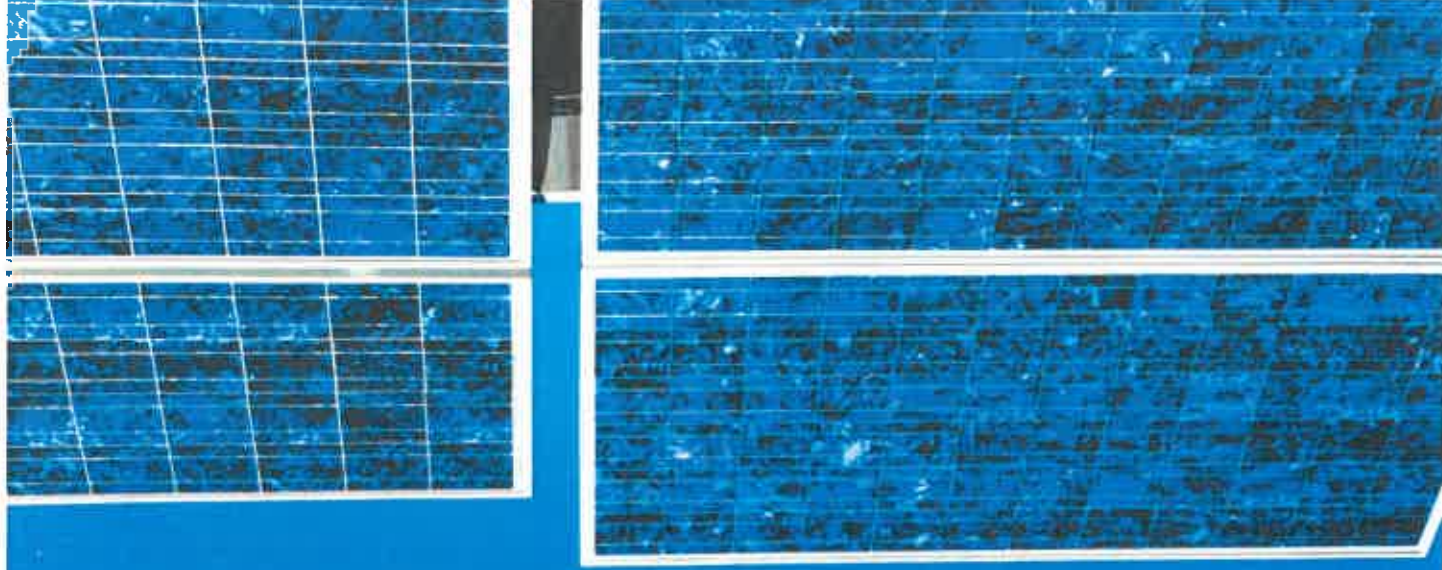




# Future Network Strategy - technology costs

SA Power Networks

15 November 2018





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Janette Beitcher  
SA Power Networks  
1 Richmond Road  
Kenswick SA 5035

15 November 2018

Dear Janette

### Report on development of the technology costs for SA Power Networks' Future Network Strategy

It is our pleasure to provide herein our report on the development of the technology cost elements of SA Power Networks' Future Network Strategy (FNS) undertaken for your 2020-25 regulatory reset proposal.

This report is provided in two parts reflecting the two broad phases of this project:

- Part 1 – Co-creation of initial cost estimates – a description of the high level process undertaken jointly by KPMG and SA Power Networks staff to develop an initial estimate of the FNS technology costs, and
- Part 2 – refinement of cost estimates – commentary on the prudence and efficiency of the continued process adopted by SA Power Networks to refine and finalise the FNS technology cost estimates and the key decisions and changes made to the initial costs.

This is an exciting and challenging time in the South Australian electricity sector with exponential increases in the use of storage and renewable energy sources in both the distribution and transmission networks. SA Power Networks' FNS is an industry leading response to these challenges and will place you at the forefront of DNSPs in Australia and globally, in the efficient and safe integration of distributed renewables within the network.

We look forward to continuing to support SA Power Networks in delivering reliable and cost effective power to South Australian consumers.

Kind regards

  
Matt Pearce  
Partner



KPMG, an Australian partnership and a member firm of the KPMG network of independent member firms affiliated with KPMG International Cooperative ("KPMG International"), a Swiss entity.

### Important Notice

This report has been prepared as outlined in the Scope Section. The services provided in connection with this engagement comprise an advisory engagement, which is not subject to assurance or other standards issued by the Australian Auditing and Assurance Standards Board and, consequently no opinions or conclusions intended to convey assurance have been expressed.

No warranty of completeness, accuracy or reliability is given in relation to the statements and representations made by, and the information and documentation provided by you and the survey participants consulted as part of the process.

KPMG have indicated within this report the sources of the information provided. We have not sought to independently verify those sources unless otherwise noted within the report.

KPMG is under no obligation in any circumstance to update this report, in either oral or written form, for events occurring after the report has been issued in final form.

The findings in this report have been formed on the above basis.

### Third Party Reliance

This report is solely for the purpose set out in the Scope Section and for your information, and is not to be used for any other purpose or distributed to any other party that is outside the agreed mechanisms in the engagement letter for services dated 11 July 2018.

This report has been prepared at your request in accordance with the terms of KPMG's engagement contract dated 11 July 2018. Other than our responsibility to you, neither KPMG nor any member or employee of KPMG undertakes responsibility arising in any way from reliance placed by a third party on this report. Any reliance placed is that party's sole responsibility.

## Glossary



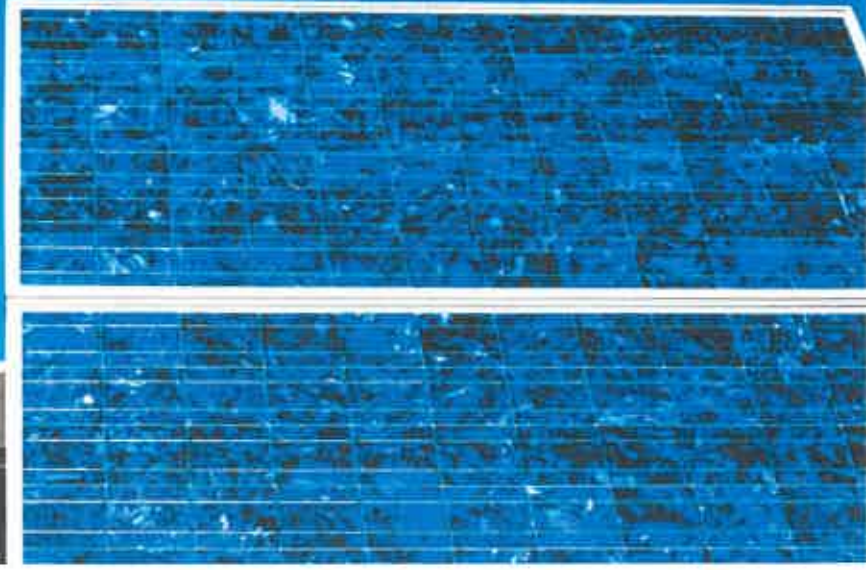
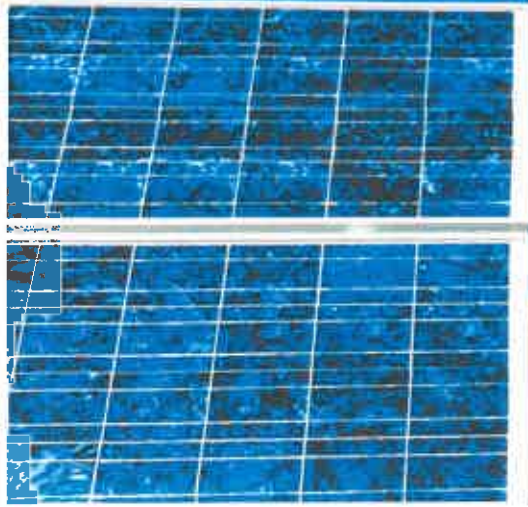
# Contents

**KPMG**





# Executive summary



# Executive Summary

## Background

South Australia is among the world's leaders in the development and use of renewable energy. In 2016/17, wind accounted for over 39% of the electricity generated in the state<sup>1</sup> and with double the current capacity committed or proposed<sup>2</sup> this will only increase. Add to this the various solar, thermal solar, battery storage and pumped hydro storage projects being proposed for the state and it is clear the challenge of integrating these into the network while maintaining stability of supply will continue for some time.

