

AER Consumer Challenge Panel CCP14
(SA Power Networks & Energy Queensland)

**Response to the SA Power Networks (SAPN)
approach to the challenges of the high penetration
of embedded generation as part of their 2020-25
Regulatory Proposal early engagement**

V5

June 29, 2018

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Document review history

Date	Version	Notes
16 June 2018	1.0	First draft of report
27 June 18	4.0	Incorporated feedback from SAPN meeting 26 June 18
29 June 2018	5.0	Minor updates remove watermark, final for submission to AER

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CCP 14 has reviewed this document titled *Response to the SA Power Networks (SAPN) approach to the challenges of the high penetration of embedded generation as part of their 2020-25 Regulatory Proposal early engagement* and can confirm that we have made relevant checks to ensure that to the best of our knowledge, the document does not contain any confidential material or material that is commercial in confidence.

This document can be published on the AER website.

1 INTRODUCTION

A combination of high retail electricity prices, falling equipment prices and various subsidies are providing strong incentives for South Australian energy consumers to continue to adopt ‘behind the meter’ renewable energy generation, energy storage and integrated demand management. We refer to them collectively as Distributed Energy Resources (DER). SAPN has advised its stakeholders that it is facing increasing technical challenges in managing its network due to the increase of DER. AEMO forecasts and analysis suggest the growth in DER will present increasing challenges to the safe and efficient operation of the national transmission system and the SAPN grid.

As part of the early engagement for its 2020-25 regulatory reset, SAPN has presented its initial analysis of a range of options designed to address both the risks identified by it and in the AEMO forecasts. The three options presented by SAPN to their community engagement workshop on the 31st May were:

1. *Grow the network capacity* - Continue to invest in network capacity and enhance network assets to ensure technical constraints are removed as the level of DER grows;
2. *Curtail the development of new DER* - Implement greater prohibition of the installation of DER in areas where network constraints emerge, including imposing blanket limits on the capability of the generator to export to the grid; or
3. *Establish a centralised generation management facility* – develop network modelling of the low voltage (LV) network and a dynamic generation curtailment capability through communication to most, if not all customers’ embedded generators.

SAPN is proposing to develop Option 3 as its preferred approach. In SAPN’s words, their objective is to *develop capabilities to understand constraints in the distribution network and provide signals to DER to ensure those constraints are not breached by DER dispatch.*

CCP14 congratulates SAPN for raising this important issue in the context of the community engagement for the upcoming regulatory reset. We view the public discussion of this issue as a positive aspect of early engagement. We also recognise that SAPN is one of the first DNSPs to address this challenge in the wider context of the proposed Distribution System Operator (DSO) model currently being discussed across the industry.¹ Consequently, we are keen to encourage and support SAPN in exploring viable and customer-aware responses to the technical issues it faces, as these responses are likely to be a blue print for other DNSPs across the NEM.

This advice

This submission comments on the content of SAPN’s presentations in its stakeholder engagement and provides advice to the AER on matters CCP14 considers should be part of the SAPN stakeholder engagement process leading up to and including the Draft Proposal to be published on the 8th August. The majority of the information and assessment in this report is based on what has been presented in SAPN’s public forums and regulatory workshops, and the information distributed as part of those workshops. Discussions with SAPN in a closed meeting of 1 June have also informed this advice.

CCP14 has received a volume of information from SAPN since this matter has been raised with them. This provides insight into the consideration and assessment made by SAPN as part of their work in developing the position presented at the workshops. CCP14 appreciates this provision of this information, however given that we are assessing SAPN’s public consultation process, our commentary is based on what has been

¹ AEMO and ENA are currently consulting on variations of a DSO model as part of their Open Energy Networks Consultation Paper released 15 June 2018

presented and discussed in those forums. We would encourage SAPN to share this additional information with its various stakeholder's groups prior to the expected publication of its Draft Plan on the 8th August.

