DMIA Annual Report 2023/24

October 2024

30/10/2024 – Version 1

SA Power Networks

Empowering South Australia

Contents

Document Control

Version	Date	Author	Notes
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1. Introduction

On 13 December 2017, the Australian Energy Regulator (AER) published a new Demand Management Innovation Allowance Mechanism (DMIAM or DMIA).[1]

The DMIAM provides distributors with funding for research and development in demand management projects that have the potential to reduce long term network costs.

In accordance with the AER's framework and approach, the AER's draft decision was to apply the new DMIAM to SA Power Networks for the 2020–25 regulatory control period (RCP).

When SA Power Networks receives funding under the DMIAM, we must submit an annual compliance report on our DMIA activities, expenditures, projects and programs undertaken in a regulatory year, to the AER for publication.

This compliance report has been prepared according to the requirements listed in clause 2.3 of the of the DMIAM.

2. Projects for which DMIA approval is sought

Projects for which approval is sought under the DMIAM for the 2020 – 25 RCP are listed in Table 1**Error! Reference source not found.** below. In 2023/24 a total cost of $1,635,493 was incurred.

Table 1: SA Power Networks' DMIA projects for 2023/24

DMIA Innovation Stream	Project	Expenditure 2023/24
1. Electrification	1.1 Electrification and Demand Flexibility Pilot	$361,274
	1.2 Electric Vehicle Integration	$212,551
2. Advanced planning	2.1 Low voltage planning engine	$339,898
	2.2 Advanced network modelling	$243,303
3. Demand Management Capability	3.1 Tailem Bend region Demand Management trial (proof of concept)	$478,465
	Total	**$1,635,493**

The projects for 2023/24 are categorised into three key streams of work:

- **Electrification and demand flexibility** – widespread electrification of homes and vehicles will occur over the coming decades and has the potential to more than double current peak demand and cost billions of dollars in additional augmentation expenditure and new generation and storage costs if managed poorly. Demand flexibility is key to integrating these loads and enabling an efficient transition. Projects in this stream aim to demonstrate the customer and network benefits of demand flexibility, and accelerate their deployment at scale.
- **Advanced planning** – planning for distribution networks is becoming increasingly more complex as DER continues to connect to the network. The long-term impacts of DER integration need to be considered, while also considering the potential of DER to provide network services and alternatives to network investment, requiring a much more sophisticated and integrated planning approach. Projects in this stream aim to develop more innovative methods and tools for network planning, including optimising efficient outcomes across both network and non-network solutions.
- **Demand management capability** – research, modelling and development projects that use innovative solutions to cost-effectively resolve voltage or thermal constraints by shifting or reducing demand for standard control services through non-network alternatives.

[1] AER, Demand management innovation allowance mechanism, Electricity distribution network service providers, December 2017.

2.1 Electrification and demand flexibility

In 2023/24 SA Power Networks undertook two projects under the electrification and demand flexibility stream:

- Electrification and demand flexibility pilot; and
- Electric vehicle integration.

2.1.1 Electrification and demand flexibility pilot

Nature and scope of the project

SA Power Networks recognises that widespread electrification of homes and vehicles will occur over the coming decades. Our modelling suggests that South Australia will require approximately twice the amount of electricity by 2050, which will need to be distributed through our distribution network. As a network operator, SA Power Networks has a responsibility to efficiently integrate these loads into the distribution network and ensure the best outcome for all customers.

Enabling demand flexibility is key to efficiently integrating these increasing loads and enabling an orderly transition. It has the potential to minimise the network impacts of increased electrical demand, removing the need for a significant uplift in network capacity investments and maximising the benefits that electric homes and vehicles can provide all customers.
Conversely, if the increased demand is managed poorly, it could more than double current peak demand and cost billions of dollars in additional augmentation expenditure and new generation and storage costs.

SA Power Networks acknowledges that actions it undertakes now will greatly influence the potential impact this additional demand has on the community and is committed to early planning to ensure an orderly transition. This project seeks to design and deliver a real-world pilot that will empirically demonstrate the customer, commercial and network benefits of demand flexibility and smart homes, and accelerate their deployment at scale.