While much of this energy transition occurs within the transmission network, the distribution network is not immune and in fact is likely to be even more significantly impacted. South Australia has one of the highest penetrations of rooftop solar in the world at 30%, and increasing. Together with the continuing fall in prices for solar panels & battery storage, and government policy promoting the introduction of virtual power plants (VPPs) - collectively 'Distributed Energy Resources' (DER) - the impact on the safe and reliable operation of the grid will be significant. These risks are recognised in SA Power Networks' Future Network Strategy(FNS) which identifies them as:

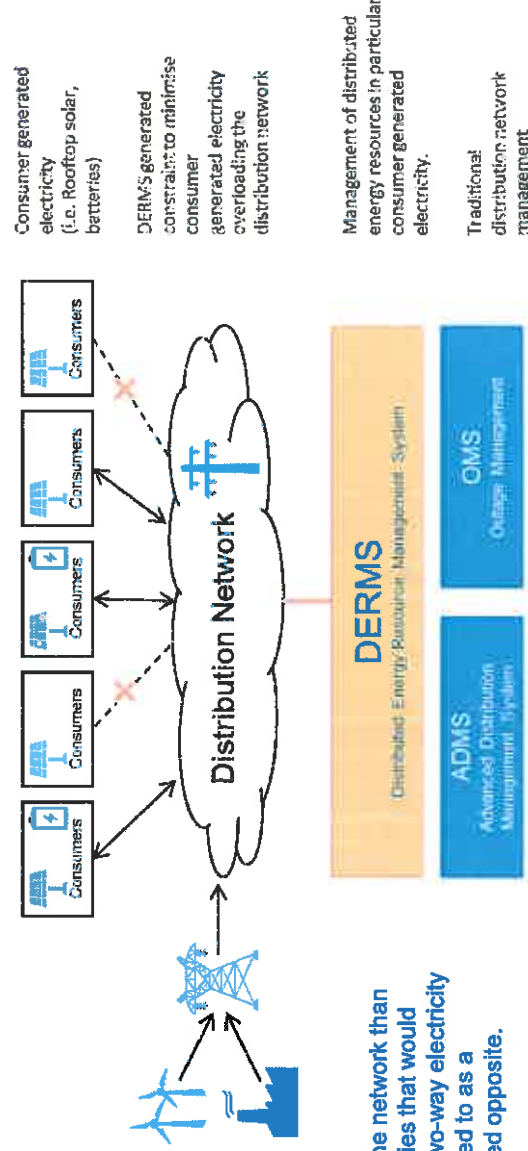
- Overloading of existing assets, particularly in the event of unconstrained orchestration
- Exceeding quality of supply (voltage) tolerances, risking damage to network and customer equipment
- Reducing the resilience of the network to faults.

SAPN's primary responses to these risks are to:

- prepare the network for the increased DER through integration of DER forecasts into the network planning process
- pursue static strategies to increase DER hosting capacity such as voltage regulation, new tariffs and inverter standards
- model, monitor and actively manage the Low Voltage (LV) network
- establish the foundations required for future real-time management of customers' DER exports.

This requires a higher degree of pro-active management of DER within the network than is possible today. This will require new operational systems and capabilities that would enable SAPN to monitor, manage and, where necessary, constrain the two-way electricity flows within the network. Such systems are sometimes collectively referred to as a Distributed Energy Resource Management System (DERMS) as illustrated opposite.

This would facilitate two-way communication with VPP operators and consumers wishing to put power into the network to ensure that the network infrastructure is not overloaded at any point.



<sup>1</sup> AEMO, November 2017 - South Australian Electricity Report 2017, p30

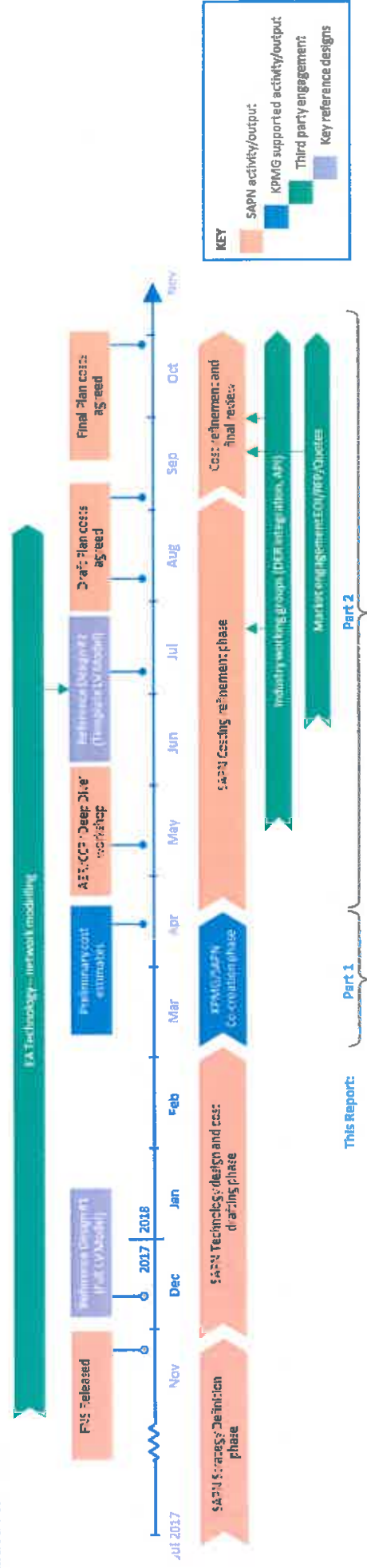
<sup>2</sup> Ibid, p34

## Executive Summary

# Project overview

SA Power Networks' Future Network Strategy (FNS) was formally approved in November 2017. The FNS outlines a strategy to enable SAPN to move from a traditional, relatively passive, role in managing the network to being prepared and capable of pro-active DER management in order to not just protect the network, but facilitate its efficient use by customers as both suppliers and consumers of electricity.

The aspect of the strategy that this report is concerned with relates to the costing of the operational and information technology changes required to elevate SAPN's capability to manage and protect the LV network to the extent required by the current and expected increase in DER. This project has been ongoing since July 2017 and the timeline is illustrated below.



As illustrated above, a key aspect of this project involved engagement with EA Technology, a UK headquartered electrical asset management consultancy with an Australian base in Brisbane. EA Technology was engaged by SAPN to help develop the detailed management strategy for the LV network. This specifically included investigation of how best to model the South Australian LV network to the degree required for pro-active DER management capability. We note that the modelling solution used by EA Technology has gained endorsement from Ofgem (the UK regulator) who has described it as "world leading"<sup>3</sup> and is used extensively by DNSPs in the UK and New Zealand.

This report is provided in two parts reflecting the two broad phases of this project:

- Part 1 – Co-creation of initial cost estimates – a description of the high level process undertaken jointly by KPMG and SA Power Networks staff to develop an initial estimate of the FNS technology costs, and
- Part 2 – refinement of cost estimates – commentary on the prudence and efficiency of the continued process adopted by SA Power Networks to refine and finalise the FNS technology cost estimates and the key decisions and changes made to the initial costs.

