Network strategy

2025-2030 Regulatory Proposal

Supporting document 5.2.4

SA Power Networks

Empowering South Australia

SA Power Networks

Network Strategy 2020 – 2030

v1.1

Foreword

As we begin our 2020-25 regulatory period, we are entering a decade of unprecedented transformation in the energy sector. Already the most de-centralised electricity system in the world, by 2030 the South Australian grid will have reached net-100% renewable generation and South Australia will be a significant exporter of renewable energy to the rest of the nation. More than 60% of homes and businesses will have rooftop solar, and electric vehicles will be a common sight on South Australia's roads.

Our distribution network sits at the heart of this transition, and the next decade will be the most exciting period for our business since the network was built more than 120 years ago. Over the next ten years we must accelerate our efforts to evolve and transform our network and the services we provide to adapt to our changing role at the centre of an increasingly distributed, two-way energy system.

The years ahead will also bring new challenges; we must manage the transformation of our network in an environment of reduced revenue and with an asset base that is already the oldest in the National Electricity Market and will continue to age further as asset replacement rates are constrained by regulatory allowances. Regrettably, it now appears inevitable that the next ten years will see the effects of climate change become more apparent in more frequent and intense bushfire and storm events, further challenging our core purpose to deliver safe, reliable, affordable energy to the community.

In this context, sound strategy is more important than ever before. This strategy has been developed through a collaborative effort across a broad range of stakeholders and thought leaders in our business. It builds on the solid foundations laid down in our 2017 *Future Network Strategy* and 2019 *Strategic Asset Management Plan*, brings these up-to-date with latest thinking and insights from inside and outside our business, and combines them for the first time in a single holistic Network Strategy.

The next decade will write an exciting new chapter in the history of our network. The pace of change is challenging but we are excited to be embarking on this next stage of our journey with a clear vision and solid strategy to light the way!

Mark Vincent
General Manager Strategy and Transformation

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General Manager Network Management

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The changing energy landscape

Nowhere in the world is the transition to a decarbonised electricity system being led so directly and strongly by customers as it is in Australia.

Since 2010, Australian customers are estimated to have invested more than $10 billion in installing their own rooftop solar PV generation, and they continue to invest in new renewable generation at a rate of more than $1 billion per annum[1].

As a result, the National Electricity Market (NEM) has been transformed, and continues to transform, with large central generators giving way to a new normal in which millions of rooftop PV systems are now an integral part of the energy system, and meet an increasing portion of the nation's energy needs. By the mid-2020s Australia will have the most de-centralised energy system of any major economy in the world[2].

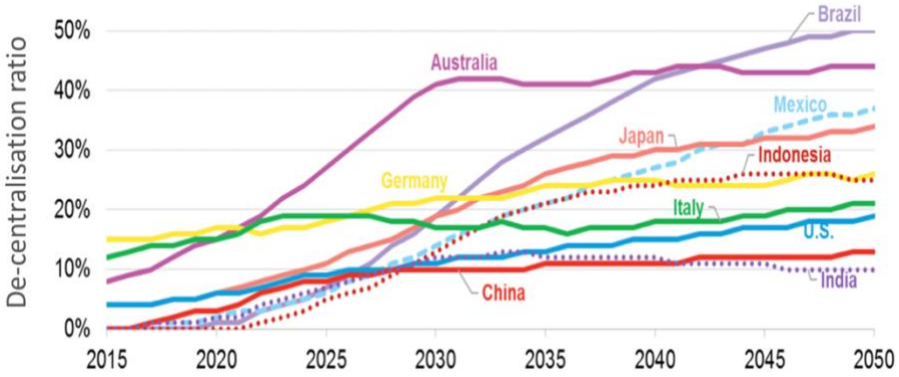


Figure 2 - De-centralisation ratio of global power systems[2]

With the continued rise of solar, the Australian Energy Market Operator (AEMO) is forecasting that, by 2025, all NEM regions will experience minimum demand in the daytime, not overnight[3]. As the imperative to reduce carbon emissions becomes more urgent over the next ten years, new policy interventions may further accelerate the uptake of renewable generation and energy storage.

South Australia is at the forefront of this transition. Rooftop solar penetration, already among the highest in the world at more than 35% of customer and business premises, continues to grow at an accelerating pace.

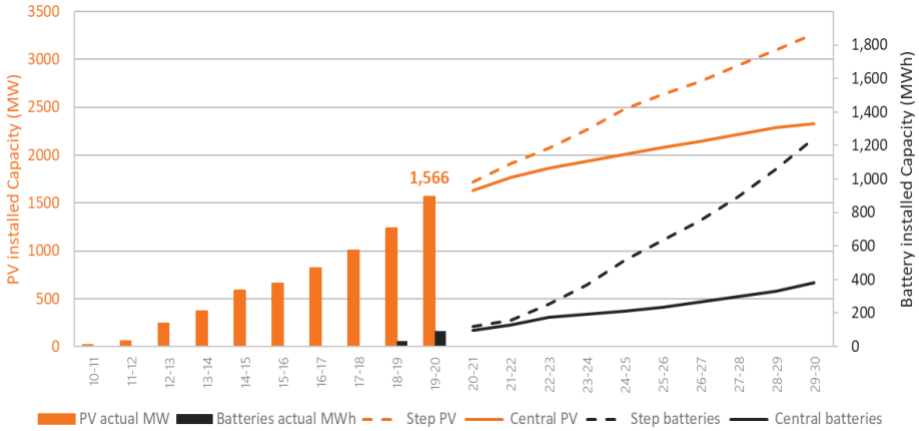


Figure 1 - Solar PV and battery uptake and forecasts in SA

As of mid-2020, SA has more than 1,500MW of installed rooftop solar, making rooftop PV by far the state's largest generator. The number of systems installed, and the average size of those systems, continue to increase year-on-year, adding capacity at a rate of more than 300MW per annum.

Although feed-in tariffs, solar subsidies and incentives are on a downward trend in SA, the economics of rooftop PV are now compelling and likely to remain so, with the levelised cost of energy over the life of a rooftop PV system forecast to be as low as 5c/kWh by 2030, or 15c/kWh with the addition of battery storage, compared to 30-40c/kWh for grid energy. Reducing up-front costs and short payback times will continue to drive strong uptake in the residential and business sector through the next decade.

While residential rooftop solar makes up the largest portion of new generation capacity on our network, the commercial and industrial sector is emerging as the next growth area, with large-scale solar and battery installations now being rolled out by businesses like Bunnings, IKEA and SA Water. Growth in grid-scale renewables is also accelerating across the state. As of late 2020, the Government is reporting a pipeline of more than 12GW of new renewable capacity planned or under development across 40 new grid-scale solar, wind and storage projects[4].

[1] RBA, *Renewable Energy Investment in Australia, Bulleting – March 2020*, 19 March 2020.

[2] Bloomberg New Energy Finance, "New Energy Outlook 2018".

[3] AEMO *2020 Electricity Statement of Opportunities*, August 2020.

[4] SA Government, Hydrogen opportunities in SA, presentation to AIE-SA, 18 November 2020

Growing pains: South Australia's system security challenge 2020-2024

As renewable penetration continues to grow rapidly and system inertia reduces, AEMO is facing urgent challenges with maintaining stability and security of supply. State-wide minimum demand fell to a new record low of 300MW in October 2020, which is below AEMO's threshold for secure operation in the event that the state is islanded[5]. AEMO is now forecasting that it may reach zero as early as 2023.

While the planned new interconnector to New South Wales ('Project EnergyConnect') will help manage South Australia's spring surplus of solar energy in the long term, AEMO has flagged that there are material risks to system security during mild sunny conditions in the early 2020s. In August 2020 this triggered an intervention by the SA Government through its 'Smarter Homes' package of measures, which includes mandating that all new solar installations in SA from end September 2020 must have the capability for remote disconnection.

The government has also invested a further $15 million towards the expansion of Neoen's Hornsdale Power Reserve, which provides frequency control services to help maintain system stability at times of low demand and when the system is under stress. Hornsdale was the world's largest battery when it was commissioned in 2017, and the expansion brings its capacity up to 150MW and 193MWh.

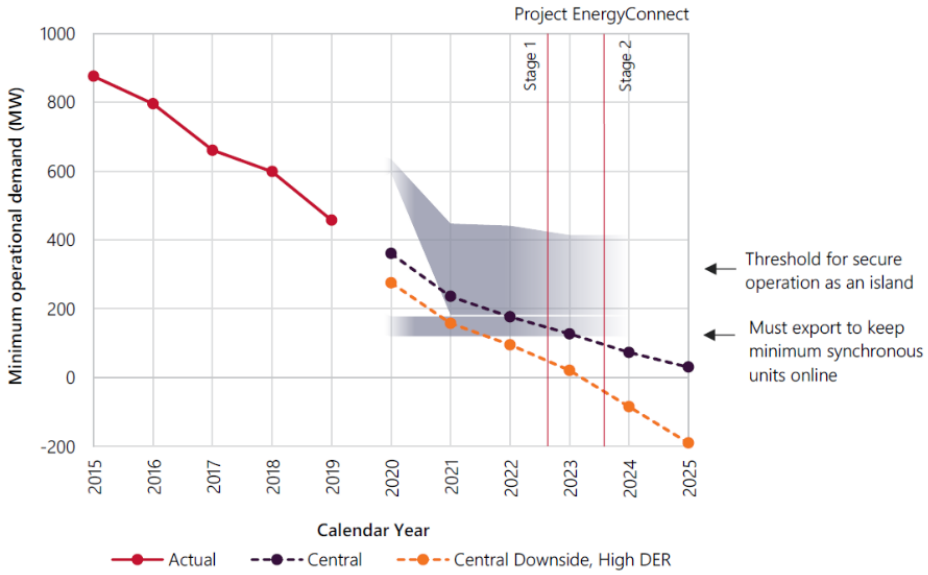


Figure 3 – SA minimum demand forecasts (AEMO)

[5] AEMO *2020 Electricity Statement of Opportunities*, August 2020.

The rise of batteries and Virtual Power Plants

Hornsdale is one of three grid-scale batteries now operating in SA, and other significant projects are in the pipeline, including AGL's recently-announced plans for a 250MW/1GWh battery at Torrens Island as part of its plan to roll out 850MW of new battery storage capacity across the NEM by 2024.

There is also increasing interest in SA in the concept of smaller 'community batteries' connected at the distribution network, following from the launch of pilot projects in Western Australia and New South Wales.

At household level, the residential battery storage market continues to grow steadily, supported by the government's Home Battery Scheme subsidies. In October 2020 there were more than 19,000 small-scale batteries installed in SA with a combined capacity of more than 190MWh, equivalent to the size of the Hornsdale battery. Of these, more than 5,000 are enrolled in 'virtual power plant' (VPP) schemes, putting SA at the forefront of VPP adoption nationally.

The largest of the nine VPPs operating in the state, Tesla's SA-VPP, has just commenced a rollout to a further 3,000 Housing SA properties, which will bring the total VPP capacity in the state to more than 35MW.

Between them, the Home Battery Scheme and the Tesla SA-VPP have targets to reach 90,000 residential batteries by the mid-2020s. These VPPs are already contributing to system stability through participation in the FCAS market, and as battery uptake grows over the next decade, VPPs will become a very material part of the state's energy system, providing hundreds of MW of highly responsive load and generation and playing an increasing role in dynamically balancing supply and demand as the state's energy mix becomes increasingly dominated by intermittent generation from solar and wind.

Evolving customer experience and expectations

The way customers use the network, and their expectations of the service they receive from us, are also changing. The electricity retail sector is being disrupted by new market entrants offering innovative products and services, appealing to customers who have felt disempowered by years of rising prices and are seeking the kind of choice, flexibility and transparency they experience in other markets.

As customers increasingly take up their own energy resources and subscribe to scheme like VPPs they want to use the network to export as well as import energy, and expect to be able to install and connect whatever combination of resources best suits their needs.

To meet these new needs, customers and their agents will need access to information on network capacity, reliability and performance in their area in order to choose the energy products and services that work best for them. In their dealings with us for connections, scheduled outages, network faults or emergencies, customers will expect ready access to accurate information and the ability to self-serve through familiar information channels and media.