CCP14's position

In terms of what has been presented:

- SAPN's approach to the problem statement draws heavily on the AEMO demand forecasting that suggests the export of power from household solar PV will begin to exceed the minimum SA demand on days of the year (particularly in Spring) around the mid-2020s. We look forward to the forthcoming engagement between AEMO and the AER to allow the AER to fully understand these forecasts and their implication for the SAPN reset.
- SAPN's preferred approach is an IT and data-investment heavy technical and communications-based solution based on a detailed network data model and control system that would be developed, owned and operated by SAPN. This system is intended to signal individual customer's generation equipment at their site, either directly or through third-party aggregators, with the intent of limiting the generator output or customer energy export at times when that generation can cause adverse network operation. SAPN's preferred approach would meet not only its network issues but would also address AEMO's concerns.
- SAPN acknowledge that they are in the early stages of their risk assessment and modelling, and much more needs to be done. At this stage our initial review of this modelling suggests that whilst a number of technical responses have been presented, they have not yet been fully evaluated for both cost and benefit. In addition, few 'non-network' matters have been meaningfully consulted upon in any consumer engagement as options for response.
- Contracting with third parties such as Energy Service Companies (ESCOs) and retailers appears not to have been considered as a viable solution. With the wider scope of demand management, demand response aggregation and 'behind-the-meter' automation clearly an area of development in the market, contracting with intermediaries encourages others to take responsibility for demand and generation aggregation, reducing risk that individual consumers may not respond as expected/contracted.
- With the current activity on tariff structure and network price reform, CCP14 would be expecting SAPN to actively explore the role of network pricing and connection agreements to encourage a better matching of loads to generation.
- Based on the consultation undertaken to date and from CCP's observations in working with SAPN, we can have little confidence that the proposed approach is in consumer's long-term interests.

Our specific advice to the AER is:

1. SAPN undertake a more a transparent, wide ranging consideration of the drivers, risks and range of potential solutions to high distributed generation penetration that present more appropriate outcomes for energy consumers.
2. The AER should separately analyse the AEMO research and forecasts to test and validate AEMO's concerns about NEM wide implications from increasing penetration of DER.

We suggest:

- the validation and socialisation of the network demand forecasts developed by AEMO;

- SAPN produce and validate through their Renewables Reference Group a more detailed and granular impact statement of DER growth using local forecasts and market intelligence and express the research in terms of the likely direct impact on customers wishing to install and operate new DER;
- significant further consideration of the wide range of legislative, commercial, market and technical options that may exist and analysis of the impacts on energy consumers;
- a clear understanding of the options around where responsibilities might lie for this network challenge;
- a robust risk assessment of each option;
- phasing investment to the maximum extent possible to allow for cost effective market-based solutions to emerge; and
- extending the consideration to reflect the point of view of energy consumers in terms of costs, expectations, connection requirements and decision making.

Progress through this investigation and consideration of options needs to be clearly communicated and researched through effective and regular consumer engagement.

We believe it would be highly desirable for SAPN to make considerable progress in this engagement prior to the publication of the SAPN preliminary proposal on 8 August 2018. However, in the confidential high level action plan SAPN shared with us on 22 June 2018 it appears that SAPN does not consider it feasible to undertake this further market and stakeholder engagement until August - September, after it releases the draft proposal.

Given the implications of this work by SAPN on the approach to the growth of embedded generation resources in other jurisdictions, CCP14 is keen to support a range of responses that reflects the current consumer environment where price sensitivity is extreme. A major contributor to this emerging issue has been various subsidies to support the somewhat unmanaged development of DER. Consumers expect that all expenditure undertaken by the energy industry be done in a very transparent and cooperative manner, at least possible cost with the utmost respect of all consumers' needs.

SAPN will benefit from a robust community narrative and considering a wide spectrum of ways to address this potential growth. CCP14 is committed to work with SAPN to address the long-term interests of energy customers and draw out solutions that are cost-effective, market-driven, technically viable and supported by the community.

1 CONTEXT

The way customers require the electricity distribution network to operate is changing.

The rapid adoption of rooftop photovoltaic (PV) solar power generators, along with the introduction of energy storage and advanced demand management (DM) capability in consumer's premises, are requiring distribution network operators to reconsider the design and operation of distribution networks. Areas subject to a high penetration of DER can experience wide variations in supply voltage, high power flow peaks risking the overload of plant and reverse power flows challenging the performance of protection and network control devices.

In addition, the change to the energy demand patterns that emerge from the wide uptake of embedded generation and DM is presenting new challenges to the commercial operation of the network through decreasing load factors.