<sup>3</sup> <https://www.eatechnology.com/australia/consultancy-software/network-innovation/techno-economic-modelling/>, accessed 26/7/18



# Executive Summary

## Summary findings

### Part 1 – Co-creation of preliminary cost estimates

KPMG were appointed to assist SA Power Networks in estimating the technology costs involved in its proposed progression to more active management of the network impacts of DER. While significant work had been undertaken by SAPN in designing the 'Future Network' technical infrastructure, further assistance was required to challenge, refine and supplement the costs involved.

KPMG took an iterative and collaborative approach to helping develop the cost estimates as summarised below.



Each iteration included workshops and one-on-one meetings with IT and operational SAPN staff to discuss and challenge the costs and assumptions as they were refined.

KPMG utilised in-house expertise, knowledge and modelling to derive specific costs related to system implementation and cost areas that were new to SAPN.

Three key assumptions used during this phase, and that had significant impact on the projected spend in the next regulatory period, were:

- Fully dynamic DERMS capability and DSO operation to be achieved by the end of the reset period. This assumes that SAPN would require full and pro-active management capability for the LV network to support future market models and cope with the projected significant volume of DER on the network.
- A full audit of the LV network would be required in order to model the LV network in ADMS to facilitate DERMS capability. This implies a significant cost in external/staff resources to inspect each part of the LV network to check and record its operating status and condition.
- Extensive monitoring of the majority of the LV network, primarily through procurement of third party data sources e.g. smart meters.

### Part 2 – SAPN refinement of cost estimates

Following the development of the initial cost estimates and presentation of them to the AER and Consumer Challenge Panel, SAPN continued to work with EA Technology to determine the best approach to modelling the LV network. Other decisions were also made in relation to the timing and extent of the development being proposed, which together, resulted in a reduction in the proposed costs in the 2020-25 reset period, shown below.

The key decisions and changes in assumptions were:

- The project as a whole was re-scheduled such that particular hardware refreshes and a number of other activities were moved into the 2025-30 reset period.
- Advice from EA Technologies that modelling the LV network to an adequate degree could be accomplished using a 10% sample audit of network segments, as opposed to the previously assumed 100% audit requirement.
- Full DERMS capability and future market functions would no longer be added to ADMS in the period also negating the need for a full-function mediation engine and reduced external communications capacity.
- Significant industry consultation and engagement with potential vendors (EOI/RFP/RFQs etc) was undertaken.

Projections for the volume of DER on the network did not change.

The table below illustrates the movement in the projected costs from the preliminary estimates to those being put forward as the basis for SAPN's regulatory proposal to the AER.

Costs for RCP 2020-25 \$m (2017)		Preliminary Cost Estimate		Final Cost Estimate	
		Capex	Opex	Capex	Opex
Build LV model		17.50	8.35	7.76	0.50
LV monitoring & analytics		16.96	7.80	11.99	2.86
Managing customer DER information		3.96	1.76	3.82	0.51
Constraint estimation & DER management		11.40	9.79	5.46	0.19
Transition team		4.32	0.00	4.47	0.00
<b>Total</b>		<b>54.14</b>	<b>27.70</b>	<b>33.30</b>	<b>4.06</b>



## Executive Summary

# Comment on prudence and efficiency

### Prudence

The continuing increase in Distributed Energy Resources (DER) – roof-top solar, battery storage and Virtual Power Plants (VPPs) – in South Australia is well documented. As more and more consumers take advantage of the opportunities DER affords them to manage their electricity bills, so the risk to the stability of the distribution network increases. A network designed to take power from major generators, through the transmission grid, and deliver it to consumers is now having to deal with two-way flows of power as the consumers become generators in their own right.

SAPN have identified this risk and developed a strategy for enabling the safe growth in DER within SA – the Future Network Strategy.

It has designed an approach that is based on advice from global leaders in this space utilising the best available advice. In developing this approach from the initial concept to the final proposal, SAPN have adopted the regulatory philosophy of ‘just-in-time’ investment to prepare for the future whilst not seeking to predict the exact level of need and the role they may have in the market, going forward.

In that context, in planning for the next RCP, SAPN have taken a prudent approach to managing the LV network

### Efficiency

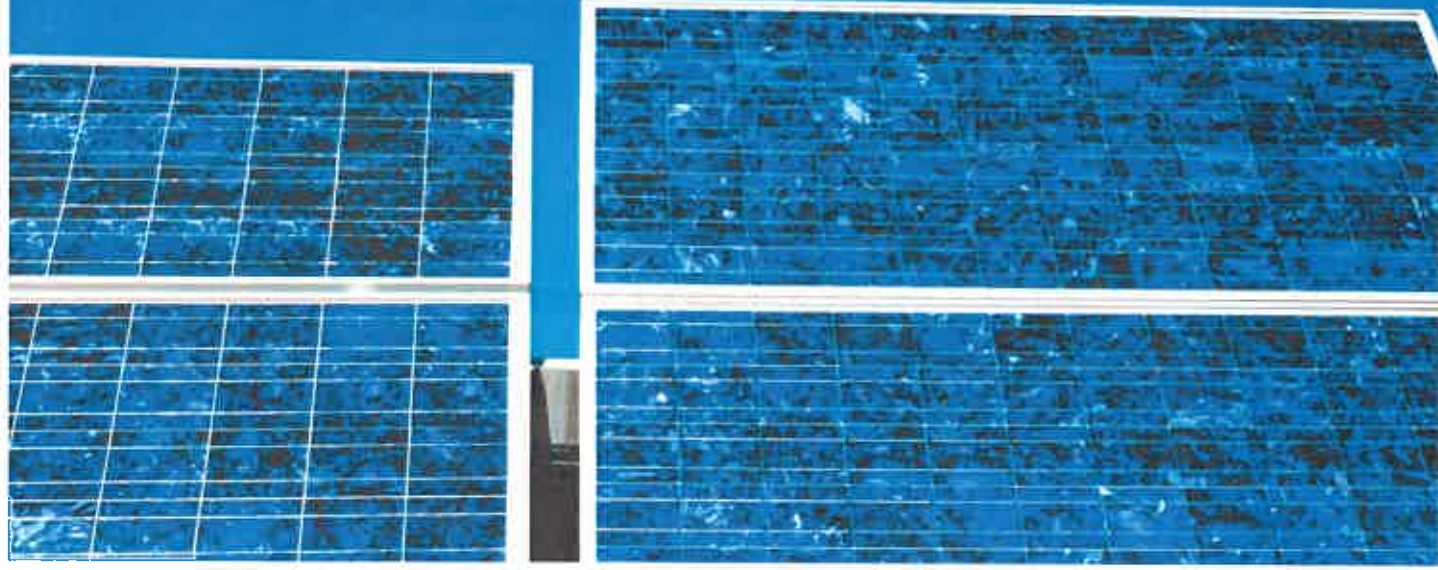
In seeking to develop a capital expenditure proposal that represented an efficient approach to managing the DER risk and providing best value for money to South Australian consumers, SAPN have adopted a number of specific approaches:

- Co-creation of an initial detailed cost estimate with KPMG utilising their knowledge and experience of similar projects and activities to get a realistic and substantiated estimate of costs.
- Engagement with global experts – EA Technology – whose UK experience was leveraged to provide a highly efficient approach to modelling the LV network through an audit of just 10% of the network, rather than the originally presumed need for a full audit.
- Engagement with vendors and other market participants to ascertain the best options and costs for specific technologies required for the future network.
- Use of standard labour rates utilised by SAPN across their regulatory reset teams, market tested for external contractor resources.
- The level of contingency applied to the cost estimates was initially lowered to 10% through significant engagement with vendors and the market and obtaining specific quotes where possible. On KPMG’s recommendation, SAPN reviewed its costing estimates at a line-by-line level based on the degree of uncertainty at this level of detail, so allowing it to apply contingency values more precisely rather than as a single broad application.