South Australia's energy future – a renewable-led economic renaissance

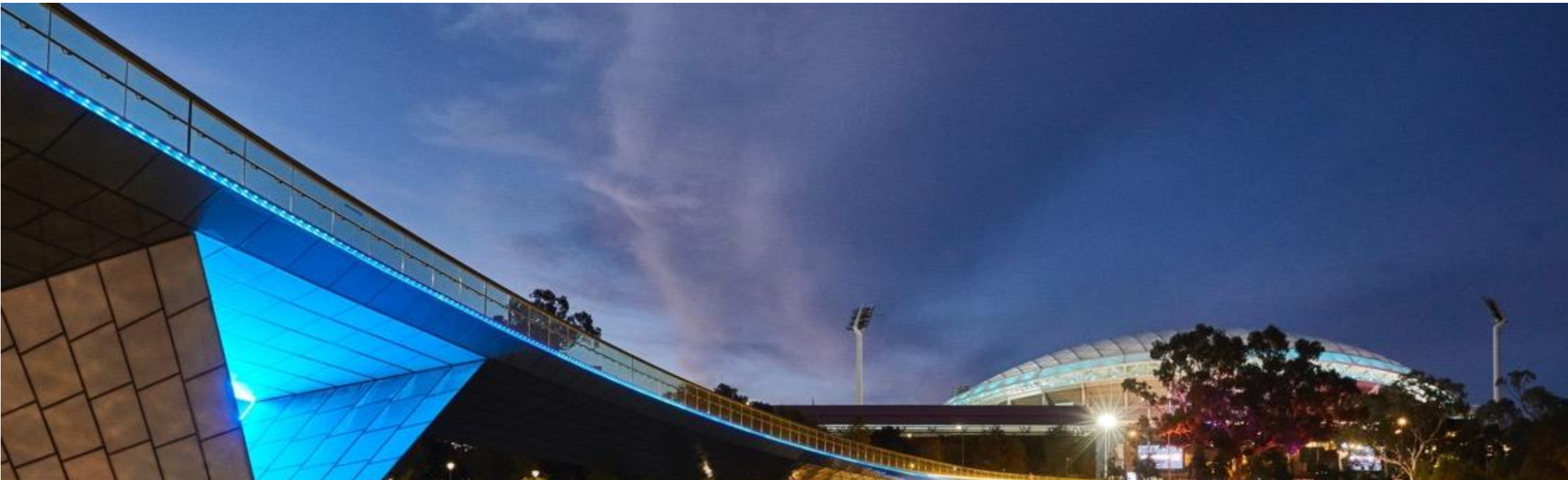
The aftermath of the COVID-19 pandemic is likely to have an impact on the energy landscape in the short term, with a weakened state economy putting increased pressure on energy prices, reduced commercial and industrial demand and the possibility of an enduring increase in daytime residential energy use from a trend towards more working from home.

As the transition to renewable energy continues, however, many believe that South Australia is on the brink of a new era of energy prosperity. Without the abundant coal reserves of other states, South Australia has historically had among the highest electricity prices in the NEM due to its reliance on expensive gas. In 2019, for the first time since 2014, the average wholesale price in SA was lower than Victoria and New South Wales thanks to the high contribution of wind and solar, now the lowest cost forms of generation. The price of grid electricity in SA is expected to ease further over the next decade as wind and solar continue to grow, while other states face a challenging decade managing the retirement of their large coal-fired power stations.

Falling energy prices and the development of large regional renewable energy hubs will create new opportunities to attract energy-intensive industries to the state, particularly those with some level of flexibility to vary loads to match times of high renewable output. The SA Government's Hydrogen Action Plan[6] also seeks to capitalise on surplus renewable energy to establish a new industry centred on the production of 'green' hydrogen and ammonia, both for domestic use (including feeding into the gas network) and to supply a growing international market.

As we emerge from the post-COVID recession, the next decade is South Australia's opportunity to lead the way to a future where all Australians have access to abundant, affordable and low-carbon energy.

[6]Government of South Australia, *South Australia's Hydrogen Action Plan*, September 2019c



The evolving role of the network

The role of the distribution network is changing.

Instead of simply supplying energy one-way from a few large generators to customers, our network now hosts a significant portion of the state's generation capacity. Residential and small-business loads are increasingly served by energy flowing entirely within the distribution network. At times of high solar output and low residential demand our whole network will soon become a net generation source for large industrial loads connected at the transmission network and, ultimately, for the other NEM states.

As the energy system becomes more reliant on intermittent wind and solar generation, the security and stability of the state's whole energy supply will increasingly depend on frequency balancing services provided by VPPs and other flexible resources connected to our network.

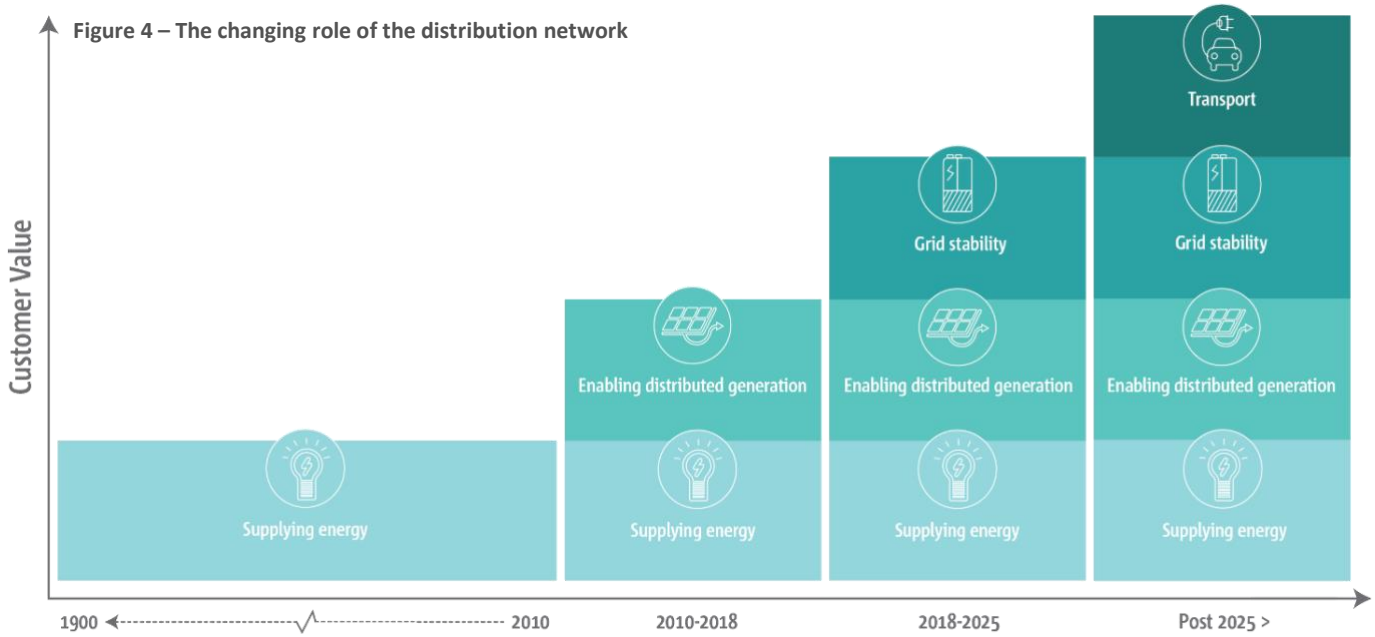
This decentralisation of the energy system shifts the distribution network from the 'last mile' to the very heart of the system; over the next decade our network will become more central, more integrated and more critical to South Australia's economy than ever before. The performance and integrity of the whole energy system will increasingly depend upon our ability to maintain the security and reliability of our network.

By the mid-2020s we also expect electric vehicles (EVs) to begin gaining significant market share in South Australia. On current forecasts, the associated substitution of petrol with electricity will see more than 800 GWh of additional energy flowing through our network annually by 2030, an increase of almost 10%, as our network starts to become the primary distribution system for transport fuel for the state. By 2050, EVs will have increased energy throughput on our network by 50%.

This broadening role brings opportunities to deliver much greater value to the community from the state's distribution network assets and enhance the value of the community's investment in distributed energy resources (DER). By playing our part to enable a well-managed transition to a distributed energy future we can maintain and grow our relevance as a business and support the state's vision to achieve net 100% renewable electricity by 2030, and net zero emissions by 2050.

The next decade is our opportunity to help South Australia lead the nation in the delivery of a new era of economic growth powered by abundant, low-cost, safe and reliable clean energy.

Figure 4 – The changing role of the distribution network



Our challenges

While the next decade will be one of great opportunity for our business, we also have significant challenges to overcome.

Managing the energy transition

One of the greatest technical challenges we face is managing the impact on our network of the ongoing uptake of rooftop PV and other DER. As we enter the 2020-25 regulatory period we know that we are reaching the limits of hosting capacity across many regions of our network, with the most immediate consequence being increasingly widespread over-voltage issues in residential areas at times of high solar output and low demand.

Beyond voltage issues, our modelling shows that reverse power flows have the potential to exceed the thermal limits of our assets in many areas over the next decade, including up to the zone substation level, due to the un-diversified nature of solar output on a network designed for one-way flows and diversified loads. These issues will be exacerbated by the aggregation of customer batteries and other DER into Virtual Power Plants which, as they grow to tens and even hundreds of MW in size, have the potential to cause extreme swings in supply and demand when they are dispatched in response to market price signals.

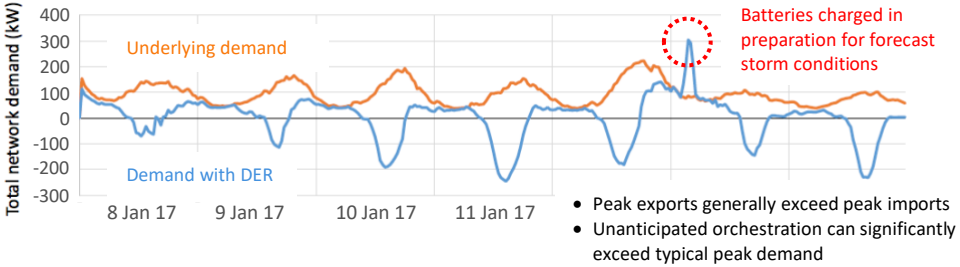


Figure 5 – Impact of solar PV, batteries and VPP operation on customer load profile

We observed these effects on a small scale in data from our Salisbury battery trial[7], and this has informed our 2020-25 program of DER management expenditure, with its central focus on the development of capabilities to improve our understanding of dynamic hosting capacity and to enable flexible (dynamic) export limits as standard for all new DER connected in SA. The successful delivery of this work program from field trials to production systems will be critical to our ability to manage DER within hosting capacity constraints, and to enable customers to continue to connect DER and export energy across the network as we reach levels of DER penetration unprecedented anywhere in the world. This will require significant investment in customer education to build understanding and acceptance of this approach, and engagement with other Distribution Network Service Providers (DNSPs) and the DER industry to build consensus on technical standards.

We must deliver this work program in an environment where the whole of the NEM is under review. State energy ministers and the industry bodies that make up the Energy Security Board (ESB) are grappling with the broader question of how Australia's electricity markets must change to facilitate the orderly retirement of legacy coal generation and the transition to renewable energy[8]. As South Australia is at the leading edge of this transition, we cannot wait for these market reforms to play out; we must solve our own issues and focus our efforts on delivering the urgent change we need in SA, while remaining engaged with the broader debate around market evolution to ensure our approaches are aligned with the long-term direction of the NEM. This will be a significant challenge, but also an opportunity to lead and influence this debate at a national level.

Our evolving regulatory environment

As well as these broader changes to market design, we will need to manage and adapt to ongoing changes to the regulatory environment that governs our network business. The next decade will be one of increasing regulatory scrutiny and new and more sophisticated methods of assessment, both to assess our expenditure proposals and to hold us accountable for the delivery of the work plans that the Australian Energy Regulator (AER) approved.

It is likely that the AER will place more emphasis on customer outcomes rather than purely economic outputs in future. This will make it even more critical that we collaborate with our customers and customer advocates and preserve trust and social license as we make changes that may be emotive or have material customer impact, such as new tariffs (including the potential introduction of export tariffs[9]),

[7] Vincent, M and Colebourn, H. (2017). Salisbury Residential Battery Trial. In Jones, Lawrence E. (Ed.) *Renewable Energy Integration, Practical Management of Variability, Uncertainty, and Flexibility in Power Grids* (Second Edition 293-308) London, UK: Elsevier.