The way electricity networks are regulated is not keeping pace with the rate of change occurring under the current energy transformation. Whilst there are measures that can directly address the change, such as a move to a more cost reflective pricing regime that relates to the efficient cost of providing the network, the fundamental basis of the regulatory framework is that consumers take demand risk. This provides a sharp focus for the CCP's review – our greatest influence is around what new capital is proposed for the 2020-25 regulatory period. We note that SAPN and other utilities are considering solutions that avoid the construction of new traditional poles-and-wires assets, giving way to new investments in IT, communications and data capability.

SAPN is at the forefront of the growth of embedded generation, not only being the electricity distributor with one of the highest penetrations of rooftop solar PV in the world, but also by operating in a government, commercial and consumer environment that is highly supportive of the further uptake of embedded energy generators, energy storage and coordinated demand management.

SAPN is well advanced in its community engagement for the 2020-25 regulatory reset, with the preliminary funding proposal planned for public release on 8 August 2018 and the formal proposal to be submitted to the AER on 31 January 2019.

At the network of the future deep dives on 17 and 31 May 2018, SAPN discussed the challenges of the expected high levels of growth of embedded generation, including solar PV, Virtual Power Stations (VPPs) and energy storage.

AEMO presentation

At both of SAPN's deep dive workshops in May, AEMO gave an opening presentation, where it presented its research drawing on its November 2017 demand forecasts. These forecasts point to significant growth in rooftop solar PV and energy storage, not only in SA, but across the NEM over the next 15 years – highlighted in the AEMO/ENA discussion paper 'Open Energy Networks' issued on Friday 15 June 2018²

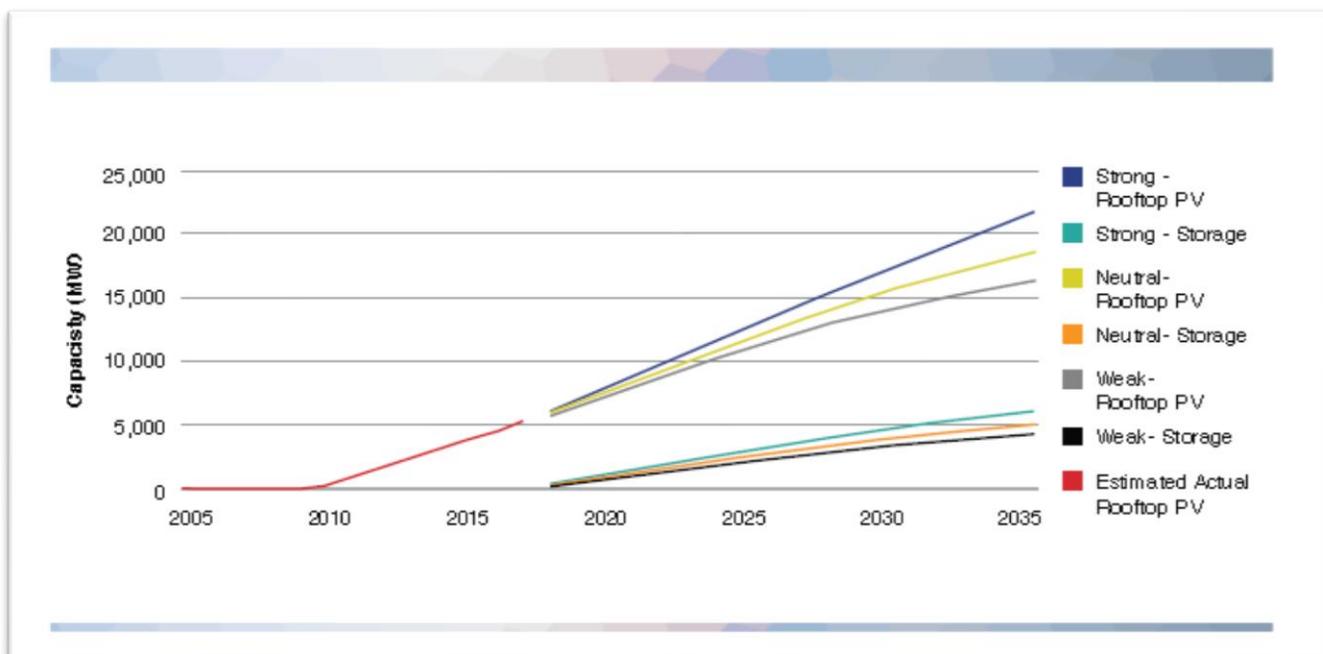


Figure 1: Projected installed capacity of rooftop PV and distributed battery storage in the NEM