Aims and expectations

The electrification and demand flexibility pilot will accelerate the establishment of smart homes in Australia by demonstrating the new consumer, network, retailer and installation industry value that can be accessed through the deployment of flexible demand-side technology in homes, trialled through simple, customer-focused 'flexible' energy service offerings to facilitate access to these benefits.

The project will demonstrate these new values in a real-world pilot, 'Energy Masters', with project partners who are leaders in their fields and have the capacity to deploy the new services at scale in Australia.

The pilot will improve commercial readiness of demand flexibility by:

- working with an established home energy management technology provider that has the necessary capability and capacity
- working with chosen partners to develop and trial simple customer-focused energy service offerings to reduce costs and improve customer service and choice regarding network access, home orchestration, customer control and reward structures
- research consumer sentiment and identify and overcome barriers to the adoption of these technologies and services
- identify government levers to remove barriers and support commercial viability of these technologies and services
- develop interoperability standards to remove the need for technology providers to develop bespoke protocols, improving customer portability and reducing barriers to commercialisation

Implementation of the project

Implementation of the project will be through a real-world pilot that will incentive 500 households to electrify their homes and trial home energy optimisation and behind-the-meter demand flexibility technologies in response to network and market conditions. Households will be offered incentive payments towards the cost

of pre-approved, efficient electric appliances, as well access to low-cost finance to cover the residual cost of the appliances. Households with electric vehicles (EVs) will also be provided access to smart chargers.

Participating households will participate in a 2-year research program spanning the technical, behavioural, policy and industry components of residential electrification and home automation and identify the foundations required to make 'smart homes' a reality at scale.

SA Power Networks has been successful in its application for funding from ARENA's Advancing Renewables Program to enable delivery of the project. The ARENA funded components of the project have been removed from DMIA expenditure.

Implementation costs

The implementation cost for the electrification and demand flexibility pilot is set out in Table 2.

Table 2: Electrification and demand flexibility pilot implementation costs

Milestone	Date	SA Power Networks' tasks / deliverables	Cumulative contribution
1	December 2022	Initial strategy development, project scoping, stakeholder engagement and options analysis	$153,000
2	May 2023	Development of ARENA 'Expression of Interest' submission, project vision, objectives, outcomes and implementation approach	$228,000
3	June 2023	Detailed project design, technical architecture development, partner selection and research plan	$401,384
4	November 2023	Development of 'Full Application' for ARENA funding, finalisation of partner participation, research plan and budget	$564,611
5	April 2024	ARENA contract negotiation and execution	$732,277

Project costs for the regulatory year 2023/24 were $361,274.

Identifiable benefits

The identifiable benefits for the electrification and demand flexibility pilot include:

- Understanding the impacts of wide-spread residential electrification and demonstrate the extent to which smart, electrified homes can offset network infrastructure costs;
- Empirically demonstrate the customer and commercial benefits of demand flexibility;
- Facilitate the development of interoperability standards for behind-the-meter devices;
- Understanding customer sentiment towards home energy management and identify strategies to maximise participation in flexible energy offers and smart, electric homes; and
- Stimulate and accelerate the establishment of a new industry capable of deploying residential behind-the-meter flexible demand technologies, including the key social, technical and commercial enablers.

2.1.2 Electric vehicle integration

South Australia's transition to EVs will reduce transport emissions and costs to consumers, while rapidly increasing electricity demand. As part of our future network planning, we have forecast over 800 GWh of additional energy flowing through our network annually by 2030 – an increase of almost 10% - due to EVs. By 2050, EVs will have increased energy throughput on our network by 50% and our network will be the primary distribution system for transport energy for the State.

If EV charging occurs frequently during peak times, the transition to EVs has the potential to drive substantial new growth in peak electricity demand, requiring significant upgrades to the distribution network. If EV charging is managed to occur mostly outside of the peak periods, our modelling suggests that South Australia has the potential to de-carbonise the transport sector largely within our existing network capacity. If integrated efficiently, South Australia could expect to see significant reductions in average network price, per unit of energy, between 2030 and 2050 due to this additional energy throughput.