[8] COAG Energy Council, *Energy Security Board Post 2025 Market Design Consultation Paper*, September 2020

[9] AEMC, *Distributed energy resources integration – updating regulatory arrangements*, consultation paper, 30 July 2020

new DER connection standards and system security measures like emergency solar curtailment. Customers will continue to expect high levels of reliability and affordability, while also being able to continue to exercise choice and enjoy the benefits of their own investments in DER without onerous constraints.

While our performance against key AER benchmarks has been good in the past, we also face a significant challenge in maintaining our position ahead of other DNSPs, as the former state-owned DNSPs have significant scope for improvements in efficiency in the coming years.

We also know that some of our business processes for planning, tracking and reporting on work are not well aligned with our regulatory reset process, in part because some of the top-down models and reporting tools like Regulatory Information Notices (RINs) that the AER requires are not well suited to planning and tracking day-to-day operations. Improving alignment of these processes will help us to achieve a good outcome from future regulatory determinations.

Reduced revenue allowances

While electricity prices are forecast to ease in SA over the next decade, we do not expect any respite from the significant pressure to minimise our revenue allowances, in particular given the likely impacts from the COVID19 recession.

Reductions in key inputs such as Rate of Return (RoR) and tax have reduced revenues significantly for the 2020-25 regulatory control period and forecast reductions in depreciation allowances will impact on revenues beyond 2025.

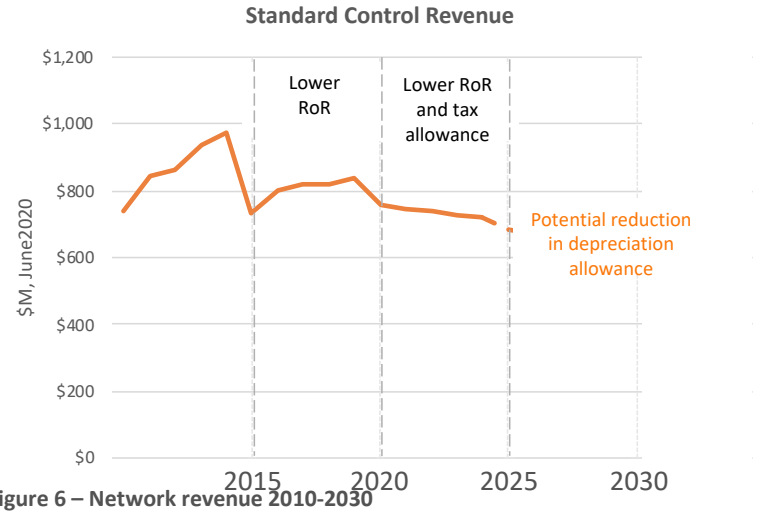


Figure 6 – Network revenue 2010-2030

Ageing assets

SA Power Networks has the oldest fleet of assets in the NEM and we currently maintain them with a remarkably low level of expenditure with, on average, less than 0.50% of our assets being replaced per annum in recent years. At this rate, our assets would have to last an average of 200 years, far exceeding the life of even our most long-lived assets.

The constraint on our regulatory allowance for asset replacement over the 2020-25 period leaves us with a significant challenge as asset replacement rates fall further below the level suggested by the AER's asset replacement model. We are entering uncharted territory in terms of the average age of our assets, and we will need new approaches to asset replacement and maintenance if we are to continue to deliver a safe and reliable service to the community from a network in which a much greater proportion of assets are at or near the end of their service life than in the past.

The increasing incidence of severe weather events in a changing climate will put further pressure on our ageing overhead infrastructure, and some parts of our network will come under stress from the new demands of extreme reverse power flows from distributed energy. Managing the increasing risks of asset failure within severe budgetary constraints will require us to completely re-think the way we understand asset condition and target replacement expenditure to our highest-risk assets.

We must also build consensus with the AER and our stakeholders around the level of replacement expenditure (repex) required in future regulatory periods if we are to put the network on a sustainable footing for the future.

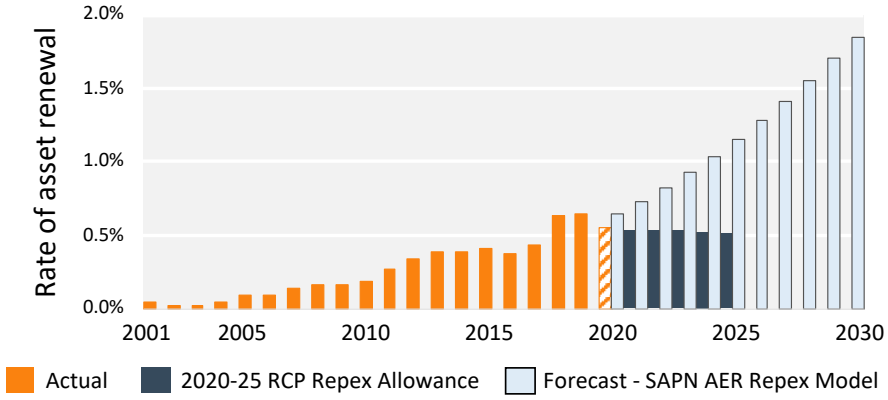


Figure 7 – Historical and approved asset replacement rates vs. AER model of required future replacement rates

Climate change and risk

The *State of the Climate 2020* report by the Australian Bureau of Meteorology and CSIRO found that the effects of climate change are now apparent in Australia. The report forecasts that the changing climate will lead to more frequent extreme weather events in South Australia, and longer and more intense fire seasons[10].

For our business, more extreme weather events will increase the incidence of storm damage to our overhead infrastructure. More intense and prolonged summer heatwaves will increase the risk of asset failure and present new challenges for field crews operating in extreme temperatures or high bushfire risk conditions.

A key risk to our business from asset failure is the potential for bushfire start, and as we begin our 2020-25 regulatory period, Australia has just endured one of the worst bushfire seasons on record, with two of the most significant fires in SA, at Yorketown and Cudlee Creek, thought to have been caused by electricity infrastructure. While SA Power Networks was not found to be at fault in either case, these fires serve to highlight the potentially devastating consequences for the community if we fail to manage fire-start risks, which will only increase in coming years as our assets become older and fire seasons become longer and more extreme.

This will drive increasing insurance costs for our business over the next decade, and also manifests as increased financial and reputational risk; in 2014 AusNet Services settled a $500 million claim in relation to the role of its network infrastructure in the 2009 Black Saturday fires in Victoria, the largest class action settlement in Australian legal history. More recently, PG&E, California's largest utility, was driven into bankruptcy in 2019 by liabilities of more than US$25 billion arising from a series of devastating fires in 2017 and 2018 linked to failures of its electricity infrastructure.

As the impacts of climate change become more apparent in coming years, this will influence community expectations of our network and our business. Customers valued and appreciated the incredible efforts of our field crews in restoring supply in the aftermath of the 2019 fires in mainland South Australia and Kangaroo Island. As fires and extreme weather events become more frequent, our challenge is to sustain this level of service to the community with limited resources.

Outside of emergency situations, our customers may also increasingly expect to see evidence that we are working to reduce our own environmental footprint, as responsible corporate citizens.

[10]CSIRO and Australian Bureau of Meteorology, *State of the Climate 2020*, November 2020

Our network strategy

As we begin our 2020-25 regulatory period and enter a new decade of unprecedented disruption in the energy sector, it is more important than ever that we have sound strategies and plans in place to light the way forward.

The development of this Network Strategy is part of a broader refresh of strategy across both regulated and unregulated sides of our business aimed to position us for the years ahead.

Just as our network sits at the centre of our business, so this Network Strategy sits at the heart of our strategic response to these changing times. Aligned with our 2020 Strategic Directions, it sets out a 10-year vision and roadmap for how our physical network, and the systems, processes and people that surround it, must adapt, evolve and deliver over the next decade if we are to truly 'Empower South Australia'.

The Network Strategy is the culmination of more than 12 months of work by a broad range of stakeholders across the business. It builds on the solid foundations laid down in our 2017 *Future Network Strategy* and 2019 *Strategic Asset Management Plan*, brings these up-to-date with the latest thinking and insights from inside and outside our business, and combines them for the first time in a single whole-of-network strategy.

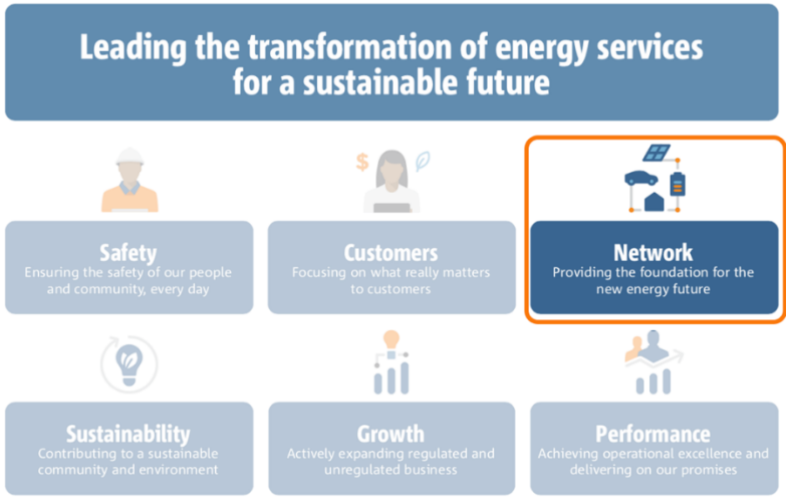


Figure 8 – The Network Strategy represents one of six key focus areas in the Corporate Strategic Plan 2021-2025

Network strategy in a nutshell

Our network strategy comprises the three key strategic themes of ***empowering our customers***, ***enabling the energy transition*** and maintaining ***a sustainable foundation***

- We will address information gaps in our business to **build understanding** of our customers, our network performance and the changing energy system. We will use this to **build capability** in our network planning, operating and asset management functions, to deliver our core services more effectively and at lower cost. Finally, we will use these new capabilities to **build greater value** for the community from the network, through new services.
- We will **stretch** the capacity, service life and performance of our ageing assets with smarter systems and processes, and well-targeted investments, and we will **fill** the troughs in asset utilisation by encouraging load shifting and smart DER through new tariffs and flexible connection options.
- We will **build stakeholder and AER consensus on efficient and sustainable future levels of repex**, and transition to a more economic approach to repex planning and works delivery.
- We will take **a holistic approach to investment planning** based on a **master plan** for the future network. We will **shift from an 'asset' to a 'service outcomes' focus**, seeking investments that deliver the best outcomes in capacity, reliability and broader customer benefits, including considering options other than traditional asset replacement or upgrade.
- We will take a more sophisticated**, economic approach to asset replacement** to actively manage risks arising from our ageing assets and the changing climate over the next decade.
- As we transition to a **Distribution System Operator (DSO)** role we will actively manage network voltage and capacity and integrate customers' smart DER through new systems, open interfaces and **flexible connections**.
- We will bring our business closer to the customer, embedding the principles of ***Simplify***, ***Personalise***, ***Connect*** in customer-facing processes.
- We will **engage proactively in regulatory reforms** to ensure that the long-term needs of our business and our community are represented.
- We will support the SA Government's **decarbonisation** agenda and the **transition to electric vehicles**.
- Above all, we will continue to **put safety first**, for our people and the community.

Our vision for 2030

Our **network** sits at the centre of the world's most **advanced**, **decentralised** and **dynamic** low-carbon energy system

Our **customers** enjoy the **lowest energy prices** in Australia. They **understand** our role, find us **easy to deal with**, and **trust** us to deliver a **safe and reliable network** that **meets the needs of the community**

Our **business** is **engaged**, **respected** and **influential** in the energy sector. We are **key partners to Government** in delivering SA's energy vision.

SA Power Networks

2030

Our **people** are **multi-skilled, collaborative,** and **flexible.** Focused on **outcomes not tasks** and operating with a **customer mindset,** they **live our vision** and are **empowered with the tools and information they need**

We **operate** Australia's most **flexible** network. Our systems **actively integrate** hundreds of thousands of **smart DER**, and we lead the nation in leveraging **advanced automation** to maximise reliability and utilisation

We have a clear, **holistic long-term plan** for the network as it continues to transform. We **lead the industry** in **targeting investments** to deliver the **best long-term value for every dollar spent**

Our vision for 2030

Our network in 2030

In 2030, our network sits at the heart of the world's most **advanced**, **decentralised** and **dynamic** low-carbon energy system.