² See <https://www.aemo.com.au/Media-Centre/AEMO-and-ENA-paper-on-DER>

(Source: AEMO / ENA Open Energy Networks discussion paper, June 2018)

The specific forecasts for South Australia, presented by AEMO at the SAPN deep dive on 31 May 2018, are shown in the next two figures. Sometime in the mid-2020s, AEMO contends passive exports for rooftop solar will supply all demand in South Australia at certain times of the year – initially in Spring when generation is high and demand low – when the interconnectors are also at their full export capacity.

AEMO contends that this will create significant problems for its grid operations. AEMO currently has no visibility of the volume and geographic coverage of this ‘unscheduled’ generation and hence cannot manage it.

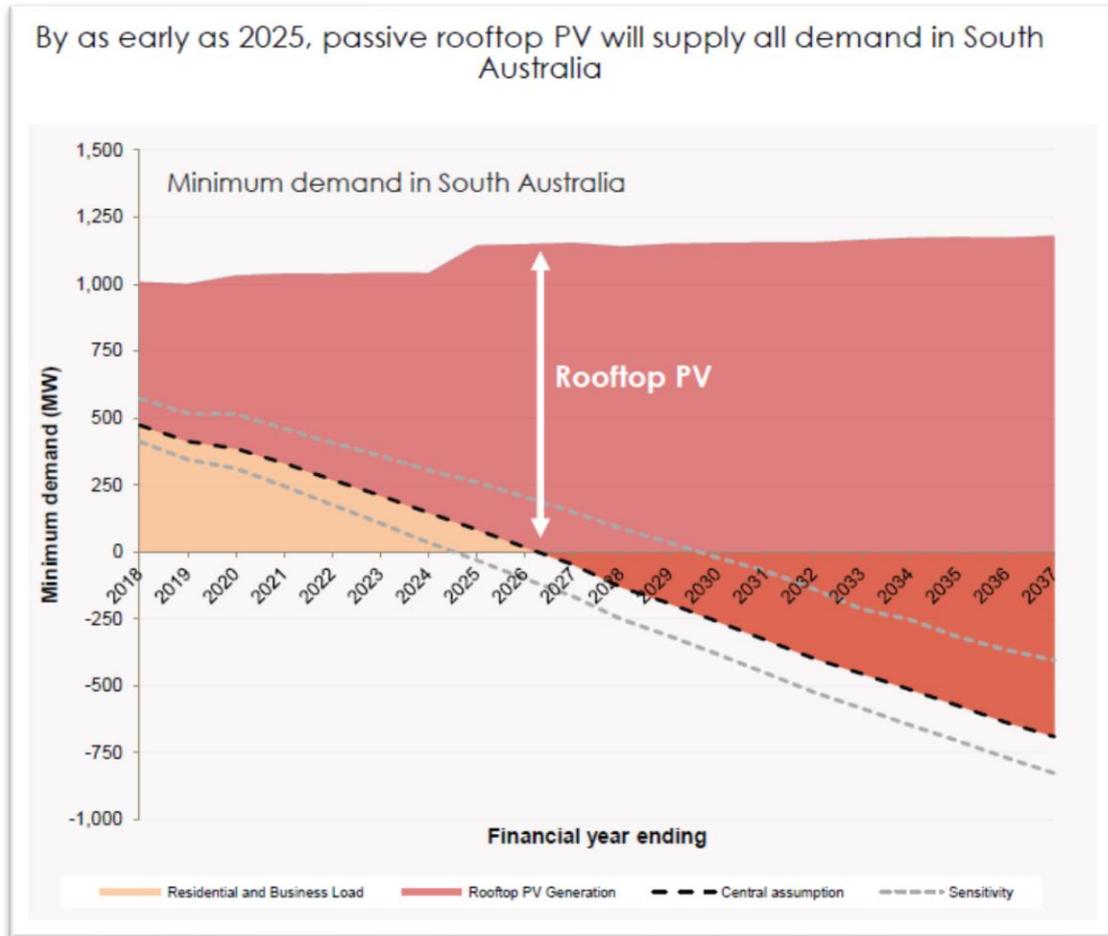


Figure 2: AEMO Forecast Minimum Demand in South Australia
(Source: AEMO)