Availability and convenience of EV charging is one of the most cited barriers for EV adoption. SA Power Networks has a role to play in ensuring the installation and operation of private and public EV charging is efficient and rapid. Ensuring an "EV ready" network will require considered adjustments to several internal processes, rules and systems such as our Service and Installation Rules (SIR) which cover any requirements for Level 2 home EV Supply Equipment (EVSE), the Tariff Structure Statement and Connection Policy which governs when and how customers are charged for network flexibility, and the After Diversity Maximum Demand (ADMD) numbers which consider potential impacts of peak EV charging loads on the grid.

Nature and scope of the project

Fortunately, it is not always critical *when* or *how fast* an EV is charged, making it a comparatively flexible load. Being able to leverage that flexible load, requires SA Power Networks to be able to reliably communicate with active EV Supply Equipment (EVSE) and provide commensurate incentives to customers.

In order to include customer EV charging behaviour in our network planning and network design, we require visibility of the location and size of EV chargers. Appropriate methodologies for capturing EVSE data need to be explored, with options including direct DER Database entry, data sharing arrangements with government departments or inference using smart meter data.

The massive potential battery storage of EVs can only be fully realised through bidirectional charging. SA Power Networks has become the first jurisdiction in Australia to allow customers to install vehicle to grid (V2G) infrastructure outside of trials.

Aims and expectations

SA Power Networks' EV integration strategies are guided by our 15-year Strategic Direction (2021-35), our Customer Strategy 2022-26, and our Network Strategy 2020-30. The objectives are:

1. Incentives – Offer EV Services that give customers optionality and incentives that are designed to meet their needs while aligning EV charging with optimised network utilisation.
2. Connections – Streamline our connection rules & processes so it's easy, transparent, and simple to connect EV chargers.
3. Operations – Efficiently plan and operate our network with EVs integrated as flexible loads that can respond to network signals while improving energy security and reliability.
4. Supporting the transition - Educate our customers, employees, suppliers and stakeholders and advocate for aligned EV charging practices.

Success of these objectives can be measured by a rapid de-carbonisation of South Australia's transport sector that is accessible to customers, supported by industry, and does not necessitate extensive network upgrades.

Implementation of the project – 2023/24

The implementation of the electric vehicle integration project is set out in Table 3.

Table 3: Electric vehicle integration project implementation

Activity	SAPN tasks / deliverables	Cost
1.	Increase EV registration compliance in the DER register (phase 2) • Negotiation with government departments • Testing inference using smart meter data	$70,000

2.	Customer education • Website updates developed and published "EV Charging for Fleets, Commercial Sites and Public Chargers" • Externally facing integration strategy developed • Website updates developed and published "SA Power Networks' approach to South Australia's EV transition"	$150,000
3.	External engagement in support of nationally consistent EV connections • ENA harmonisation of EV connections project • Bidirectional EV charging survey and workshops	$150,000

Project costs for the regulatory year 2023/24 were $212,551.

Identifiable benefits

The identified benefits for each milestone of the electric vehicle integration project completed in 2023/24, include:

- Increased confidence in available EV registration data assists with network planning, while avoiding duplication of workloads for the industry.
- Customer education updated in response to frequently asked questions to make it commonly requested information consistent and easily accessible. While aligned integration strategy helps prioritise future initiatives and provides clear direction to internal and external stakeholders.
- Aligned improvement priorities across DNSPs and industry to support the continued scale up of EV charging infrastructure across Australia. Charge point operators and customers operating across multiple jurisdictions get a consistent service from DNSPs in the longer term.

2.2 Advanced planning

In 2023/24 SA Power Networks undertook two projects under the advanced planning stream:

- Low voltage planning; and
- Advanced network modelling.

2.2.1 Low Voltage Planning

Nature and scope of the project

SA Power Networks procures various levels of power quality measurements from residential smart meters and power quality monitoring devices installed throughout the state. The need for additional monitoring data has been driven by DER Enablement spend in the 2020-25 RCP.

Historically augmentation expenditure on low voltage networks was driven by customer enquiries, with very little forecasting and planning. This project aims to develop tools and processes that leverage new diverse data sources and hosting capacity models to increase SA Power Networks' ability to strategically plan the low voltage network. This project will establish a constraints model and demand forecasting tool for each low voltage area within the distribution network which will be used to rank performance of low voltage areas and guide targeted remediation work to proactively manage low voltage networks and prioritise augmentation spend.