Our network is a true two-way platform, with more than 70% of premises having rooftop PV and the majority of the energy consumed by our customers produced from within the distribution network, meaning our assets are more highly utilised than ever before.

Across the state a number of newer housing developments and commercial precincts operate as local microgrids. Largely self-sufficient, these still rely on our network as a backup, and at times of energy surplus or deficit.

Regional South Australia has become a major supplier of low-cost clean energy to the state and the nation, and our rural network connects more than 600 MW of grid-scale wind and solar.

Although extreme weather events are more common, our network is more resilient than ever, highly segmented with advanced self-healing capabilities that mean our customers in 2030 experience fewer outages and faster service restoration.

Our network also connects thousands of EV charging stations in homes, car parks, shopping centres and service stations, supplying more than 2 GWh of additional energy every day to fuel the state's fleet of more than 350,000 EVs.

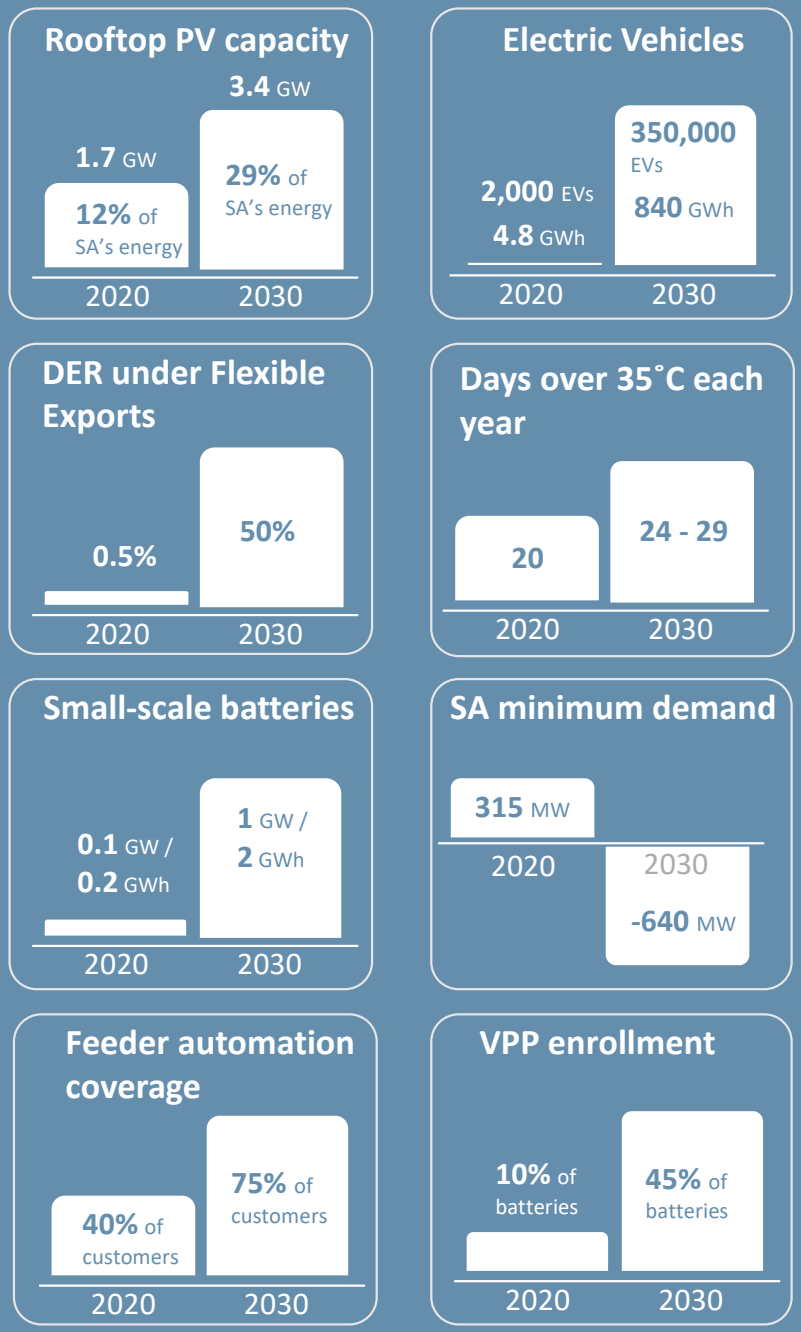
Our customers in 2030

South Australians in 2030 enjoy the **lowest energy prices** in Australia and are proud to live in a net-100% renewable electricity state. They **understand** our role, find us **easy to deal with**, and **trust** us to deliver a safe and reliable network that **meets their individual needs and those of the community.**

While we now supply some of our most remote customers using stand-alone power systems, the majority of our customers are more interconnected than ever before. They exchange energy easily over our network and are continually shifting and optimising load and generation in response to changing prices, enabled by smart homes and a rich and competitive market of energy products and services, including local schemes like solar gardens, peer-to-peer trading and community batteries.

Our customers engage more directly with us through new channels and have access to information that enables them to optimise their energy decisions. They value their relationship with us and the services we provide, and support and endorse our business through the regulatory process.

A decade of change



Our network in 2030

FUTURE NETWORK ARCHITECTURE
All new infrastructure built for 2-way flows
Increased resilience through greater network automation, segmentation and self-healing

NEW SYSTEM SERVICES
Enhanced network operations capabilities used to provide valuable system services
Advanced and fine-grained load & generator shedding capabilities for system security, including small-scale PV
Demand response

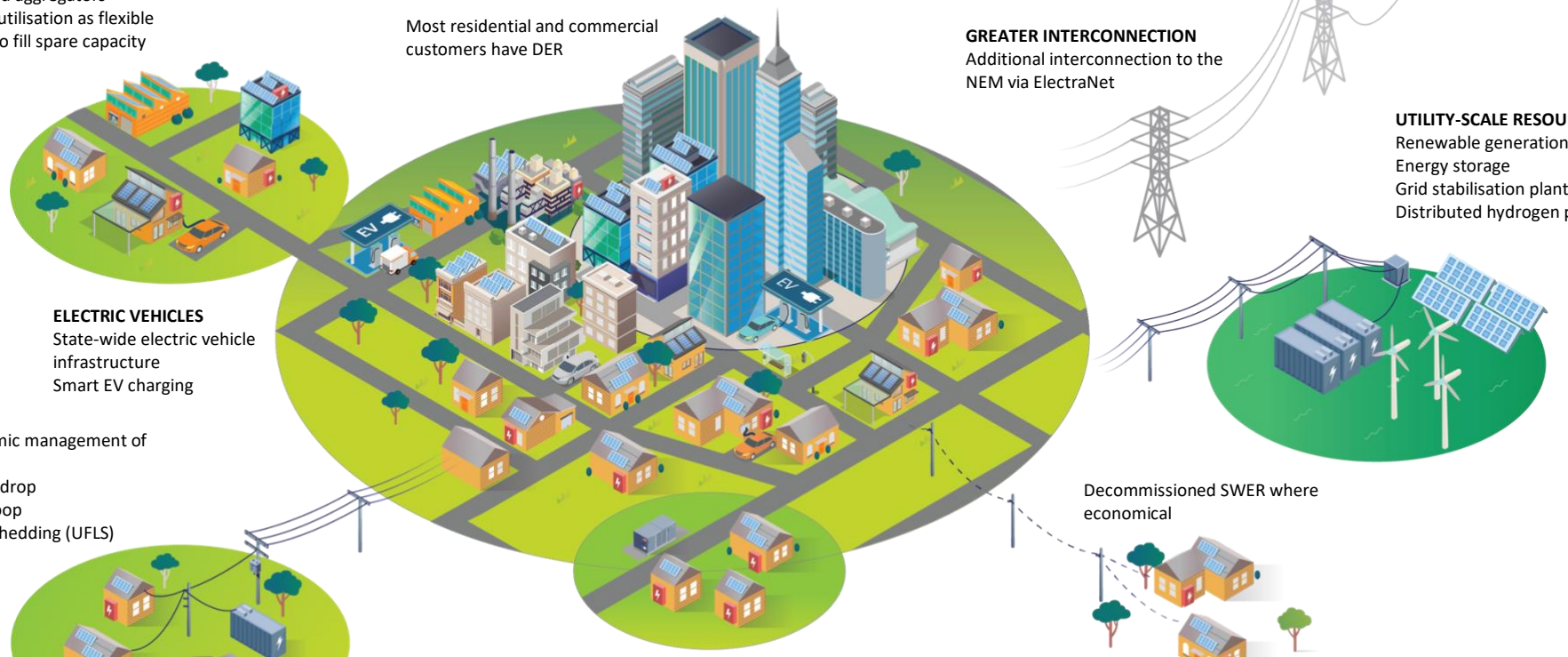
THE DIGITAL NETWORK
Physical network enhanced with digital overlay for planning and real-time visibility and control
Full LV network and DER model in Advanced Distribution Management System (ADMS)
Enhanced network visibility through third-party data sources

DER INTEGRATION
Flexible connection options for smart customer DER
Open APIs for DER registration, telemetry and operating envelopes
Active integration of VPPs and aggregators
Significantly increased asset utilisation as flexible loads and generators adapt to fill spare capacity

Most residential and commercial customers have DER

GREATER INTERCONNECTION
Additional interconnection to the NEM via ElectraNet

UTILITY-SCALE RESOURCES
Renewable generation
Energy storage
Grid stabilisation plant
Distributed hydrogen production



ELECTRIC VEHICLES
State-wide electric vehicle infrastructure
Smart EV charging

SMART SUBSTATIONS
Smarter substations enable dynamic management of two-way flows
Enhanced voltage control via line-drop compensation (LDC) and closed-loop
Enhanced under-frequency load shedding (UFLS)

Decommissioned SWER where economical

VIRTUAL POWER PLANTS
Hundreds of MW of residential batteries aggregated in VPPs

MICRO GRIDS AND COMMUNITY ENERGY
High-DER developments
Embedded networks, community batteries and community energy schemes

RURAL AND REMOTE AREAS
Fringe-of-grid customers supported via network-provided stand-alone power systems (SAPS)
Advanced protection systems reduce fire-start risks in high bushfire risk areas

The way we plan the network in 2030

By 2030 we have a clear, **holistic long-term plan** for the network as it continues to evolve and transform. We **lead the industry** in **targeting investments** to deliver the **best long-term value for every dollar spent**, and we consistently deliver on our work programs.

We no longer separate capacity planning from asset replacement, but rather take a whole-of-system approach to investment planning, building a program of asset investments that will deliver the best overall outcomes in terms of risk, reliability, network capacity (both downstream and upstream) and ongoing cost.

Every decision to add, repair or replace an asset is informed by a clear long-term 'master plan' for that part of the network as we progressively adapt our network for its role at the centre of the distributed energy system of the future.

Our planning functions are supported by a complete physical and electrical model of our network, as well as rich data sets and new tools and systems that enable us to clearly understand, model and forecast the condition and performance of our assets and identify the highest-value investments.

The way we plan the network is also more tightly integrated with our 5-year regulatory cycle. We continually track progress against our work programs and measure performance of our assets and the outcomes of our investments. That way we ensure that we are delivering on the plans we put to the AER in our regulatory proposal and the commitments we made to our stakeholders, and we build the evidence base for the investments we will put forward in the next period.

The way we operate the network in 2030

In 2030 we **operate** the most **flexible** and **dynamic** network in the NEM. Our operational systems **actively integrate** hundreds of thousands of **smart distributed energy resources**, and we lead the nation in leveraging **advanced automation** to squeeze the highest levels of reliability and capacity out of our network assets.

All our operational systems, whether managing switching, network access, supply restoration, voltage or DER, are more integrated, dynamic and automated. Our Advanced Distribution Management System (ADMS) sits at the centre of a suite of advanced applications used by Network Operations and accessed remotely by field crews. Underpinned by a detailed and accurate common network model used for both planning and operations, and rich real-time data from hundreds of thousands of monitoring devices on our assets and in customers' premises, these systems enable us to actively manage network capacity and performance in a world of highly dynamic two-way power flows.