# Part 1

## Co-creation of initial cost estimates



## Part 1 – Co-creation of initial cost estimates

# Overview

**KPMG Role:**

- Challenge existing estimates
- Market research
- Internal modelling
- In-house expertise
- Previous experience

**Cost attribution based on three work streams:**

- Advanced Network Planning Tools
- Enabling the DSO
- Supporting and Managing the DSO

KPMG was appointed to assist SA Power Networks in estimating the technology costs involved in its proposed progression to active LV network management and DER integration.

SAPN had already commenced work in designing the 'Future Network' technical infrastructure through a top down capability design process partnering with EA Technology (EAT) (UK headquartered energy consultancy) and based on EAT's modelling and international expertise/best practice

Whilst SAPN's initial efforts had resulted in an overall technical design for the future network, further assistance was required to challenge, refine and supplement the costs involved particularly where the necessary knowledge and experience was not available internally. A key objective was to ensure that the NER expenditure objectives and criteria were being appropriately met by the proposed strategy:

**NER Expenditure Objectives:**

Meet or manage expected demand over the period

Comply with regulatory obligations

Maintain the quality, reliability and security of the distribution system, or the supply of standard control services

Maintain safety obligations

EA Technology has a significant consulting footprint with UK and NZ utilities and has gained endorsement from Ofgem (the UK regulator) describing its distribution network modelling capability as "world leading"<sup>1</sup>

In addition to partnering with EA Technology on modelling the LV network as a whole, specific elements of the design and implementation process were put to market to ascertain prices from third-party vendors. These included quotes for specific technology solutions and the collection of data about the LV network and its current state.

To enable a cohesive cost structure to be developed, the individual technical design elements already identified by SAPN were first segmented into three work streams.

KPMG then undertook an iterative and collaborative approach to helping develop the cost estimates. Each iteration included workshops and one-on-one meetings with IT and operational SAPN staff to discuss and challenge the costs and assumptions as they were refined.

KPMG utilised in-house expertise, knowledge, experience of similar clients and projects and modelling to derive costs related to system implementation and cost areas that were new to SAPN. In particular an in-house project costing model for estimating IT resources, that KPMG has used successfully with other similar regulated clients, was used to help approximate the quantum of resources required to deliver the various sub-projects.

A number of assumptions were made by KPMG or provided by SAPN that had significant impact on the nature and timing of the costs being assessed. These included:

- Where possible, cloud based, SaaS or off the shelf packages were to be preferred as the more efficient solution
- Add a module to ADMS to enable DERMS functionality and the implementation of a new LV model
- DERMS functionality would gradually increase such that it was fully operational by the end of the RCP
- The new systems would require 24/7 support.

Some of these assumptions were subsequently revised for the final cost estimates.

<sup>1</sup> <https://www.eatechnology.com/australia/consultancy-software/network-innovation/techno-economic-modelling>, accessed 26/7/18





## Approach - scope

Core Strategies	In scope	Relevant Work Stream
Expand Choice and convenience	No	N/A
Increase planning scope and sophistication	Yes	1
Manage two way-energy flows	Yes	2 & 3
Right size our assets	No	N/A
Promote new grid applications	No	N/A
Enable new markets	No	N/A



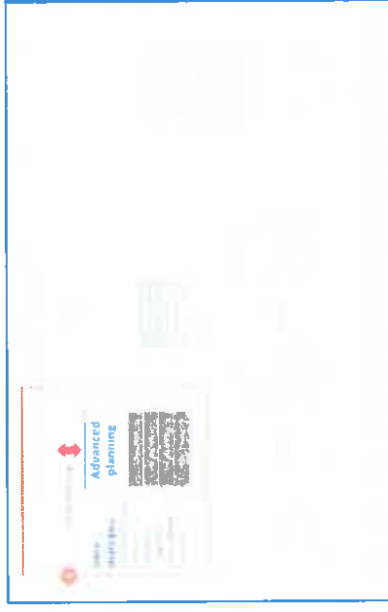
- **Work Stream 1: Advanced Network Planning**
- **Work Stream 2: Integrating DER**
- **Work Stream 3: Network Modelling & Visibility**





## Part 1 – Co-creation of initial cost estimates

# Approach – work stream structure



### Work Stream 1 – Advanced Network Planning

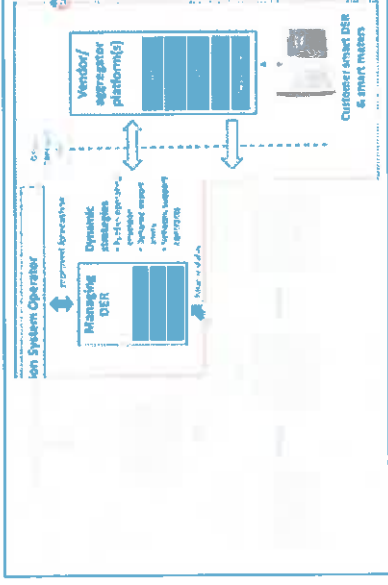
This Work Stream involves the implementation of advanced planning and forecasting tools and processes that enable the full impact and value of DER to be assessed & managed, and to prudently migrate to a high-DER network architecture.

Work Stream 1 was designed to achieve the following key objectives:

- Low voltage network modelling, planning and configuration management
- Integration of DER into planning process
- Integrate non-network solutions (such as batteries) into asset management solutions.

Key benefits of adopting more advanced planning are:

- Critical to enabling the level of management required as current planning practices cannot be sustained for the current levels of DER penetration
- Facilitate non-network solutions for maintenance of the network
- Replace current manual and error prone process to enable improved data access and better correlation of data.



### Work Stream 2 – Integrating DER

This Work Stream involves the integration of new operational systems and processes to enable real-time management of network hosting capacity and forecasting. It further enables the dynamic management of the network by systemising DER registration.

Work Stream 2 was designed to achieve the following key objectives:

- Progress implementation of LV management features initiated in the current reset period (2015-20)
- Network support (demand or voltage) utilising distributed and/or 3rd party resources
- Increase access to available network capacity and enable large VPP operation.

This work stream contains the core operational systems and will provide the following benefits:

- Enable two-way energy flows and active management of DER across the network
- Improve network reliability and quality of supply
- Allow better understanding of customer demands and needs through DER registration and increase compliance to connection standards
- Allow extra flexibility of network resources through use of DER.



### Work Stream 3 – Network modelling & Visibility

This Work Stream focuses on the active management of the network. It leverages static and real-time data sources to manage and model network constraints in ADMS.

Work Stream 3 was designed to achieve the following key objectives:

- Support and manage DERMS capability through real-time operational data collection, storage and power system modelling
- Allow active management of the LV and HV network to increase DER hosting capacity.