Aims and expectations

The aim of the low voltage planning project is to:

- Understand the minimum data inputs and network information required to categorise a sufficiently accurate demand forecast and detect associated network constraints for a given LV network area;
- Develop an innovative methodology to accurately extrapolate data inputs and model the remaining LV network areas where limited or no visibility is otherwise available;
- Identify relevant performance metrics and establish risk quantification based on power flows, asset ratings and durations of network constraints; and
- Establish cost benefit calculations based on lost energy, service level performance and risk + performance metrics against costs of various solutions to best guide investment decisions and unlocking further value to customers.

Implementation of the project

The low voltage planning project is being phased over the 2021/22, 2022/23 and 2023/24 regulatory years delivering benefits in each phase of the project. Implementation is split across 4 key milestones as set out in Table 4.

Table 4: Low voltage planning project implementation

Milestone	Target date	SA Power Networks tasks / deliverables
1	1 January 2022	- Establish initial power flow calculation and constraint model + initial procedures for its utilisation
2	1 December 2022	- Develop integration of constraint model with forecasting methodologies in order to establish a 25 year low voltage network forecasting tool, capable of measuring asset utilisation and performance over time and risk quantification of asset failure for all LV areas.
3	30 June 2023	- Expand the risk and performance valuation to include investment decision making functions capable of evaluating various solution types and specifying works programs capable of delivering a desired performance target, including cost benefit assessment.
4	30 June 2024	- Utilisation and testing of the tool to create a range of different targets with sensitivities for investment decision making functions.

Implementation costs

The implementation cost for the low voltage planning project is set out in Table 5.

Table 5: Low voltage planning project implementation costs

Milestone	Indicative date	Cost
1	1 January 2022	$50,000
2	1 July 2022	$20,000
3	30 June 2023	$671,694
4	30 June 2024	$339,898

Project costs for the regulatory year 2023/24 were $339,898.

Identifiable benefits

The identified benefits for low voltage planning project completed in 2023/24, include:

- Alleviate power quality issues such as voltage rise;
- Establish forecasting capabilities and better address the priority issues;
- Inform solution efficacy;
- Increase the network hosting capacity of distributed energy resources where required to deliver a target level of service that customers desire and is economically prudent;
- Improve customer experience and increase efficiency through proactively identifying and resolving network issues without requiring customers to make enquiries prior;
- Minimise network augmentation through building a better and more holistic understanding of network constraints and determining the most efficient means to meet them;
- Optimise ratings of assets to improve asset utilisation and defer expenditure; and
- Assist in providing inputs to our future Regulatory Proposals.

2.2.2 Advanced network modelling

Nature and scope of the project

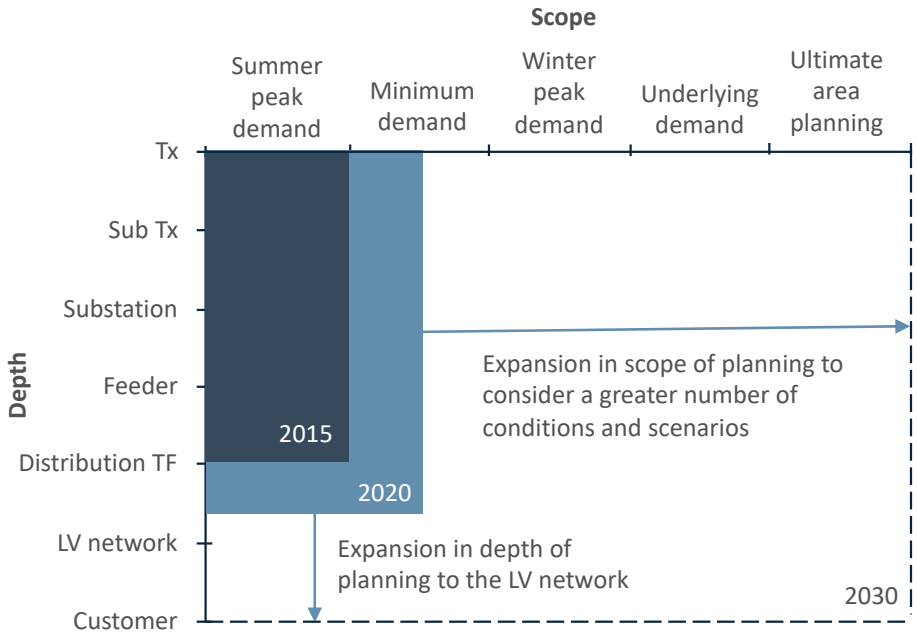
SA Power Networks publishes a Distribution Annual Planning Report (DAPR) intended to assist non-network proponents in proposing alternative solutions to defer network upgrades and to inform interested parties. It also aims to guide new load and generation proponents to suitable parts of the network that would result in reduced network augmentation associated with any new connection. Stakeholders have commented that the information presented currently is not easily interpreted or sufficient to guide their decision making. This has resulted in large numbers of high-level connection enquiries as customers and proponents often consider several geographic locations before determining a suitable site.