Smart automation equipment deployed to cover more than 75% of customers provides enhanced automatic fault restoration and also new capabilities in remote network reconfiguration.

Our operational systems exchange data via secure real-time data interfaces, both upstream with AEMO and Electranet to help manage system-level performance and contingency events, and downstream to actively integrate hundreds of thousands of smart energy resources in homes, businesses and connected directly to our network. Smart inverters receive flexible export limits[11] for their local area, maximising their access to available hosting capacity. Microgrids, customer batteries, flexible loads and energy management systems are also able to optimise their behaviour to match network capacity and in response to other real-time data feeds such as price signals, storm warnings, system security events or maintenance notifications.

[11]Also referred to as 'dynamic operating envelopes'

Our people in 2030

In 2030 our people are **proud** to work for SA Power Networks. They are **multi-skilled**, **collaborative**, and **flexible**. Focused on **outcomes not tasks** and operating with a **customer mindset**, they understand and **support our vision and strategy**, and are **empowered with the tools and information they need** to plan, operate and maintain the future network.

Across all network business functions, whether it be planning, operations, systems, or works delivery, our people share a common vision and collaborate effectively to deliver the best outcomes for our customers and our business. Our workforce is more efficient and productive than ever, empowered by ready access to the information and data they need to make informed decisions and improved processes that eliminate duplication and rework. Our skills and competencies are continually improved and aligned with strategy through targeted training and development.

Safety of our people and customers remains our top priority. Technologies such as autonomous inspection vehicles and enhanced automation, remote monitoring and control of our assets have enabled us to reduce high-risk work activities such as driving, working at heights and operating in extreme weather or bushfire conditions.

Our business in 2030

Our **business** in 2030 is **engaged**, **respected** and **influential** in the energy sector. We are **key partners to Government** in delivering South Australia's energy vision.

In 2030, SA Power Networks is recognised as a world leader in the energy transition, having successfully managed the transformation of our network while consistently benchmarking as the most efficient and productive distribution network in Australia.

We deliver greater community value from the state's network assets than ever before, and we use our influence to lead positive change in the electricity sector for the benefit of South Australia, our customers and our shareholders.

"SAPN is the most advanced distribution network in the NEM in thinking strategically about the energy transition in the long term, and responding to high bidirectional flows in the short term." – Total Environment Centre[12]

[12]TEC submission to SA Power Networks 2020-25 regulatory proposal

Our network strategy

Our vision

A decarbonised, decentralised future enabled by a resilient, affordable and flexible network

A common approach to transformation

Build understanding
Develop a comprehensive understanding of our customers, our assets and our performance

Transform and optimise
Transform the network to provide an efficient, resilient, flexible platform for the future

Create new value
Create new value for our business and the community from new energy services

Our core strategies

Empower our customers

1 Understand our customers
- Agreed levels of service for network performance
- Embed links to customer outcomes in network planning and operations

2 Transform the customer experience
- Embed the Simplify, Personalise, Connect principles in network services
- Enhance connection processes

3 Enable new services & markets
- Empower customers with information and choice
- Enable SAPS, community energy, peer-to-peer
- Actively engage in national market reforms

Enable the energy transition

4 Understand the impact of new technologies
- DER data and modelling
- Network visibility and analytics
- Integrate DER into network planning

5 Enable the two-way network
- Optimise hosting capacity
- Activate smart DER
- Dynamically manage the network

6 The heart of the new energy future
- Transition to DSO and deliver new system services
- Integrate electric vehicles
- Support decarbonisation of the economy

A sustainable foundation

7 Optimise performance & risk
- Quantify asset risk
- Economic repex planning and forecasting
- Stakeholder consensus on future repex
- Understand impacts of climate change

8 Integrated asset management
- Improve repex execution efficiency
- Develop a network 'master plan'
- Integrate augex and repex planning

9 Maximise asset value
- Encourage electrification of transport and fuel substitution
- Attract new industrial loads and grid-scale DER
- Support decentralised hydrogen production

Key enablers

- Technology, digital and data
- Engaged and empowered people
- Excellence in delivery
- Industry leadership and influence
- A strong network of key partners

Empowering our customers

Empowering our customers begins with a deep understanding of the changing needs and expectations of our customers, so we can deliver the network services that customers value, now and in future.

Strategy 1: Understand our customers

- Deepen our understanding of customer needs through best-in-industry customer engagement
- Develop agreed levels of service for network risk and performance
- Embed line-of-sight to customer outcomes in all aspects of network planning, operations and asset performance

Strategy 2: Transform the customer experience

- Embed the customer service principles of *Simplify, Personalise, Connect* as we continue to evolve our network service offerings
- Continue to improve our network connection process and services to provide a more flexible, customer-centric connection experience
- Provide more convenient ways for our customers to engage with us on network services, and remove costs and delay from customer-facing processes

Strategy 3: Enable new energy services and markets

- Empower customers with information and choice in relation to network services
- Enable new energy services that customers value like stand-alone power systems (SAPS), community energy schemes and peer-to-peer trading
- Actively engage in policy and market reform to represent our customers' interests

Strategy 1

Understand our customers

Our customer engagement tells us that what most customers want from us is simply access to safe, reliable energy at an affordable price. Although the electricity system is evolving and becoming more complex, this basic premise will remain true, and we must not lose sight of this.

The emergence of new technologies and the falling cost of distributed energy resources will, however, present customers with new choices and options in the coming years, and broader societal changes and new ways of doing business will shift customer expectations in terms of the services they receive from us:

- customers may demand a more personalised service tailored to their unique needs;
- in a changing climate, customers may place increasing value on network resilience, not just reliability;
- customers will expect to be able to install a range of distributed energy resources and smart appliances, and use these to their full potential to get the best payback on their investments;
- customers in regional and remote areas, and areas that have historically experienced lower than average reliability, will expect to see progress made in improved service levels; and
- vulnerable customers will need confidence that they are not being left behind in the energy transition.

South Australians may place increasing importance on carbon emissions reduction, reflected not just in the choices they make in their own energy use and the take-up of electric vehicles, but in an increasing expectation that the businesses they deal with have strong environmental policies in place.

Building on our established customer engagement program, relationships and reference groups we will deepen our understanding of what our customers, community and stakeholders need and expect from our network service, across all customer groups and demographics including residential and business customers, large commercial and industrial customers, and those seeking to connect new grid-scale energy resources such as solar, wind and storage. We will translate this understanding into tangible, measurable goals and we will:

- develop agreed customer service measures for the network (e.g. safety, reliability, DER export capacity, quality of supply, etc.);
- understand expected levels of service for each of these measures, and willingness to pay for improvements;
- automatically capture and track these customer service measures, and;
- openly and transparently report performance to build understanding and trust.

We will build a clear line-of-sight between these levels of service, the performance of our assets, and operational delivery. This will ensure that we maintain or improve the aspects of asset performance and operations that deliver the service outcomes our customers value.

We will also build a deeper understanding of customers' uptake and use of distributed energy resources and smart appliances, to ensure that our network provides the capabilities they need, and we can support them with information to make informed choices when investing in their own energy resources. This includes developing a DER database, and enhancing it over time to include electric vehicle chargers, home energy management systems and smart appliances.

Strategy 2

Transform the customer experience

Our goal is to make it easy for the South Australian community to access cheap, abundant, reliable, low-carbon energy. The distribution network, and how it is planned and operated, forms a core part of our customers' experience of the state's energy system. We want to be easy to deal with, and to empower our customers with choices and information that they care about and can engage with. We will do this by embodying the Customer Strategy principles of *Simplify, Personalise, Connect* in all our customer-facing network services.

We will **simplify** the customer experience by streamlining new and existing connections services. This will include a re-design of the connections process from a customer and user-experience perspective, and enhanced connections processes for both small-scale DER and large connections. We will improve this end-to-end process flow through redesigning supporting systems such as our DER database and customer portal.

We will **personalise** the customer experience by being more flexible with our network service offerings. With an increasingly diverse and active customer base, we will need to provide customers with more options in terms of the service they receive from the network, tailored to suit customers with differing needs, such as:

- business customers with lower tolerance for outages vs. residential customers with less willingness to pay for higher reliability;
- customers who want to use their solar and/or battery primarily for self-consumption vs. those who want to export energy or participate in a VPP;
- commercial and industrial customers seeking to install large-scale DER vs small customers; or
- customers who prefer a "set-and-forget" service vs. highly active prosumers.

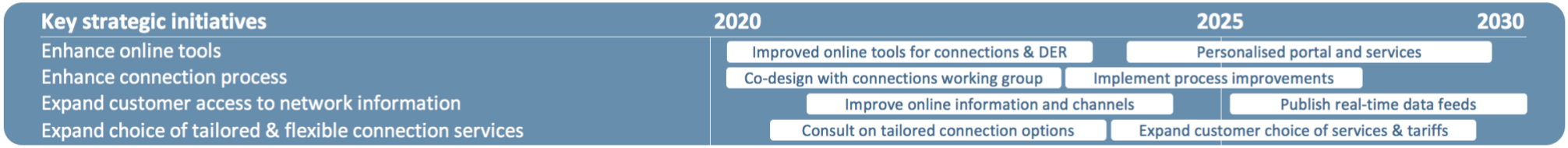
Building on our improved understanding of network performance and customer needs, we will provide high quality, timely information through multiple channels that customers can understand and use. We will develop new online tools to give customers visibility of the hosting capacity of the network in their area, and for commercial and industrial customers to explore the best places to connect grid-scale DER or new loads such as data centres, highway EV charging stations or hydrogen production plant. We will provide timely and accurate outage and supply restoration notification through multiple channels, and we will publish real-time data feeds that customers' smart DER can respond to.

We will **connect** with our customers by enhancing customer engagement, experience and outcomes, bringing our network 'closer to customer.'

We will build skills and knowledge in our call centre and customer-facing roles so that we can provide trusted, independent advice. By empowering our residential, commercial and industrial customers with information we can help them better manage their energy needs and make the most of their network connection to meet their individual goals, whether to reduce their energy bills, support their local community, achieve greater self-sufficiency or minimise their carbon footprint.

We will engage our customers throughout our Regulatory Reset journey to ensure our regulatory proposals are aligned with customer expectations, and we will seek opportunities to embed consultation with our customers and reference groups into our network planning and decision-making processes.

By openly sharing information with our customers and listening to their needs we will build trust and deepen customer understanding of our role in the energy sector, our network, the services we provide, and our vision as a leader in decarbonisation, so our customers are our advocates through the regulatory process.



Strategy 3

Enable new services and markets

As the energy market evolves in the coming decade, customers will have new opportunities to trade surplus energy and energy services in new markets outside the NEM, such as community energy schemes, community batteries, solar gardens or new peer-to-peer trading platforms.

Our strategy is to take a proactive rather than a reactive approach to change and leverage our core capabilities and network assets to become a leader in the transformation of the energy sector. We will:

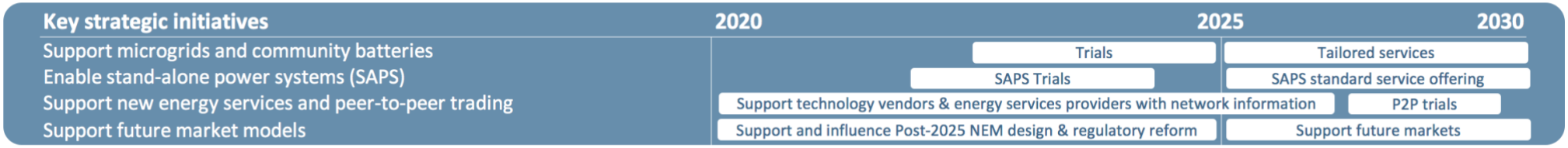
- seek to remove barriers to the emergence of new markets, including advocating on our customers' behalf for any regulatory reform required to enable them;
- work with the community to ensure that our network can support and enable these new uses;
- align our standards, rules and processes to make it easy for customers to take up new network service offerings;
- support local trials of innovative energy schemes where there is clear value in doing so, and act as a conduit of information for South Australia to learn from trials in other states and internationally; and
- position to be an active facilitator of these future markets.