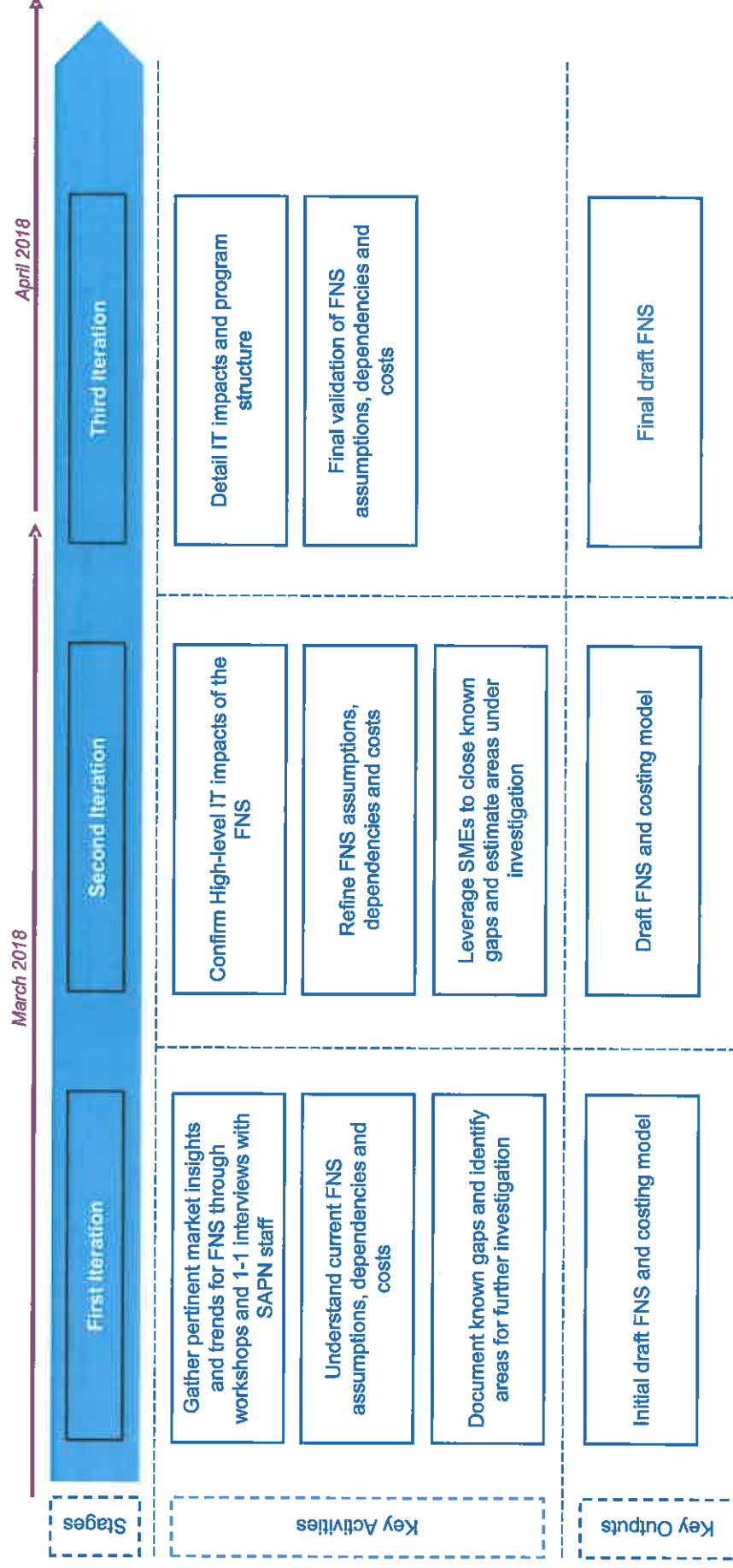
Leveraging static and real-time data will provide the following benefits:

- Enabling the level of management required as current planning practices cannot be sustained for the current levels of DER penetration
- Foster even closer integration between planning, operations and corporate functions (e.g. customer, IT etc.) as operational systems and market structure evolve
- Enable a single source of models and data points to manage the complexities of high penetration of DER and the impact of virtual power plants (VPPs) using static and real-time data leveraging the data analytics platform.

## Part 1 – Co-creation of initial cost estimates

# Approach – collaborative process

The overall approach taken by KPMG in partnership with SAPN for the Future Network Strategy (FNS) technology cost development is broadly illustrated below:



## Part 1 – Co-creation of initial cost estimates

# Key decisions and assumptions

In developing the preliminary network design, in particular the costs and strategy for management of the LV network, SAPN made a number of assumptions in relation to the market and the environment that guided the extent of the development initially being proposed. In addition SAPN had made a number of decisions on constraints to be applied to the solution in order to efficiently manage the cost and risk associated with the strategy.

### Market/environment assumptions

- Adoption/uptake of Virtual Power Plants (VPPs) would increase during the Reset period.
- DERMS would gradually increase in functionality and scope until a fully dynamic DERMS would be operationalised at the end of the Reset period enabling complex mediation of market-integrated VPPs and other DER.
- Enablement of DERMS software capability would provide
  - Mediation of dispatch to VPPs
  - Curtailment
  - Forecast constraint interface to AEMO.
- A data analytics platform will be implemented by the business and will be leveraged by FNS and would provide
  - Reporting capabilities
  - Common data standards and interfaces between multiple systems.
- High data quality in ADMS, GIS and Asset Management (SAP). Data clean-up and field audits would be executed to enable FNS.

### Project/constraint decisions

- Leverage off-the-shelf and/or existing systems first
- Minimise system customisations, all implementations would be “vanilla”
- Leverage cloud infrastructure and/or software as a service if possible
- In order to model the LV network, a full (100%) audit of the network would have to be undertaken
- Key business IT systems would have 24x7 operations
- ADMS would be upgraded to incorporate the new DERMS functionality and the LV model
- Costs were to allow for Technical and Organisational Change management to enable SAPN as a DSO (e.g. training, new process documentation etc.)
- The scope of the FNS was to be defined such that its costs were clearly self-contained with no dependences or duplication of costs with any other business case.

## Part 1 – Co-creation of initial cost estimates

# Resultant cost estimates

The cost estimates resulting from this collaborative phase of the project are summarised below. Due to a change in the emphasis in the management of the model within the design team, the structuring of the costs changed from the three work streams defined previously to the following five cost elements.

Cost element (\$m)	Initial Capex
Build LV model	17.50
LV monitoring & analytics	16.96
Managing customer DER information	3.96
Constraint estimation & DER management	11.40
Transition team	4.32
<b>Total</b>	<b>54.14</b>

The overall strategy and these cost estimates were subsequently socialised and reviewed within the broader regulatory team at SAPN before being presented by SAPN management to the AER and CCP during their 'deep dive' workshops.

Key cost drivers for each of these cost elements are:

### Build LV Model

- Field audit of LV circuits to feed into network model
- GIS data cleansing and process field audit data

### LV Monitoring & Analysis

- Monitoring data tool (licence and implementation)
- Analytics capability for reporting on network performance and connectivity

### Managing customer DER information

- Setup, interface and maintenance of DER database

### Constraint estimation & DER management

- Mediation engine
- ADMS enhancements for dynamic modelling and real-time constraint generation

### Transition team

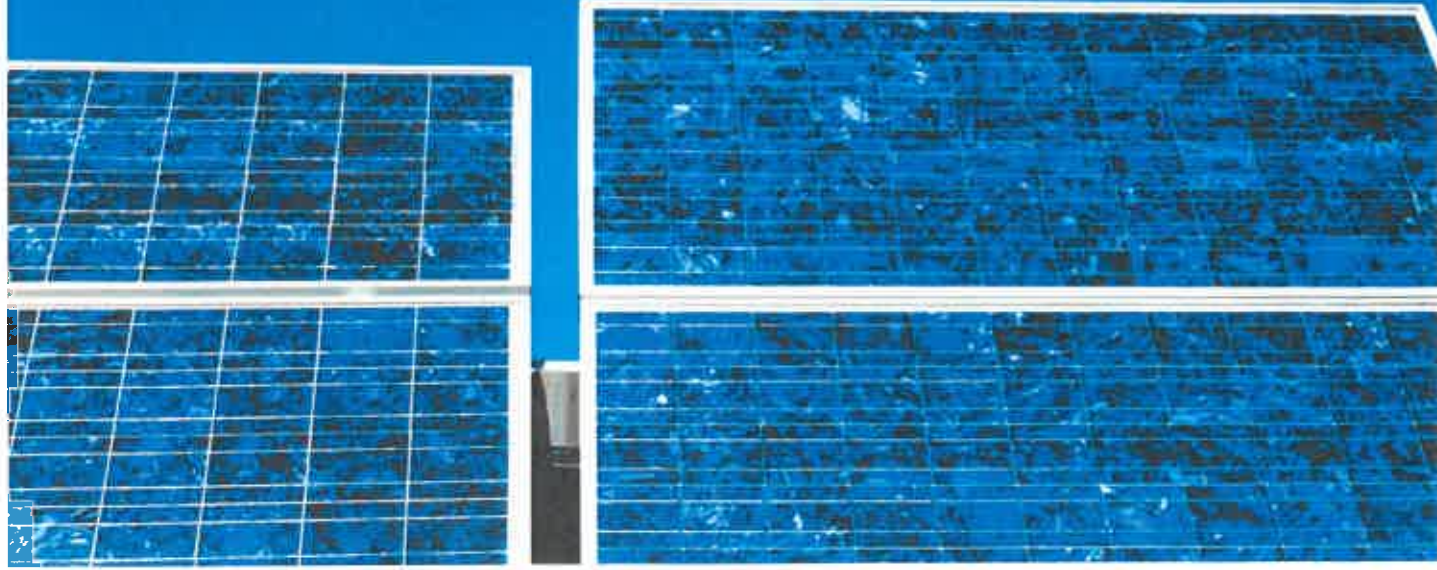
- Transition and change management
- Administrative support.





