters over three years, in line with our plan to return to compliance that we have submitted to the Essential Services Commission (ESC).

2.2 AER draft decision

The AER's draft decision did not accept our proposed capital expenditure (as shown in table 1). In making its draft decision, the AER determined that our proposal:

- focused on treating the symptoms rather than addressing the root cause of harmonic distortion, which the AER implies are high emitting customers
- did not consider alternative approaches including mailing reminders to customers, installers, and electricians about their compliance obligations, allocating modest operational funding for local monitoring, and offering power quality and harmonics monitoring as an alternative control service
- effectively allowed a small number of customers to remain non-compliant with their harmonic contributions under the EDCoP.

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2 Electricity Distribution Code of Practice clause 20.6.1.

3 The Mallee Catchment Management Authority, Victorian Mallee Irrigation Region Land and Water Management Plan 2020-29, 2020, p.14.

3. Our revised proposal

We maintain that the preferred option set out in our regulatory proposal is required to maintain compliance with our jurisdictional regulatory obligations. As such, we have reproposed these works in our revised proposal.

Harmonics are conventionally monitored at the zone substation. However, zone substation buses can maintain compliant harmonics while connected feeders deeper within the distribution network are non-compliant due to the gradual decline in power quality as power flows further away from the transformer.

It is not industry standard practice to monitor harmonic levels on feeders as this is not a requirement to maintain compliance. We were made aware of non-compliant harmonics due to customer complaints and customer data sharing. Since being made aware, we have been actively working with non-compliant customers to address harmonic distortion across the Northern Murray area. We have collaborated with non-compliant customers and followed all applicable remediation steps, including implementing site-specific solutions such as temporary uninterruptible power supply systems (UPS) where feasible. However, solutions such as UPS are only suitable for very small customer loads. Broader solutions are required to address network harmonic distortion in this area.

Under the EDCoP, all of our customers can be compliant with their individual obligations and we can still be non-compliant at the feeder level, meaning that we are responsible for meeting our compliance obligation rather than customers.

As we show below, even with widespread customer actions, harmonic distortion will be beyond the 6.5 per cent THDv allowed under the EDCoP. Accordingly, we will not maintain compliance with our obligations without further investment.

3.1 Customer action alone is insufficient to meet our compliance obligations

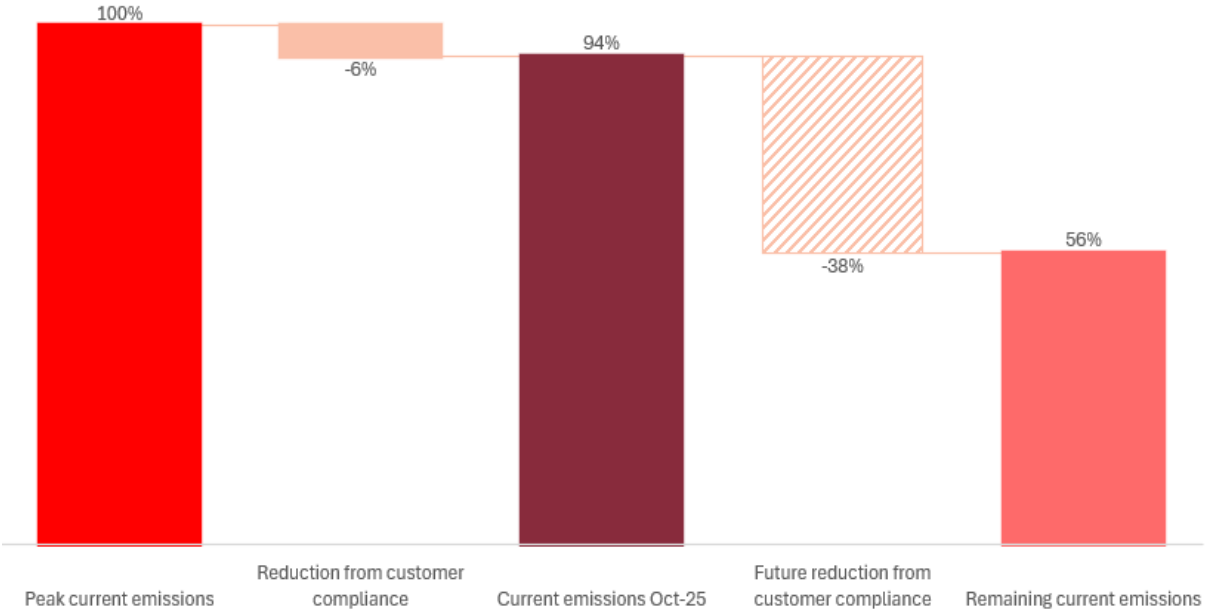
In rejecting our proposal, the AER found that we had focused on treating the symptoms rather than addressing the root cause of harmonic distortion, which the AER implies are high emitting customers. The AER stated that the proposed measures under the EDCoP effectively allow a small number of customers to remain non-compliant with their harmonic contributions. While the AER does not elaborate, we infer that the AER believes customer action to meet their compliance obligations is sufficient to lower THDv to a compliant level.