We will continue to actively engage with aggregators, VPP operators, technology vendors, the solar industry and the retail sector through our industry reference groups and other forums so we can support them with the network services and data they need to develop a rich, open and competitive marketplace of innovative energy products and services for South Australian customers.

> *"I have been thoroughly impressed by SAPN's dedication and commitment to true engagement with industry and community..... it is evident that genuine engagement is highly valued and that SAPN is actively encouraging and taking on board feedback and recommendations arising from these forums" - Mike Stone, Clean Energy Council, Solar Industry Reference Group chair*

In future, larger customers, customers at the fringe of the grid, and customers with non-standard connection requirements will have credible alternatives to a grid connection. We will need to understand their present and future energy needs and be ready to support them with tailored connection options or stand-alone power systems (SAPS).

We will continue to engage actively in the policy debate around the broader evolution of the National Electricity Market, the development of new markets at the distribution level and related reforms under consideration such as 'multiple trading relationships.' We are in a unique position in South Australia at the forefront of the energy transition, and we will draw on our experience and expertise to help guide market reform and ensure that the interests of our customers and the South Australian community are represented in the development of new market mechanisms and policies that affect them.



Enabling the energy transition

Enabling the energy transition is about transforming our network and the services we provide to adapt to our new role at the heart of South Australia's low-carbon, distributed energy future.

Strategy 4: Understand the impact of new technologies

- Improve DER records through electronic registration and data analytics
- Implement a network visibility and analytics platform
- Model the Low Voltage (LV) network
- Enhance network planning capabilities to consider minimum demands, reverse power flows and DER operating scenarios

Strategy 5: Enable the two-way network

- Enhance DER integration, from passive measures like technical standards and tariffs, to flexible exports and active integration of smart DER
- Lead positive reform in network access and pricing regulation
- Coordinate management of DER for system security
- Actively manage voltage across the network

Strategy 6: Network at the heart of the new energy future

- Transition to DSO and actively integrate with VPPs and aggregators
- Integrate electric vehicles
- Investment in hosting capacity enhancements
- Leverage our network assets and capabilities to deliver new services to system-level markets
- Support decarbonisation of the economy

Strategy 4

Understand the impact of new technologies

To plan and operate our network effectively in future we will need to model the impact of new energy technologies and services at a range of time horizons, from long-term planning to real-time operations. This in turn will require more complete, timely and accurate data. In the next decade we will:

- enhance our capability to collect and maintain accurate information on installed DER, firstly by enabling and encouraging smart DER to register automatically with our systems via the internet, and secondly by the use of advanced analytics on smart meter data, aerial imagery and other data to infer the characteristics of DER at customer premises;
- build a complete, maintainable model of our LV network through targeted field audits, the deployment of field data capture tools and the transition to digital LV switching;
- use advanced analytics to 'profile' the network using a variety of data sources;
- integrate forecasts for a broad range of small and large-scale DER in our planning process, including solar, battery storage, VPPs, EV uptake, the progressive 'smartening' of controllable loads such as air conditioners, water heaters, pool pumps and industrial processes, and emerging technologies such as distributed hydrogen production;
- plan for a broad range of scenarios to understand how best to target investments for maximum flexibility and optionality through a period of uncertainty and change. Electric vehicles, in particular, have the potential to grow very rapidly in Australia once price parity with internal combustion engines is reached in the mid-2020s, as there is considerable pent-up demand in the Australian market. Some potential aspects of the transition to EVs, such as the prevalence of Vehicle-to-Grid (V2G) or shared mobility, are difficult to predict but could have material grid impacts;
- build a whole-of-network hosting capacity model, from substation to LV, in the ADMS. This will be a core capability underpinning future scenario planning, real-time operations, flexible exports and the provision of network capacity maps and forecasts to our customers; and
- achieve visibility of the dynamic state and performance of our LV network through LV switching management, and by implementing a network visibility and analytics platform to integrate data from third-party smart meters and DER, complemented by targeted deployment of low-cost monitors on transformers and other assets.

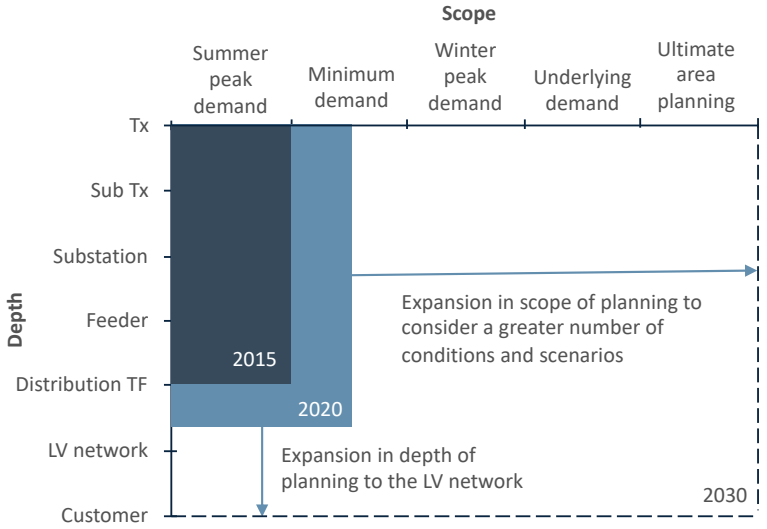


Figure 9 – Increased scope and depth of network planning in a 2-way network

Key strategic initiatives	2020	2025	2030
Accurate DER records		Electronic registration; Data analytics	
Model the network	LV constraint model	HV/LV NOM & ADMS LV switching	Whole network hosting capacity model
Capture LV network asset data		Opportunistic data gathering; Targeted field audits	
Build diverse data platform and tools	Trials	Data platform and sources; Embed diverse data in operations and planning	
Advanced forecasting & analysis tools for network planning		Model DER and EV uptake; Enhanced tools for scenario analysis	

Strategy 5

Enable the two-way network

There is tremendous latent capacity in our network assets that can be unlocked through more active and dynamic management of voltage and power flows. At the core of our network strategy are a range of strategies to achieve this.

We will continue to be industry leaders in the active integration of flexible DER with our network, by:

- actively supporting the development of new DER standards like IEEE2030.5 to encourage a rich ecosystem of smart, connected and grid-aware DER;
- providing a secure, standards-based web interface (API) through which DER will self-register, provide telemetry such as local voltage readings, and receive dynamic operating envelopes. While the initial driver will be the management of DER exports within available hosting capacity and system security limits ('flexible export connections'), future applications will include the publication of maximum demand profiles to flexible loads such as EVs;
- leveraging our new API to provide a more sophisticated and lower-cost option than traditional SCADA for integrating grid-connected DER, opening the market for mid-scale systems where the cost of SCADA is a barrier; and
- engaging with DER aggregators and others to maximise the opportunity for DER to support the network, e.g. via locally optimised Volt-VAr response curves.

"SAPN is proceeding with introduction of flexible export capability as part of their regulatory determination for 2020-25, and AEMO strongly supports this program" - AEMO[13]

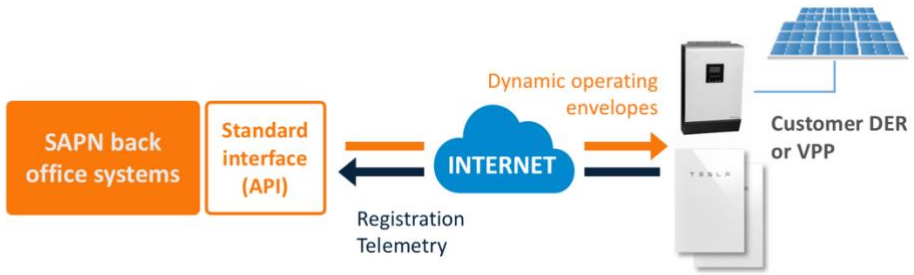


Figure 10 – Integrating smart DER via standards-based API

We will continue to enhance our capability for dynamic voltage management within the network. This will enable:

- increased export hosting capacity, by dynamically compensating for voltage rise due to embedded generation;
- targeted voltage reduction to manage peak demand events and potentially reduce losses; and
- emergency voltage raise to curtail DER output during minimum demand contingencies.

We will progressively enhance and integrate the operational functions of switching (including at LV), network access, fault restoration and voltage and thermal capacity management to enable the Network Operating Centre (NOC) to perform holistic, end-to-end optimisation of network performance using all available tools and informed by a common platform for network visibility.

We will continue to actively engage in regulatory reforms that recognise the two-way nature of the network in the rules, support and incentivise efficient network investment in hosting capacity, and enable future two-way network tariffs.

Key strategic initiatives	2020	2025	2030
Flexible connections and active DER integration	Flexible exports trial	Flexible exports rollout	Flexible load connections
Enhanced voltage management (EVM)	EVM for hosting capacity	Closed loop voltage control	
Manage DER for system security	Simple DER curtailment	Advanced DER management for system security	
Access and pricing reform	Access & pricing rule change	Develop new tariffs	2-way tariffs / DER STPIS

[13] AEMO, *Minimum Operational Demand Thresholds in South Australia Review*, 2020

Strategy 6

Network at the heart of the new energy future

As the broader energy system transforms and decarbonises over the next decade, we will expand our role to a become an active **Distribution System Operator (DSO)**. In so doing we will create additional value from our network assets for our customers, the South Australian community and the energy market, both as an active enabler of services provided from DER, and by providing new services from the network.

We will enable DER and DER aggregators to participate in the future energy and services markets to the fullest extent possible, by:

- actively integrating with grid-scale DER operators, VPPs and other aggregators to give them accurate local forecasts of available network capacity and enable them to operate with confidence within the technical limits of the network as they bid services into the market;
- maximising DER access to available network capacity through dynamic operating envelopes;
- playing a critical role in coordinating energy flows across the distribution network and at connection points with the transmission network;
- engaging actively with Electranet and AEMO to coordinate on upstream voltage regulation, DER integration and whole-of-system performance;
- offering innovative network access services, including enabling customers to share or trade capacity with aggregators or one another;
- leveraging API or SCADA interfaces to facilitate DER participation in central dispatch; and
- building the case for targeted investment in increased DER hosting capacity in our 2025 and 2030 regulatory proposals in line with customer expectations.

We will also consider opportunities to leverage our new network operational capabilities to provide new services to the broader system directly, where this is efficient and allowed under the National Electricity Rules, including:

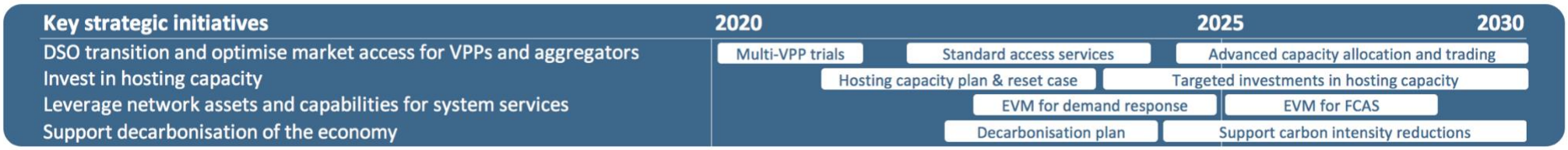
- providing frequency regulation and system-wide demand reduction services, e.g. Reliability and Emergency Reserve Trader (RERT) or equivalent, using our voltage control and DER management capabilities;
- supporting AEMO and the SA Government in contingency situations through targeted shedding of load or generation using our DER interface, as well as enhanced under-frequency load shedding and new capabilities such as emergency network voltage raise or lower; and
- new capabilities to support system-wide resilience, such as system restart support and local islanding.

We will actively integrate new flexible loads with our network, in particular electric vehicles and smart charging infrastructure as the transport sector electrifies.

We will continue to engage in the evolution of the NEM at a policy level, to support reforms that will help enable the integration and co-optimisation of active resources connected to our network.

As the imperative to de-carbonise the state's economy becomes more urgent, we will support this as a key enabler of low-carbon technologies such as solar and electric transport, as well as by proactively reducing the carbon footprint of our network and our business – a low carbon network for a low carbon future.

We will build community trust by engaging openly on our decarbonisation plans, and we will advocate for greater support from the AER with regard to networks' response to climate change where this is supported by our customers.



A sustainable foundation

A sustainable foundation means ensuring we can continue to provide a safe, resilient and affordable platform that supports customers' future energy needs in an environment where investment is constrained and risk is increasing.