Furthermore, to continue to plan our network effectively we will need to model the impact of new energy technologies and services, such as PV, VPPs and EVs, which not only introduce complex new constraints in peak demand, minimum demand, and the need to manage diverse power flows, but also significantly increase the necessary depth, breadth, and overall complexity of planning. We need to be able to plan for a broad range of scenarios to understand how best to target investments and identify efficient non-network opportunities.

The project scope includes establishing and enhancing data, tools and processes associated with SA Power Networks' digital network models, to enable advanced network constraint analysis. This will produce improved visualisation of hosting capacity via opportunity maps, provide more accurate identification and transparency of network constraint information, and enable the identification of the most efficient solutions to these constraints.

The scope of the advanced network modelling project is shown in Figure 1.

Figure 1: Advanced network modelling project scope



Aims and expectations

The project aims to provide advanced network planning tools and models that allow for accurate digital models of the Distribution Network suitable for planning purposes which can be used to identify the most efficient solutions to network constraints, including the assessment of non-network alternatives. The concept involves developing innovative techniques to model the HV network by automation and optimisation of the network build process. New advanced planning functionality and processes will then be developed to enable efficiency and quality improvements.

A key objective is to improve the transparency of network constraint information and visualisation of hosting capacity. The higher degree of accuracy within the models and the advanced planning functionality delivered by the modelling tool is expected to automate processes for constraint identification and facilitate efficient options analysis. This functionality will also enable the publication of hosting opportunity maps as part of the DAPR highlighting those areas with load and generation hosting constraints (thermal and voltage limits).

Implementation of the project

The project will be phased over the 2020/21, 2021/22, 2022/23, 2023/24 and 2024/25 Regulatory years delivering benefits in each phase of the project.

Phase 1 – HV model creation and automation of planning processes

- HV model automatic build (and update) from the GIS to Sincal modelling tool;
- Model validation and establishment of processes to ensure model accuracy;
- Functionality to simplify and improve the quality of Network Planning analysis;
- Functionality and process efficiency improvements for assessment of load and generation connections.

Phase 2 – Advanced Network Planning and automation capabilities

- Functionality to facilitate the efficient analysis of investment options including augmentation deferral through demand management and non-network solutions associated with load connections and long-term network development;
- Functionality to analyse the future wide area effects of DER, BESS and EVs;
- Hosting capacity analysis for both generation and load on the HV network;
- Publication of Hosting Capacity Opportunity maps; and
- Integration of DER register data into HV Sincal models via automated process.

Phase 3 –LV Model creation

- Trial of LV model automatic import of LV GIS model to Sincal
    - Inform DER management trials
    - Inform more efficient deployment of voltage control solutions
    - Understand LV hosting capacity
    - Enable improved LV planning including Quality of Supply analysis and proactive planning
- Enhanced functionality to integrate LV model import into production; and
- Integration of DER register data into LV Sincal models via automated process.

Implementation costs

The expected implementation costs for the advanced network modelling project are outlined in Table 6 below.

Table 6: Advanced network modelling project implementation costs

Project Phase	Cost	Regulatory Year(s)
Phase 1 – HV model creation and automation of planning processes	$282,445	2020/21
	$100,000	2021/22
Phase 2 – Advanced Network Planning and automation capabilities	$200,000	2021/22
	$182,891	2022/23
	$243,303	2023/24

Phase 3 –LV Model creation trial	$50,000	2021/22

Project costs for the regulatory year 2023/24 were $243,303.