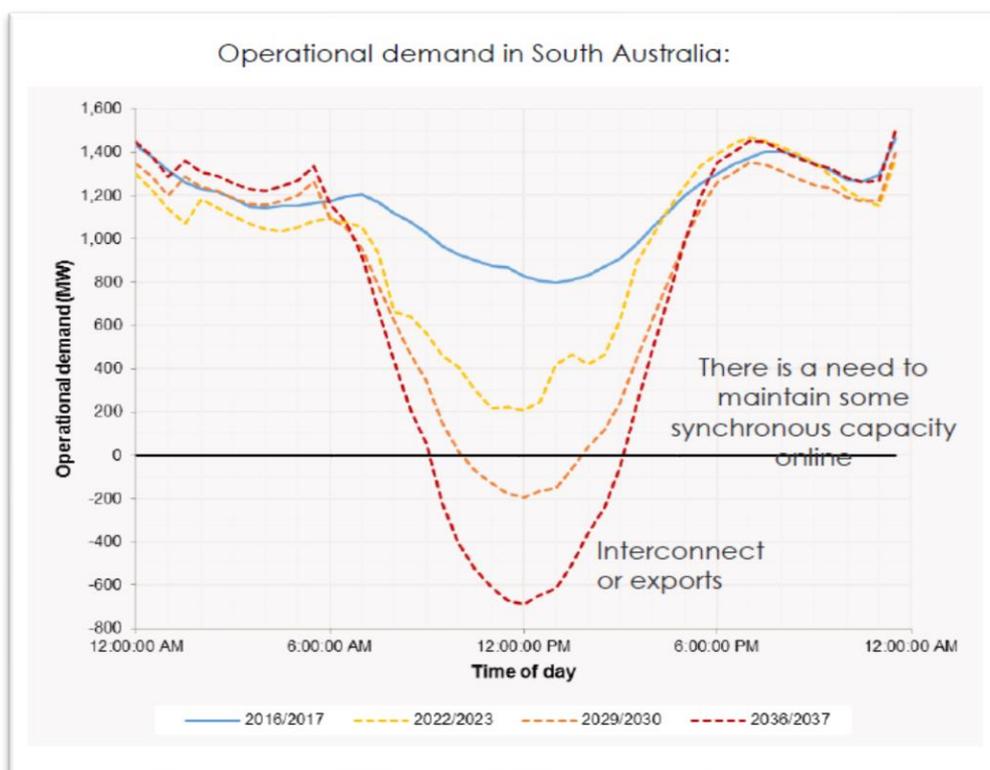


Figure 3: Forecast Operational Demand in South Australia

(Source: AEMO)

In response to its forecasts, AEMO proposes the need for a greatly enhanced level of control of embedded generation where rooftop PV, energy storage and customer demand management is required to be 'signaled' to curtail or modify operation based on state and NEM supply / demand balance. Consultation on the form (if not the need and justification) of dispatch control for DER will continue in the forthcoming engagement process on the AEMO / ENA discussion paper.

We look forward to the forthcoming engagement between AEMO and the AER to allow the AER to fully understand these forecasts and their implication for the SAPN reset and future resets as DER penetration continues to grow across the NEM.

SAPN's Initial Position

The SAPN presentation at the recent deep dives relied heavily, but not solely, on the AEMO report to provide a growth forecast that was then taken by SAPN as the minimum basis for the forecast growth of DER in SA.

SAPN has highlighted that should DER grow in line with its forecast, the emerging local constraints in the distribution network and the wider AEMO concerns of network operability could be addressed by three broad approaches:

1. *Grow the network capacity* - Continue to invest in network capacity and enhance network assets to ensure technical constraints are removed as the level of DER grows (referred to as the 'no constraints' option);
2. *Curtail the development of new DER* - Implement greater prohibition of the installation of DER in areas where network constraints emerge, including imposing blanket limits on the capability of the generator to export to the grid (referred to as the 'static limit' option); or
3. *Establish a centralised generation management facility* – develop network modelling of the low voltage (LV) network and a dynamic generation curtailment capability through communication to a

majority of customers' embedded generators (referred to as the 'local dynamic management' option).