Strategy 7: Optimise performance and risk

- Enhanced understanding of asset condition and performance through new data capture tools, advanced analytics and new inspection strategies
- Quantify risk for all assets
- Understand impacts of ageing assets and climate change on reliability and bushfire risk
- Transition repex planning and execution to align with economic principles
- Build AER and stakeholder consensus on efficient repex spend

Strategy 8: Integrated asset management

- Improve repex execution capability and efficiency
- Shift from an 'asset focus' to a 'risk and service performance' focus
- Holistic augex/repex planning and network 'master plan'
- Integrate day-to-day investment decisions with reset process
- Enhance resilience through segmentation and feeder automation

Strategy 9: Maximise asset value

- Actively encourage new commercial/industrial loads and grid-scale DER
- Support and accelerate the transition to electric vehicles
- Explore opportunities for distributed hydrogen production

Strategy 7

Optimise performance and risk

To maintain an acceptable level of network performance and risk into the future with an ageing network we need to:

- optimise how we target asset replacement expenditure; and
- consult and build consensus with our stakeholders and the AER as to what is a prudent, efficient and sustainable long-term repex trajectory.

To do this we will need to enhance our understanding of the factors influencing network performance, e.g. the root cause, location and frequency of failures, and the factors influencing the consequences and the impacts on customers and the community when failures occur. We will:

- build systems and processes to **automatically capture, analyse and report on performance data** such as reliability, safety and DER hosting capacity at all layers in the network;
- develop the capability to **model and forecast condition and risk for all assets**, not just those that can be physically inspected or have observed defects. This will involve capturing granular condition information for each asset and developing new risk models that can be applied consistently across all asset types, which consider both the probability and consequence of failure across a range of failure modes; and
- **model climate risks** including extreme weather, fire damage and bushfire-start risks.

We will use real-world performance to calibrate the models and improve the accuracy with which we can predict failures for specific assets or asset families. This will enable us to perform "what-if" analysis to understand the implications of different investment strategies on risk levels and network performance.

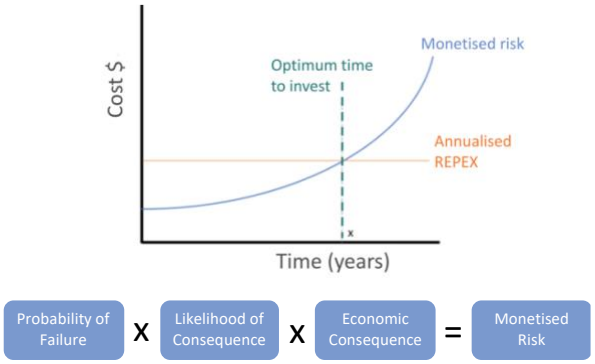


Figure 11 – Economic approach to quantifying risk, based on AER 2019 guideline[14]

We will adopt a new framework for valuing investment and forecasting asset expenditure based on economic principles and the management of monetised risk. This will require us to close gaps in our understanding of the network through:

- the use of new field tools like the Asset Activity Tool to capture the precise location and cause of failures, record work undertaken on the network and opportunistically capture asset condition as part of all jobs;
- new asset inspection strategies to target inspections based on risk, and leverage new techniques and technologies like autonomous vehicles;
- analysis of data from online condition and performance monitoring equipment, low-cost sensors and third-party data sources; and
- Undertaking a program of 'data foundations' initiatives, aimed at ensuring the capture of required asset data at each stage in the asset lifecycle, and aligning electrical and physical models of the network.

Finally, we will need to understand the broader risk appetite of our business, our community and our owners as it changes over time, and ensure our investment strategies align.

Key strategic initiatives	2020	2025	2030
Improve understanding of asset condition	Asset activity tool	New inspection strategies & analytics	Enhanced inspection regime & methods
Model asset performance and risk	Build risk & performance models	Embed into operational decision making	
Manage climate & bushfire risk	Model climate risks	Climate & bushfire risk mitigation strategy	
Sustainable investment strategy	Stakeholder engagement	Build long-term repex plan	Transition to sustainable investment

[14] AER, *Asset replacement planning*, Industry practice application note, January 2019

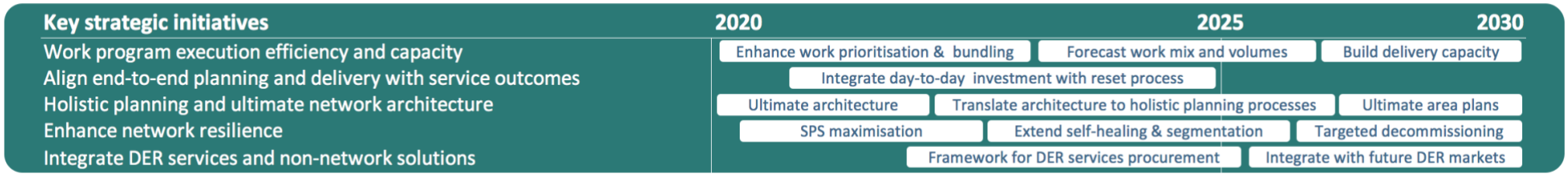
Strategy 8

Integrated asset management

Managing our changing risk profile and customer needs will require significant changes in the way we approach planning and execution of network investment. In the next decade we will:

- **enhance the capability, capacity and efficiency of our capital work program execution** through improved work prioritisation and bundling, more effective forecasting of work volumes and the mix of jobs for our field crews and by actively building the capacity we will need to deliver our long-term asset investment strategy;
- build **flexibility and agility** into our investment planning and works delivery processes to ensure we can adapt effectively to changing circumstances;
- **improve capital governance.** Better linkage between the regulatory reset process, network planning and works delivery will ensure that the plans we take to our regulatory determinations are consistent with our internal approach to annual planning/budgeting and day-to-day investment decision making;
- **shift from an 'asset centric' to a 'service performance outcome' approach to network planning**. Our plans will need to be underpinned by a consistent, data-driven investment framework supported by stakeholders and accepted by the AER, in which all investments are framed in terms of what they deliver to customers and how they contribute to levels of service;
- take **a holistic approach to investment planning** that considers both the capacity (augex) and the condition (repex) of our assets, as well as broader market benefits and opportunities for 'value stacking'. We will also need to consider the value of optionality in a time of rapid change, to better weigh the merits of non-network solutions vs. investment in long-lived assets;
- **develop a 'master plan'** to ensure every investment made – whether in planned work or in response to asset failure – is a move towards the optimal long-term size and function of our assets. This may be a combination of specific, locational plans in combination with general rules and standards like conductor sizing or smart equipment. This plan will consider the network in context as the centre of a dynamic and interconnected system, taking into account the long-term integration of primary infrastructure, non-network solutions and intelligent secondary systems. It may even identify opportunities to actively downsize parts of our network, using non-network solutions or mobile assets to manage extreme peaks and troughs in lieu of permanent network capacity; and
- **continue to transition to a safer, more resilient network architecture** to mitigate the impacts of our ageing assets and climate change, capture incentive scheme benefits and improve key benchmarks. This will include expanded use of feeder automation and segmentation, and targeted investments to harden the network against key risks such as fire start. Greater asset monitoring and data analytics will enable us to detect actual and impending faults, including asset failures and customer safety risks such as degraded neutrals.

During the 2020-30 period it may become economical to decommission some of our assets. We will therefore need to model the cost to serve customers on each segment of our network and determine an appropriate transition pathway for areas that are candidates for decommissioning. Trials of stand-alone power systems and microgrids will help us understand how to manage the risk of future changes to energy needs (e.g. EVs) for customers taken off-grid.



Strategy 9

Maximise asset value

As efforts to reduce carbon emissions accelerate in the next decade, electricity will progressively displace fossil fuels as the fuel of choice for a broad range of applications. In combination with the continued increase in daytime reverse power flows due to rooftop PV, these changes will drive a significant increase in the amount of electricity flowing through the distribution network.

While the most significant opportunity will be the transition to electric vehicles, opportunities for fuel substitution will arise in commercial and residential space heating, water heating (reversing the trend away from electricity to gas in the residential sector) and the conversion of some energy-intensive industries. The increasing abundance of cheap renewable energy at certain times will also create new opportunities for those businesses that have a high degree of flexibility to ramp their energy use up and down, such as large data centres or certain industrial processes, potentially attracting new industries to the state.

Our strategy is to encourage new applications for grid-supplied energy, to maximise the capabilities of our distribution network in supporting them, and to put in place appropriate incentives and controls to encourage efficient use of the network.

We will also actively support those seeking to connect new grid-scale renewable generation, storage and emerging technologies like small-scale distributed hydrogen generation plant.

We will **use price signals and flexible connection arrangements** to encourage new loads and generators to operate outside of peak times so we can 'fill the trough' and activate the very significant latent capacity in our network. As well as improving our utilisation benchmarks, this will amortise the cost of the network over a much higher volume of delivered energy, reducing unit costs for all.

We will **actively encourage the transition to electric vehicles**, by:

- ensuring that our network is both 'EV ready' and 'EV friendly' with respect to capacity, connection processes and pricing;
- actively supporting councils, SA Government and private enterprise in the rollout of EV charging infrastructure;
- 'modelling the way', by maximising EV use within our own fleet; and
- publicly advocating for policy change to stimulate EV uptake.

We will **actively encourage new large-scale commercial loads and generators to connect to our network**, by streamlining connection processes and publishing maps of least-cost locations from a network connection perspective.

We will engage with the SA Government's hydrogen strategy and actively explore opportunities to use our network to facilitate distributed hydrogen production.

Finally, we will build a greater understanding of emerging opportunities for **fuel substitution** and support customers seeking to switch from fossil fuels to electricity.

Key enablers

The successful delivery of our network strategies will depend on certain core capabilities and strategic initiatives being pursued in other areas of the business, captured in other key business strategies such as our Digital Strategy and People Strategy. The sections that follow outline some of these key enablers and how they will support, and be supported by, the Network Strategy.

Technology, digital and data

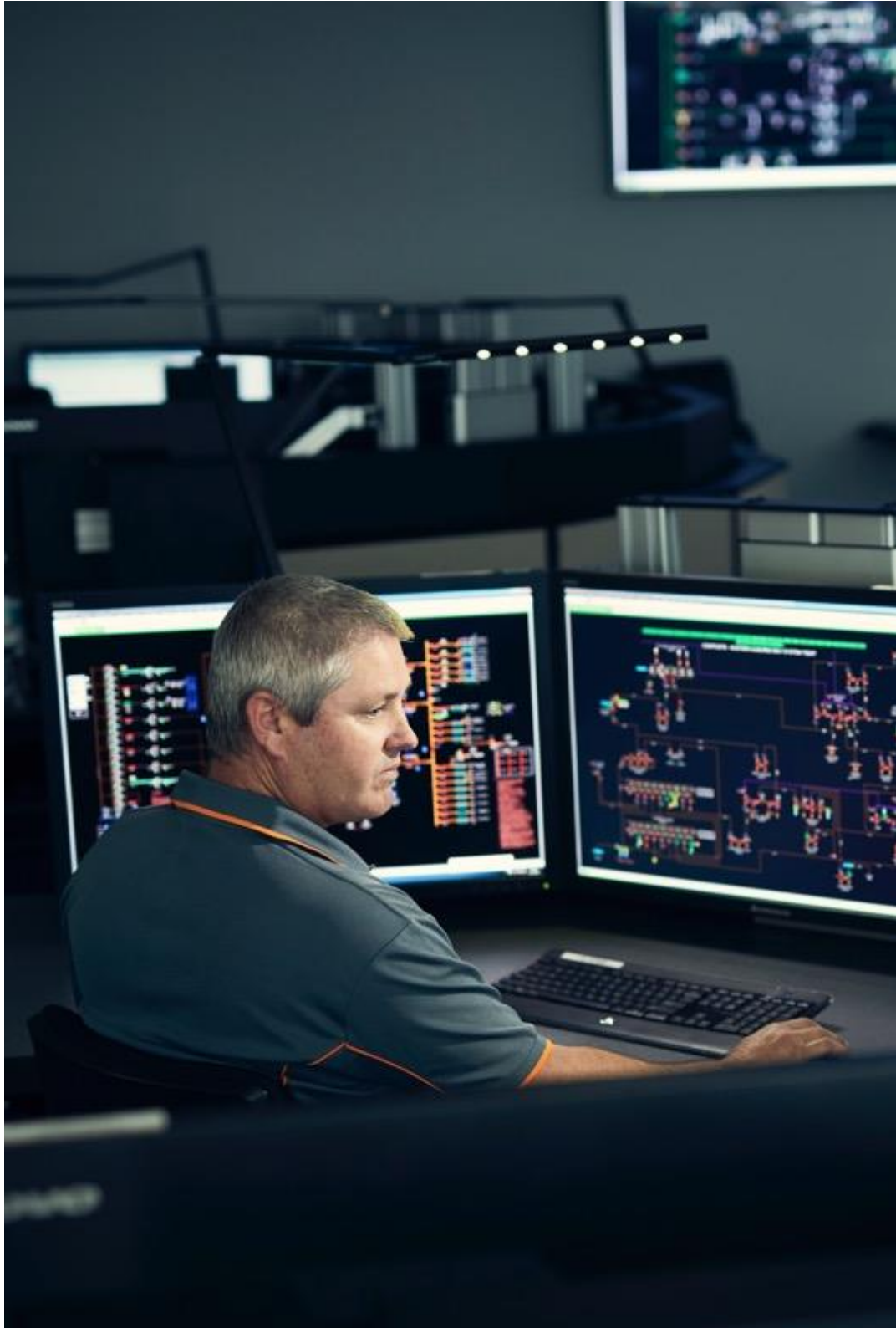
A key enabler underpinning all our network strategies is the increasing digitalisation of our network and our business. While the physical network of poles, wires and transformers will look much the same in 2030 as it does today, in 2030 the physical network will be enhanced with a digital overlay of sensors, data analytics and automation. This will activate traditionally passive assets and enable us to deliver much greater capacity, reliability and value from our network than we can today.