# Part 2

## Refinement of final cost estimates



# Overview

A separate assessment of the process undertaken and key decisions made by SAPN in refining the initial cost estimates originally created with KPMG.

Assessment against the National Electricity Rules criteria for prudence and efficiency.

SA Power Networks' overall process for building its strategy for the future of the South Australian distribution network commenced in early 2017 and has culminated in a proposed technical design, approach and estimated costs to be put forward to the AER in SAPN's 2020-25 regulatory reset proposal.

The key activities and assumptions made up to mid-April 2018 when an initial estimate of the costs of the proposed strategy at that time was socialised with the AER and with the Consumer Challenge Panel, have been summarised in Part 1 of this report. From this point, Part 2 of this report assesses the process undertaken by SAPN to refine these initial cost estimates, against the National Electricity Rules (NER) expenditure objectives and criteria:

The AER will assess whether the expenditure forecast ...  
... aligns to NER objectives (i.e. demonstrates the expenditure is prudent):

**Expenditure objectives**

6.5.6 (a)  
6.5.7 (a),

(1) Meet or manage expected demand over the period

(2) Comply with regulatory obligations

(3) Maintain the quality, reliability and the security of the distribution system, or the supply of standard control services

(4) Maintain safety obligations

... meets each of the NER criteria (i.e. demonstrates efficiency):

**Criteria**

6.5.6 (c)  
6.5.7 (c)

(1) Efficient cost of achieving objective(s)

(2) Cost of a prudent operator

(3) Realistic expectation of forecast and cost impact

*Note – in Part 2 we only report on the changes made between the initial and final cost estimates and on the process and decisions related to those changes.*

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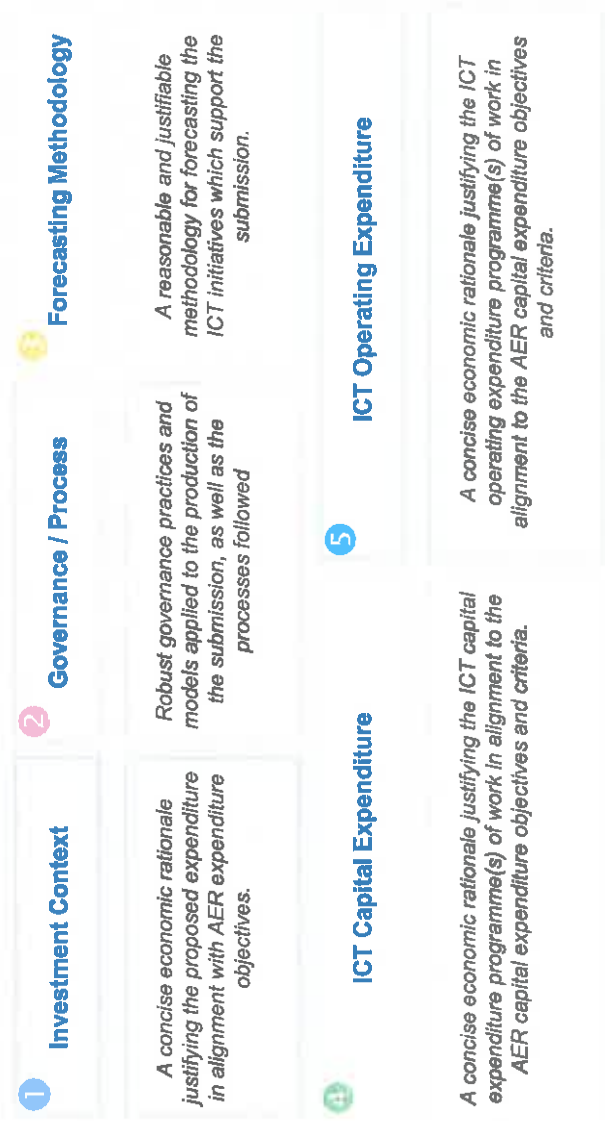
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18

Part 2 – Refinement of final cost estimates

Assessment framework

In assessing the prudence and efficiency of the refinement process (noting that this was in effect a continuation of the work already underway since development of the Future Network Strategy), we have used KPMG's Regulatory Prudence and Efficiency Framework.

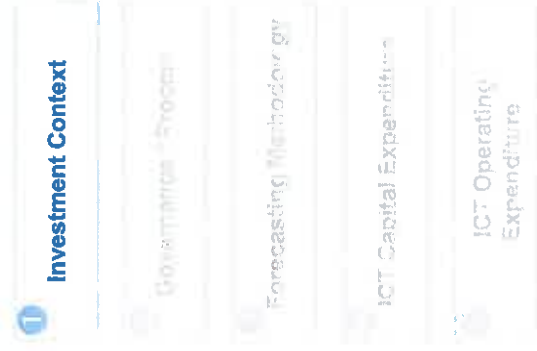


Each of the five elements of this framework are described overleaf in the context of their applicability to the refinement process

## Part 2 – Refinement of final cost estimates

# 1. Investment Context

Provides the economic rationale justifying the proposed expenditure in alignment with AER expenditure objectives.



SA Power Networks' Future Network Strategy was approved by the business and published in November 2017. This document outlines the reasoning behind the need for a change in the way the South Australian distribution network is managed and how best this can be done to maximise the value provided to consumers. Six separate strategies were identified in this document, of which the two highlighted below are the subject of this investment and are critical to enabling the other four.

The main argument for this investment is that the increased, and increasing, level of DER within South Australia puts the stability of the network at risk if not properly managed. Simply preventing consumers from accessing the range of energy sources now available to them, in the name of network stability, is clearly not possible. New ways, therefore, need to be found to manage and control the diverse electricity flows within the network whilst facilitating new markets and customer choice.

The investment being proposed by SAPN provides a prudent approach to tackling these issues in a staged and progressive way.

The key changes made during the cost refinement phase were designed to ensure that the safety and stability of the grid remained paramount whilst the investment was timed to commence later and be undertaken over a longer period to better match the latest predictions for DER uptake. This in turn enabled the scope of the systems being planned to be reduced to provide efficient delivery of the investment objectives.

Whilst the processes described in this report are concerned with the development/refinement of the scope and costs of the project, it is important that in its submission to the AER, SAPN clearly articulates the need for this expenditure and provides an analysis of the relative costs and benefits of undertaking this work verses not doing so. Any other options considered for managing the LV network through a time of increasingly diverse energy flows should also be enunciated and their pros and cons described.



Taken from: SA Power Networks – Future Network Strategy 2017-2030 – Transforming our future network and services to meet customers' future energy needs, November 2017.