Identifiable benefits

The project is expected to deliver significant benefits for customers and non-network solution providers including:

- Visualisation of hosting capacity (load and generation) via opportunity maps will facilitate greater network utilisation and reduction in augmentation;
- Greater transparency of network constraint information leading to greater awareness of network capability and opportunity for greater utilisation;
- Improved identification of network constraints that can be resolved or deferred by demand management including non-network service solutions;
- More efficient targeting of network investment;
- Greater stakeholder access to network information is expected to reduce the number of speculative load and connection enquires that connection proponents need to make;
- Innovative advanced planning functionality to analyse the future network needs of DER, BESS, flexible connections and EVs and ensure this is incorporated into forward planning; and
- Facilitating engagement with third party non-network solution providers.

Whilst modelling tools have been implemented in other jurisdictions, the modelling tools and techniques developed in this project are new approaches to model build and visualisations. Benefits are expected to be realised for customers, non-network solution providers and internally within SA Power Networks.

2.3 Demand Management Capability

In 2023/24 SA Power Networks undertook one demand management project under the demand management capability stream:

- Tailem Bend region demand management trial.

2.3.1 Tailem Bend region demand management trial

Nature and scope of the project

SA Power Networks recognizes the high cost of installing inter-tripping schemes, particularly in rural parts of the network with limited telecommunications infrastructure, is inhibiting utilization of customer owned standby generation to alleviate network constraints.

The scope of this project is to undertake modelling, design, and development of a cost-effective demand management control system, to enable a customer owned standby diesel generator to be run in parallel with the distribution network during peak demand periods, without the need for protection grade inter-tripping to mitigate the risks associated with islanding.

The design solution and proof of concept build achieved as part of this project will facilitate establishment of a non-network service thus accommodating increased customer demand in the region as an alternative to extensive network upgrades.

Aims and expectations

This project aims to demonstrate innovative demand management capability, in the Tailem Bend region. The control system will achieve load reduction by automated start and ramp up of the customer owned standby diesel generating system, or by voluntary load shedding, to reduce demand on the distribution network. The intent is to also demonstrate that removing barriers to customer participation in demand management services will enable cost-effective services to be provided.

Implementation of the project – 2022/2023/2024

Works undertaken in the 2022/2023/2024 period include:

- Model and validate the ability to leverage the generator to mitigate voltage constraints;
- Develop the operating philosophy, control system and interface requirements;
- Scope, design and commence commissioning of the control and automation works;
- Commissioning of the control and automation works; and
- Implementation and testing to validate capability.

Works forecast to occur in the 2024/25 period include:

- Performance monitoring and as-needed control adjustments during 2024/25 summer period.

Implementation costs

Project costs for the regulatory year 2023/24 were $478,465.

Identifiable benefits

Implementation of this project is expected to deliver reductions to required capital expenditure through deferral of augmentation. Additional benefits to customers include:

- Alleviate power quality issues such as under voltage during periods of peak demand;
- Increase the network hosting capacity for new customer loads in the region;
- Removal of cost-prohibitive inter-tripping requirement to mitigate islanding risk when the standby generator is connected in parallel with the distribution network; and
- Demand management capability to enter into a network support service agreement to reducing demand for standard control services through a non-network alternative.

3. Costs not recoverable

The costs for the DMIA projects described above:

a. are not recoverable under any other jurisdictional incentive scheme,
b. are not recoverable under any other State or Commonwealth government scheme, and
c. are not included in the forecast capital or operating expenditure approved in the AER's distribution determination for the regulatory control period under which the scheme applies, or under any other incentive scheme in that determination.

4. Calculation of DMIA

The total amount of the DMIA spent in the 2023/24 RCP was $1,635,493. This amount equates to the total spend against the projects for which approval is sought under the DMIA as detailed in this report. The costs associated with these DM trials have been separately captured at the individual project level in SAP, SA Power Networks' integrated business management system. The expenditures incurred against these trials for each year of the RCP have been reported in Table 7.11.2 of SA Power Networks' Annual Reporting RIN Response and subject to independent external audit in accordance with the RIN requirements.

A. Appendix – DMIAM annual template FY 2024

Refer to the ‘DMIAM annual template FY 2024’ excel file.