SAPN presented the very early results of its modelling of these 3 options in the following slide (Figure 4 below) to its Future Network Deep Dives on both 17 and 31 May:

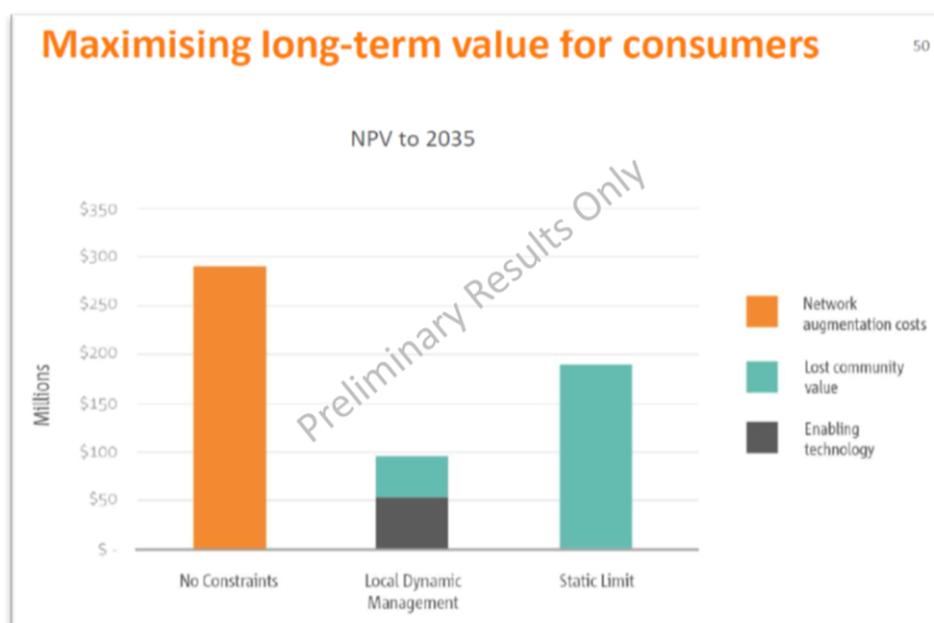


Figure 4: SAPN workshop presentation on DER challenges

(Source: SAPN)

Some aspects of this discussion and the information in Figure 4 were unclear, including:

- what "value" meant or how it was calculated in the consideration of *long term value for customers*;
- the value to the community of unconstrained exports to the grid seems to have been omitted from the "no constraints" option;
- the form of 'Local Dynamic Management' is wide and varied, and therefore difficult to value; and
- 'NPV' is perhaps more accurately *Net Present Cost*.

SAPN's proposed solution and preliminary revenue proposal reflects option 3 "local dynamic management".

By creating a DER central control capability (noting 'control' is often referred to as 'co-ordination' by ENA and AEMO), the SAPN proposal is consistent with that proposed by ENA and AEMO in the recent *Open Energy Networks* consultation paper as options 1 and 2 - referred to as 'Single Integrated Platform' and 'Two Step Tiered Regulated Platforms'.

This proposed capability reflects the wider industry proposal to make a transition to a DSO model. CCP14 understands that SAPN's proposed solution involves developing a detailed LV network model, enhanced by data sources deep in the network where available, then using that model to provide signals to individual customer's rooftop generators to curtail generation in near-real time based on network performance and ultimately national grid requirements.

The signaling may be direct to an energy consumer's installation, or to a third-party system operator such as a demand aggregator or operator of a VPP.

CCP14's view is that there is currently insufficient evidence to favor any of the three options proffered nor the need for a DSO solution controlled either by AEMO or by distributors.

2 CCP14'S RESPONSE TO SAPN'S PROPOSAL

The concept of centralised control of customers' equipment is not new. Remote control of water heating, and more recently pool pumps, air conditioners and other home appliances has been employed by distributors as an effective means of demand control for many years, with great benefits to consumers in the form of lower tariffs resulting from deferred capital investment. The 'peaksmart' load control proposal of Energex using AS4755 control facilities is noted as a useful development in control of modern appliances.

SAPN's proposal, and indeed the other options noted in the AEMO / ENA engagement paper, reflects similar thinking. The key difference is that the control decisions are based on extensive and detailed network models, internet or mobile telephony-style communication facilities and control equipment connected to the customer's equipment.