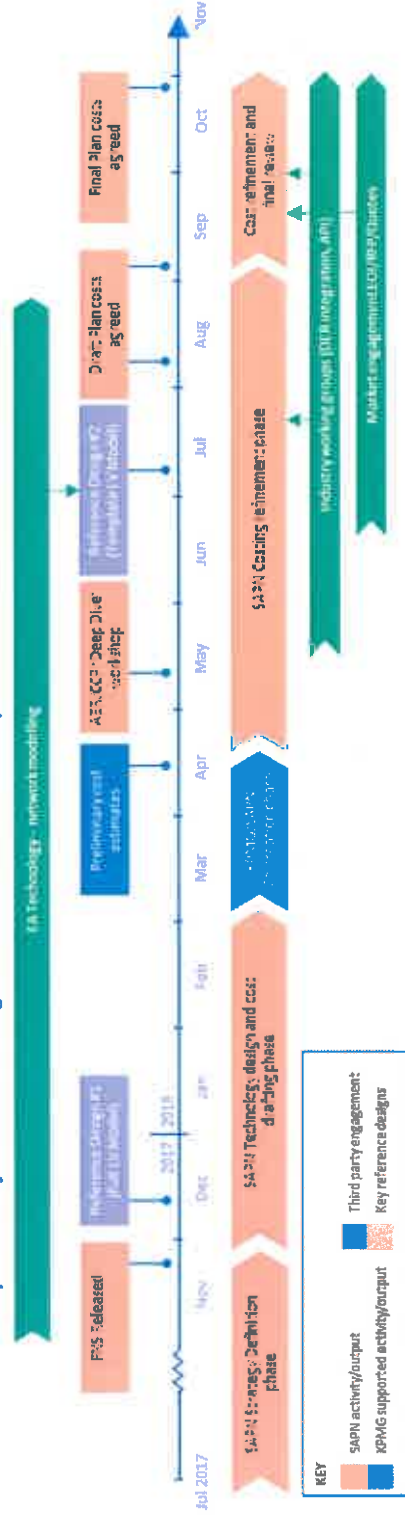


## Part 2 – Refinement of final cost estimates

# 2. Governance / Process

Describes the governance practices and models applied to the production of the submission, as well as the processes followed.

The process of refining the preliminary cost estimates is a continuation of the overall process for developing the investment case with the socialisation of those preliminary estimates being a milestone in the overall process as illustrated below.



The project was managed internally as part of a portfolio of projects under the Future Network Strategy project governance framework approved by the GM Network Management and aligned with the SAPN CPMO governance framework.

Cost estimates were developed in accordance with SA Power Networks' normal Business Planning and Budgeting, and Capital Project Evaluation and Approval Procedures. Whilst the Future Network team in SAPN were responsible for developing these costs, there a number of internal and external stakeholders who were consulted and who reviewed and provided feedback on the initial results:

- 'top down' reviews by EA Technology drawing on their experience of similar work in other jurisdictions, and by IT and Network Management Reset teams for consistency of assumption, messaging and approach with other elements of the regulatory proposal.
- In specific areas (e.g. data platform, procurement of monitoring data, API development), costs were market tested through vendor quotes and EO/RFP processes in accordance with SAPN procurement guidelines
- The IT, Network Model and Network Operations / ADMS teams were consulted on the technical aspects of the investment proposal to ensure that the level of functionality being proposed was appropriate.
- The initial strategy and costs were presented to AER representatives and the AER's Consumer Challenge Panel (CCP) to gain regulator and consumer feedback on the broad justification for the investment and level of proposed costs.

# 3. Forecasting Methodology

Describes the methodology for forecasting the ICT initiatives which support the submission.



We consider the following aspects of SAPN's approach to refining the initial cost estimates to be of particular significance in ensuring the prudence and efficiency of the final investment proposal:

## Third party quotations and advice

Throughout the process, SAPN have engaged with external consultants and third party vendors to ensure that realistic and competitive prices are used in the costing of the project and that the strategy being adopted represents the most efficient approach to achieving the objectives. Examples of this include:

- Engagement with EA Technology and Western Power Distribution (UK DNSP) to leverage their advice and real-world experience in modelling the LV network through a sample based audit approach to data gathering.
- Use of consistent market sourced labour rates for contract labour as used by other parts of the broader IT investment proposal.
- Quotes for the technical audit of the LV network in order to populate the network model
- Quotes for specific software packages/services (e.g. OsiSoft monitoring tool).

## Standardised internal labour costs

The IT and OT labour rates used for the costings are the standard ones used elsewhere within the SAPN investment proposal which were developed through engagement with the external contractor market and appropriate contracted rate cards. (Further described in the main IT regulatory submission documentation).

## Contingency

Whilst this project is seeking to efficiently manage the risks and opportunities of DER trends that are already well underway, there remains a degree of uncertainty as to the extent to which DER will impact the distribution network in the next regulatory period. In addition, due to South Australia being at the leading edge of DER penetration, the infrastructure changes being proposed are likewise new and to a large degree untested.

Through detailed engagement with the industry and obtaining more precise cost estimates from potential equipment vendors, the 20% contingency originally applied to the base cost estimates was reduced to 10%. On KPMG's recommendation, SAPN subsequently reviewed the level of uncertainty in the cost estimates on a line by line basis to more precisely refine the degree of contingency at that level.

Part 2 – Refinement of final cost estimates

4. ICT Capital Expenditure

Provides an explanation of the ICT capital expenditure programme(s) of work and alignment to the AER capital expenditure objectives and criteria.

The table below illustrates the high level breakdown of the proposed capital investment and the change in the level of that investment between the initial and final cost estimates.

Cost element (\$m)	Initial Capex	Final Capex	Change
Build LV model	17.50	7.76	(9.74)
LV monitoring & analytics	16.96	11.99	(4.97)
Managing customer DER information	3.96	3.62	(0.34)
Constraint estimation & DER management	11.40	5.46	(5.94)
Transition team	4.32	4.47	0.15
Total	54.14	33.30	(20.84)

The total reduction in the estimated costs of \$20.84m is as a result of a movement in three specific assumptions/strategies as shown below.

Reason for change (\$m)	Change
10% Audit of LV Network	(13.96)
Reduced market integration	(6.30)
Move costs to next period/Update labour and exchange rates	(0.58)
Total	(20.84)

Each of these is discussed overleaf.

## Part 2 – Refinement of final cost estimates

# 4. ICT Capital Expenditure

Provides an explanation of the ICT capital expenditure programme(s) of work and alignment to the AER capital expenditure objectives and criteria.



### 10% audit of LV Network

Throughout this process, EA Technology has been advising SAPN on related work and best-practice in other jurisdictions. During review of the initial cost estimates EA identified relevant recent work by UK distribution business Western Power Distribution (WPD) in LV network modelling. WPD have found that by categorising each section of their network then undertaking just a 10% detailed audit of those segments, they were able to develop a model with an estimated 80% accuracy.

The initial plan to undertake a detailed audit of 100% of the LV network in SA constituted a significant cost, so SAPN are now proposing to adopt the WPD template approach. This will be supplemented over time by a gradual process of data gathering as SAPN staff undertake work on the network. Associated with this change is a corresponding reduction in the number of monitoring end-points required in the LV network.

This should provide a network model that is of sufficient accuracy now and will become more accurate as the incidence of DER on the network grows over time. Whilst not being 100% accurate from day one will lead to the need for potential 'over curtailment' (playing it safe) in export limits for DER providers, this represents a cost effective solution to protecting the network whilst still allowing customers to benefit from the opportunities it provides.

### Move costs to next regulatory period

As part of the ongoing refinement of the FNS, scheduling of specific elements has been moved such that some now fall into the following period. These include hardware refresh previously targeted for year five but now not required until the following year. Labour and exchange rates have also been updated for the latest information.

### Reduced market integration

The original assumptions included a DERMS module to be added to ADMS with a full function mediation engine to facilitate broad orchestration of the network participants and communication to VPP platforms and to AEMO.

Whilst this assumption presumed a particular role for SAPN in the market, the structure of the market and composition of the disparate roles available is currently undecided and is the subject of a consultation paper<sup>2</sup> from AEMO and Energy Networks Australia. Because of this, only the systems that are required for SAPN's role under the existing, or 'certain' future market structure, have been included in the final cost estimates. The lack of a full baseline model of the LV network also impacts these costs as full ADMS constraint generation is not possible with just the 10% audit data.