Customers are responsible for current emissions while we are responsible for harmonic voltage. Harmonic voltage is an outcome of cumulative current emissions as they interact with network impedance across the feeder. Customers will meet their compliance obligation at their connection point while still emitting current that results in non-compliant total harmonic voltage at the feeder extremity, leaving THDv above the compliance threshold.

We have been actively working with customers to lower their current emissions since we became aware of non-compliance through network analytics and customer data sharing in 2022. Our harmonics monitoring program has identified a total of 38 non-compliant customers. We sought to engage the highest emitting customer first, sending letters notifying them of non-compliance and undertaking subsequent collaboration to log their harmonic data and discuss site-specific solutions.

Three of our highest emitters have installed customer harmonic filters as of October 2025.This customer action has resulted in a six percent reduction in current emissions. We expect action from the remaining 35 non-compliant customers to result in a further 38 per cent reduction of current emissions, resulting in a total reduction of 44 per cent from the 2022 peak, shown below in figure 1.

FIGURE 1 CURRENT CUSTOMER EMISSIONS



The remaining current emissions will result in non-compliant harmonic voltage at the feeder without further action. Achieving a further 44 per cent reduction in current emission will require both high customer uptake of harmonic filters and successful implementation of the filters themselves at every site.

Customer actions to return themselves to compliance with the addition of harmonic filters also has the potential to exacerbate harmonic distortions or harmonic resonance in other areas. The exercise of successfully designing a harmonic filter in a single location is challenging, if several customers seek to do this simultaneously, it is likely to result in filter installations that are not compatible, which would negate the intended reductions in THDv. For example, if two or more customers on the same feeder individually install customer harmonic filters at their connection that are not compatible, the impact of combined changes may create a new resonance that amplifies other harmonics. Customers have no obligation or practical ability to act in a coordinated manner when installing filters, and in our experience, coordination between customers has not been practicable.

While we can notify customers of non-compliance and recommend they take remediation actions, we have no jurisdiction to dictate or influence the actions that customers take to meet their compliance obligations, including the type of filter they install. Even with high uptake of harmonic filters by emitting customers, non-emitting customers on the feeder will continue to experience the impact of distortions, such as pumping infrastructure overheating and crops being placed at risk due to underwatering, until we become compliant with our obligations at the feeder level.

Moreover, if emitting customers are unwilling or unable to take action after our engagement, the only avenue open to us outside of filtering within the network is disconnection of the customers. As these customers are an integral part of their communities as employers and producers, plus material contributors to the Victorian economy, disconnection would have significant local and state impact. As a result, we do not see disconnection as a credible action.

3.2 We are exhausting all options to lower THDv

The AER found that we did not consider alternative approaches including mailing reminders to customers, installers, and electricians about their compliance obligations, allocating modest operational funding for local monitoring, and offering power quality and harmonics monitoring as an alternative control service.

Since becoming aware of non-compliance, we have self-reported a breach to the ESC and developed a compliance plan to respond. We have attached the plan as part of our revised proposal.[4] We are delivering our compliance plan through a three stage strategy, each stage targeting a distinct source of harmonic distortion. Stage one and two are already delivering all of the alternative solutions the AER suggested we employ. Stage three is reliant upon the augmentation we proposed in our regulatory proposal and are reproposing in our revised proposal.

If implemented in isolation, each stage will lower THDv across our network to a level that is beneficial but ultimately immaterial to meeting our compliance obligations. Implemented together, our approach will collectively reduce THDv to five per cent, below the compliance limit of 6.5 per cent.

Stage one: customer compliance

Between 2022 to 2025 we identified harmonic emitters and written to each notifying them of their obligations to comply with the EDCoP's harmonic limits standards. Each emitting customer has been manually identified through manual data logging and analysis to monitor harmonic levels at their point of connection. This has led to 38 confirmed non-compliant customers across seven feeders being identified. Eight customers have responded to non-compliance notices, resulting in the installation of three customer harmonic filters, with five more scheduled.

The installation of three harmonic filters has had a positive impact to date, reducing feeder THDv levels from 22 per cent to 20 per cent. However, our initial action has targeted the responses from the highest emitting customers, which collectively make up approximately two percentage points of emissions. Continued customer compliance impact on THDv will substantially lower as we progress to lower emitters. With a high response rate, we expect customer compliance to further reduce THDv to 15 per cent. In addition, there is a risk with multiple customer side interventions that, while addressing their own THDv issues with passive filters, they may create new issues or excite other harmonic orders further limiting any expected reduction.

Stage two: network optimisation

We have leveraged existing optimisation opportunities before considering augmentation. Under stage two, we have identified eight opportunities to improve the harmonics impedance of the network via optimisation of all existing capacitor banks in the supply area, all of which have been implemented. This has resulted in a five percentage point reduction of THDv. Even if most or all non-compliant customers return themselves to compliance, we will remain non-compliant. These interventions took place between 2022 to 2025.