We will move to smart, online field equipment as standard wherever possible, and expand visibility across the network through use of new low-cost sensors and communications channels, supplemented with data sourced from third parties and the use of analytics and modelling to bridge data gaps.

We will develop a whole-of-system architecture for the digital systems that support the network. Our core operational and asset management systems of GIS, ADMS and SAP will be enhanced through greater integration and the addition of new capabilities, including: a DER management system (DERMS) within the ADMS; a new data and analytics platform to process high volumes of data from smart meters, DER and new network monitoring devices; and new risk modelling and investment prioritisation tools. These systems will share a common ‘single source of truth’ data store that holds richer and more accurate data for asset condition, risk and performance than we have today, overlayed with a complete (LV and HV) Network Operating Model. This ‘digital twin’ of our physical asset will be continually improved by data captured in the field during every work order undertaken.

Data itself will become a key business asset to be managed and maintained through its lifecycle. Ready access to high-quality, timely and accurate data, enhanced with sophisticated data analytics, will empower our teams with new insights and tools for data-driven decision making.

We will build on the ‘embedded IT team’ model pioneered in our recent trials to ensure that our data and digital strategies, architecture and IT resources are well aligned with the Network Strategy and are focused on our highest-value challenges and opportunities.



Engaged and empowered people

The key to the successful delivery of the Network Strategy will be a workforce that is committed to a shared long-term vision for our business. Our people will need to be **engaged** with our customers and what is important to them, **empowered** to make decisions and to have the courage to lead and innovate, and **enabled** with the tools, information, trust and support that they need to succeed.

If we are to increase productivity in the next decade we will need to break down silos and build a culture that focuses on customer outcomes in all the work we do and every decision we make. Our workforce will need to adapt to take on new skills, supported by training to ensure they stay ahead of the technology curve and understand the changing energy system and our customers' changing needs. Our people will become more multi-skilled, as changing technology erodes the traditional boundaries between IT and OT, and asset planning and network operations. Flexibility, curiosity, collaboration and an eye on the big picture will be highly valued.

Excellence in delivery

We will strengthen our portfolio management capability, processes and tools to ensure that our work program is consistently delivered as planned. We will continually track progress against the capital expenditure profile in our regulatory determination, while also building flexibility into our planning and delivery processes so we can respond and adapt as circumstances and priorities change.

To prepare for future levels of investment we will also need to build capacity in our field workforce. We will need to consider the changing nature of our works portfolio and plan for the mix of skills and capabilities that will be required in future.

We will pursue a new model for works delivery that significantly increases the flow of information between field personnel and the network management team. Providing field staff with more insight into the intent behind the forward work program will empower them to be more flexible and innovative in bundling, planning and executing tasks, leveraging local knowledge and expertise to deliver the highest value work more efficiently. This will reduce re-work and repeat visits to the same site and maximise the value achieved from every hour spent working on our assets.

Information flows in the reverse direction will be equally important; as well as the continuous capture of asset condition data from the field, greater access to the local knowledge and expertise of our field crews will help to refine and improve network planning, risk management and work scheduling processes to align more closely with field work practices and delivery methods. It will also create opportunities to enhance construction designs to increase delivery efficiency and reduce risk and cost.

Industry leadership and influence

In the last five years SA Power Networks has become recognised as a leading thinker and innovator in the electricity sector when it comes to managing the energy transition. Our opportunity now is to build on this reputation and use it as a platform to influence positive change in the sector.

> *"Tesla strongly believes that SAPN is leading the way when it comes to innovative approaches to better enabling DER" – Tesla*[15]

We will be proactive, with the courage to propose and lead positive changes to industry standards and the National Electricity Rules that align with our long-term vision, rather than accept the status quo. Our focus will be in key strategic areas such as network access and pricing regulation, benchmarks, future distribution market models, DER standards, replacement expenditure, access to smart meter data and climate change.

We will continue to 'model the way' and make our network the reference implementation for new capabilities and approaches through consistently delivering high-profile, well-targeted technology pilots and trials and sharing our experience actively and openly with key stakeholders and influencers.

Our regulatory strategy and our industry-leading stakeholder engagement program will be vital in building and maintaining understanding, trust, support and advocacy with key stakeholder groups, from our customers to the regulator. Our customers and the SA community can be our most powerful ally and advocate, especially in the regulatory reset process, if we involve and engage them in issues and decisions that affect them.

[15]Tesla submission to SA Power Networks 2020-25 regulatory proposal

A strong network of key partners

In the coming decade, the technical, operational and regulatory environment in which we operate will continue to become more complex and more interconnected as the role of the distribution network changes and expands. The skills and capabilities we require to succeed will be different from in the past, and it will not make sense to develop all of them in-house. Navigating this future will require a greater level of co-ordination and collaboration with external parties if we are to achieve our strategic objectives.

In the next five years we will focus on building and developing our most important strategic partnerships, with key vendors, consultants and technology providers, the SA Government and the renewable industry. We will also actively partner with Energy Networks Australia and other DNSPs to advance common industry positions on regulation, technical standards and the future role of networks.

> *"We are actively supporting further improvements to inverter standards, including moves toward dynamic management capabilities such as those used in California and drawing on international standards. SA Power Networks has taken a leading role in that work." – Clean Energy Council*[16]

We will continue to seek opportunities to leverage external funding sources such as the Australian Renewable Energy Agency (ARENA) or SA Government grants to multiply the value we can achieve from our internal innovation budgets. We will work with other DNSPs to avoid duplication in our pilots and trials, and we will take a disciplined approach to engagement, seeking opportunities to partner with the highest-calibre academic and industry partners and targeting our resources to projects that fill specific knowledge gaps or advance key aspects of our strategy.

[16]CEC submission to SA Power Networks 2020-25 revised regulatory proposal

Delivering the network strategy

The intent of the Network Strategy is to set the overall strategic direction and vision for our network, and to provide an enduring set of high-level strategies for the next decade.

A companion document, the *Network Strategic Plan*, will be developed to capture and plan in more detail the specific projects and initiatives that will give effect to these strategies and embed them into the business.

Figure 12 below shows the proposed governance structure, in which the delivery of the strategy is managed under two primary work programs, Asset Management and Distributed Energy Transition. Each program will have one or more dedicated Program Managers to provide oversight, ensure alignment between complementary projects, and report up to the program Steering Committee and PMO as appropriate. The assignment of projects, owners and steering committees will be set out in the *Network Strategic Plan*.

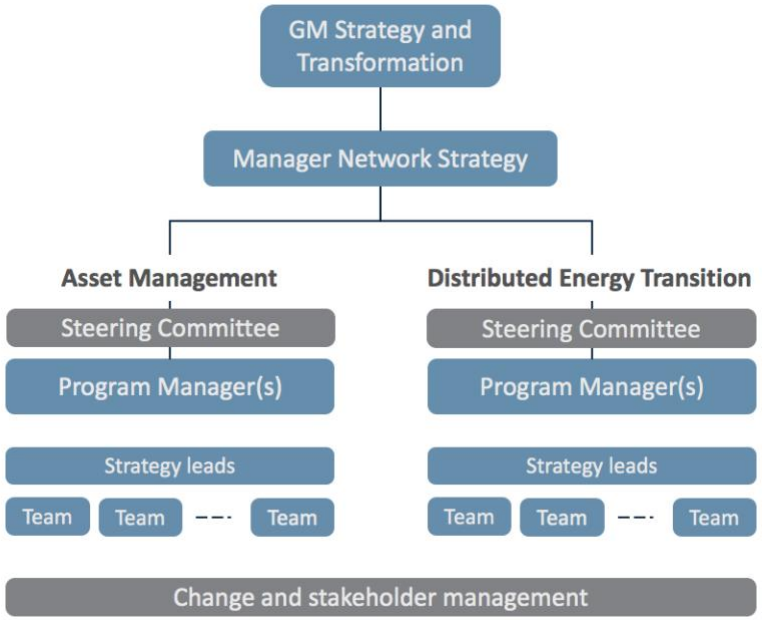


Figure 12 – Strategy delivery governance

Individual strategic initiatives within the two work programs will be delivered by cross-functional teams from across the business. Most initiatives will follow the transition pathway illustrated in Figure 13, with research, strategy, pilots, trials and early works led from within Strategy and Transformation and a progressive transition of ownership to the relevant group within Network, Field Services or Customer and Community for those initiatives that are intended to deliver business-as-usual tools, services and capabilities.

To ensure that the strategy and plan remain aligned with broader corporate strategy and our regulatory reset goals as circumstances change, the Network Strategy will be reviewed twice in each regulatory period, while the Network Strategic Plan will be refreshed annually.

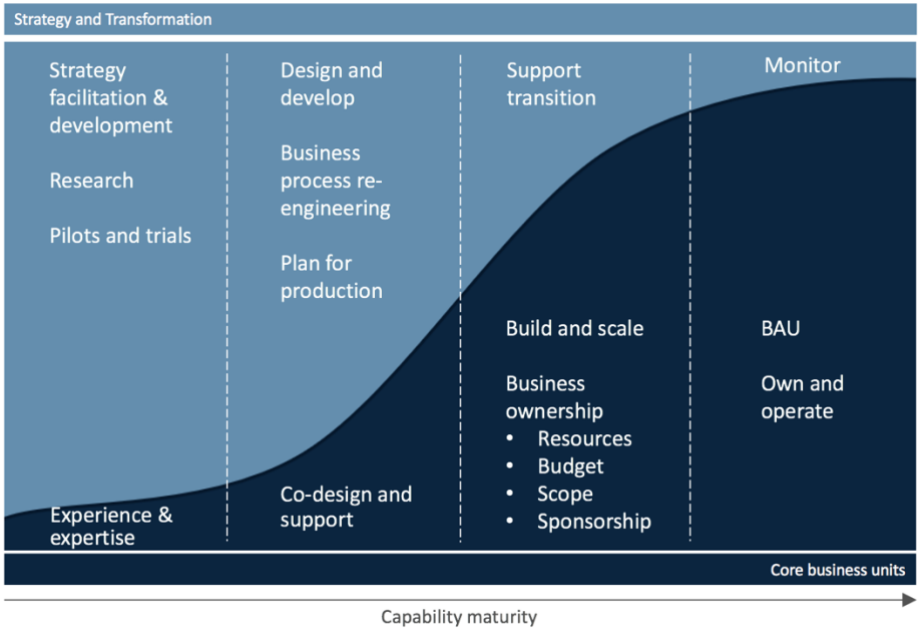


Figure 13 – Delivery process and transition pathway for strategic initiatives