The key changes in the costs are related to:

- Reduced complexity of the APIs required for communication to the market
- Mediation engine of significantly reduced complexity, level of integration and need for auditability
- Previous interim constraint generator outside of ADMS upgraded to ongoing operational status
- No ADMS DERMS module required.

This reduction in costs aligns well with the regulatory philosophy of only committing to expenditure related to future events, rule changes and regulatory requirements that are certain and have been approved by regulators.

<sup>1</sup> <https://www.westernpower.co.uk/About-us/Our-Business.aspx> - electricity distributor to the English Midlands, South West and Wales.

<sup>2</sup> Open Energy Networks - Consultation on how best to transition to a two-way grid that allows better integration of Distributed Energy Resources for the benefit of all customers: © Energy Networks Australia 2018.

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## Part 2 – Refinement of final cost estimates

# 5. ICT Operating Expenditure

Provides an explanation of the ICT operational expenditure programme(s) of work and alignment to the AER operating expenditure objectives and criteria.

The table below illustrates the high level breakdown of the proposed total operational expenditure in the period and as an annual cost in the final year. The change in the level of the proposed opex between the preliminary and final cost estimates is also provided.

Cost element (\$m)	Initial Opex	Final Opex	Change	Initial Year 5 Opex	Final Year 5 Opex	Change
Build LV model	8.35	0.50	(7.85)	1.74	0.14	(1.60)
LV monitoring & analytics	7.80	2.86	(4.94)	2.48	1.07	(1.41)
Managing customer DER Information	1.76	0.51	(1.25)	0.44	0.24	(0.20)
Constraint estimation & DER management	9.79	0.19	(9.60)	2.76	0.23	(2.53)
<b>Total</b>	<b>27.70</b>	<b>4.06</b>	<b>(23.64)</b>	<b>7.42</b>	<b>1.68</b>	<b>(5.74)</b>

The total reduction in the estimated five year operational costs of \$23.64m and final year (ongoing) operational costs, are as a result of a movement in three specific assumptions and strategies as shown below.

Reason for change (\$m)	Change	Change
10% Audit of LV Network	(11.87)	(1.60)
Reduced market integration	(10.10)	(3.94)
Move costs to next period	(1.67)	(0.20)
<b>Total</b>	<b>(23.64)</b>	<b>(5.74)</b>

Each of these has been discussed previously in section 4. ICT Capital Expenditure. The Operating expenditure impacts relate to a reduced effort requirement for the ongoing management of the significantly less complex and smaller scoped infrastructure being proposed in the final estimates.

## Part 2 – Refinement of final cost estimates

# 6. Summary



### Investment Context

SA Power Networks' Future Network Strategy that was approved by the business and published in November 2017 forms the basis for the proposed technology changes costed in this exercise.

The investment being proposed by SAPN provides a staged and progressive approach to tackling these issues and is therefore prudent.

Safety and stability of the grid remain paramount whilst the timing of the investment has been extended and the scope of system functionality has been reduced to provide efficient delivery of the investment objectives.



### Governance / Process

The process of defining and then refining the preliminary cost estimates was an integral part of the overall process for developing the investment case. Key groups of people, internal and external to the business, have been consulted throughout the process as strategies were refined and better information came available.

The review and approval process for the costs and key decisions being made was integrated with the broader business and IT reset team's proposal development processes.



### Forecasting Methodology

The prudence and efficiency of the cost estimates developed through this process were tested through engagement with a number of third parties including:

- EA Technology for the best approach to modelling the LV network,
- OSI Soft and other vendors for quotes for provision of particular technologies
- Industry working groups to share learnings and leverage other NSPs' experiences and expertise.

Standard labour costs used across the business were used in pricing internal and contract resources.



### ICT Capital Expenditure

The adopted two phase process of an initial co-development phase utilising external expertise followed by further and extensive refinement and industry engagement, has resulted in a proposed program of capital expenditure that prudently manages the risks associated with the network's increasing levels of DER whilst efficiently only providing the necessary technology and functionality as it is required, and not ahead of time.

The key factor in minimising the capital outlay required to upgrade the network control systems is the use of a 10% audit of the LV network as the basis for modelling the DER impacts. This approach was adapted from a similar template applied in the UK and should provide a network model that is of sufficient accuracy now and becoming more accurate as the incidence of DER on the network grows over time.

Adoption of the regulatory philosophy of Just-in-time capital expenditure has resulted in a reduction to the originally planned extent of market integration until such time as the



### ICT Operating Expenditure

The same factors that were applied in refining the capital costs also impacted the proposed operating expenditure. The Operating expenditure impacts relate to a reduced effort requirement for the ongoing management of the significantly less complex and smaller scoped infrastructure being proposed in the final estimates.

#### Capital & Operating Expenditure – Five Year totals (RCP 2020-25)

Cost element (\$m 2017)	Capex	Opex
Build LV model	7.76	0.50
LV monitoring & analytics	11.99	2.86
Managing customer DER information	3.62	0.51
Constraint estimation & DER management	5.46	0.19
Transition team	4.47	-
<b>Total</b>	<b>33.30</b>	<b>4.06</b>

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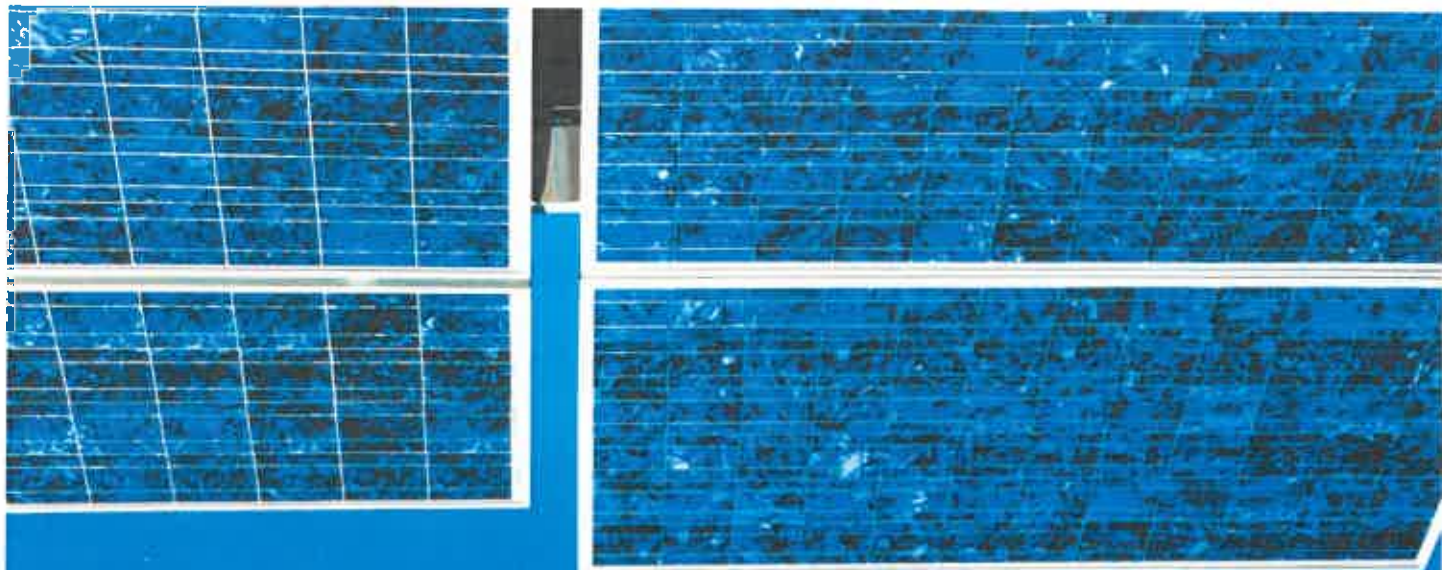
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