Stage three: harmonics targeted network augmentation

The network augmentation proposed in our regulatory proposal and reproposed here is the final stage of our plan. We will install 13 low voltage active harmonic filters on seven feeders and one HV capacitor bank across three zone substations in the northern Murray region. LV active filters inject currents to counteract the remaining customer current emissions, which will offset harmonic distortions. Active filtering is also far more adaptable than traditional passive filtering, allowing tuning of filters in future if customer emissions change.

We began preparatory works to deliver stage three in 2025. We have a pilot project underway to test a new internal standard, developed in consultation with industry stakeholders, for construction, of the harmonic filters we plan to deploy.

The implementation of stage three will result in a further five per cent reduction of THDv, bringing us within the compliance threshold of 6.5 per cent. We aim to achieve compliance by FY30. Figure 2 shows the sequential impact of each stage on THDv levels in the northern Murray region.

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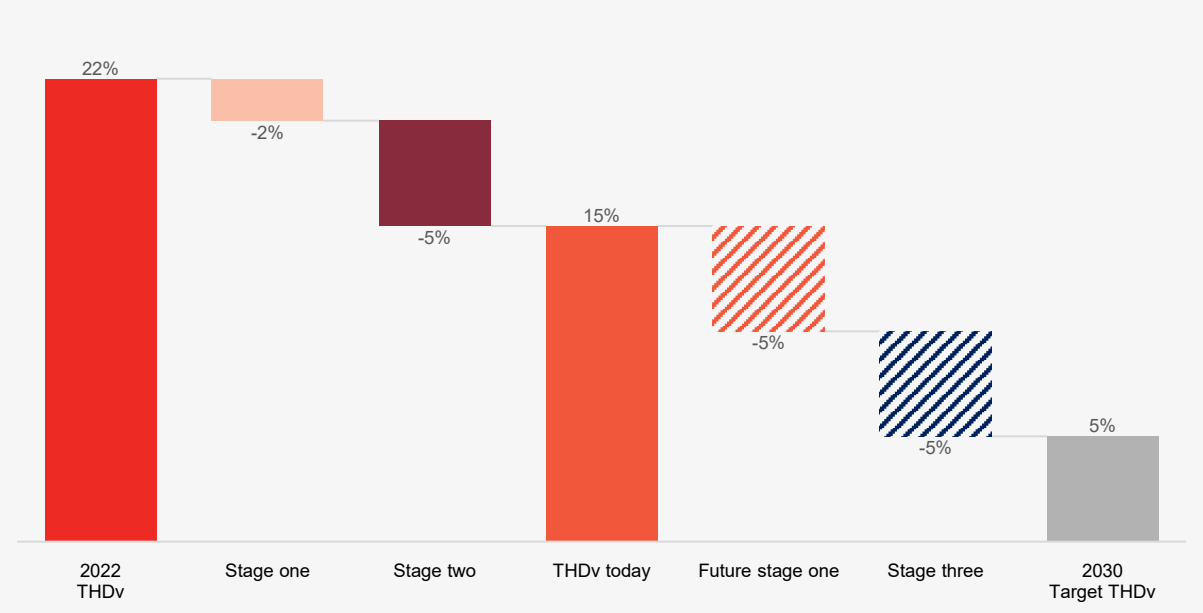
[4] See PAL RRP ATT 3.3.02 – Letter to ESC - voltage harmonics non-compliance report – Dec2025 – Public

FIGURE 2 COMPLIANCE PLAN STAGED IMPACT



Note: Future stage one future reductions from customer measures to improve compliance

3.3 Revised proposal forecast

We have maintained our regulatory proposal forecast in our revised proposal, which is to install 13 LV active harmonic filters and one HV capacitor bank across three zone substations in the northern Murray region: Merbein (MBN), Boundary Bend (BBD), and Wemen (WMN). LV active harmonic filters are the lowest cost augmentation solution available and are the lowest risk option as they present minimal risk of exacerbating harmonic distortions through interaction with incompatible filters installed elsewhere on the feeder.

Our augmentation solution is the final stage in our plan to return to compliance with our EDCoP obligations in the northern Murray region. We are not capable of maintaining compliance with our jurisdictional compliance obligations under the EDCoP without augmentation.

Our revised proposal capital expenditure forecast is set out in table 2. Further detail is provided in our attached cost-benefit modelling.[5]

TABLE 2 DETAILED EXPENDITURE FORECAST ($M, 2026)

CAPITAL EXPENDITURE	FY27	FY28	FY29	FY30	FY31	TOTAL
Install 13 LV active harmonic filters on seven feeders	2.4	2.9	2.4	-	-	7.7

[5] See PAL RRP MOD 3.3.15 - Northern Murray harmonics management - Dec2025 - Public

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