The proposed response by SAPN is a highly technical system permitting very granular response across the whole LV network and providing a platform for other control capabilities. The proposed system does not seek to focus only in areas where the SAPN network is currently constrained or likely to be in 2020-25.

CCP14 contends that SAPN has to date focused on only one viable solution within the option 1 (grow the network) and option 2 (regulate DER installation) 'book-ends'. We believe that should the network challenge be validated, then a multitude of technical, market, pricing, commercial and legislative options exist.

SAPN's modelling

SAPN has engaged several consultants to assist in modelling of various options:

- EA Technology – applying a proprietary model that is used by UK networks in their RIIO-ED1 business plans, modelled the technical characteristics of the SAPN network and the forecast uptake rates of solar PV, battery storage etc. This tool estimates, year on year, when hosting capacity limits will be reached in different areas of the network and considers the least cost technical investments required to maintain the network within technical limits as DER grows. The model includes a statistical estimate of the "hosting" capacity of the network based on limited amount of actual SAPN data on specific parts of the network.
- KPMG – providing advice on model input assumptions such as the costs of alternative technologies.
- Houston Kemp – modelling the economic value of the solar PV exports that are curtailed in Options 2 and 3, including the passive exports from solar PV and the 'active' exports from a VPP.

SAPN has provided some information on their modelling approach. CCP14 has had a preliminary discussion with SAPN and Houston Kemp to understand the modelling exercise.

SAPN acknowledge that they are in the early stages of their modelling and much more needs to be done. Our position remains that much of the modelling starts from a 'network technical' paradigm and a set of growth forecasts that are yet to reflect the impact of several alternative approaches to addressing the impact of DER growth.

CCP14's analysis of the SAPN approach

CC14 has a number of concerns regarding the SAPN approach to determining this response. These concerns reflect both the impact on costs to consumers and the acceptance by energy users of any solution to embrace the proposed action. One needs to look no further than the difficulties surrounding the acceptance of the smart meter rollout in Victoria and the very limited adoption of the tariff reform that was at the core of the rollout business case.

We present these comments with the intent they may assist SAPN further develop a strong and engaging narrative that will support the case for change should it be required.

1. The challenge is largely stated in terms of operational concerns for the national grid and the impact of DER on wholesale energy costs – an issue that consumers would reasonably expect to be resolved or at least ‘owned’ at a government and regulator level, especially where Government policies have subsidised investment in the increased DER capability.
2. Community and consumer acceptance of the problem as stated by SAPN is unlikely whilst the proposal places a reliance on forecasts that are not transparent or widely available for discussion, and where the ‘problem statement’ is not communicated to, and understood by, energy consumers. It is worthwhile noting the characteristics of peak demand forecasting in past years, where the growth was shown to be mitigated by a range of factors. The forthcoming AEMO/AER discussion is a useful step in that transparency process.
3. There is not a strong connection between the DER growth forecasts and a clear statement of the magnitude, distribution and commercial impact on SAPN and its customers in terms of network risk, power quality and connection requirements. Such issues will need to resonate with consumers who will ultimately be asked to fund any action.
4. A formal assessment of risks and sensitivity to external variables and forecast accuracy is not evident, meaning the timing, rate of implementation and vigilance of influencing factors is in question.
5. The exploration of a wide range of technical, commercial, contractual, pricing and legislative options is not evident, and the relative value of each approach has not yet been socialised.
6. With the current activity on tariff structure and network price reform, CCP14 would be expecting SAPN to actively explore the role of network pricing and connection agreements to encourage a better matching of loads to generation.
7. The further adoption of energy storage over time, along with appropriate tariff incentives and connection requirements, may mitigate the expected degradation in network performance to some extent, superseding this solution or at least delaying its requirement – hence our concern that any solution be phased in over the upcoming regulatory period.
8. The costs to customers and the commercial arrangements needed to successfully implement many solutions have not been articulated. This not only provides an incomplete view of the costs of any proposed approach, it is critical in engaging customers who will need to participate in any scheme.
9. Based on the information presented in the public forums, there is little evidence of effective two-way engagement with the wider DER market to demonstrate or develop the viability of a common approach and commitment to mitigating any network constraints or contributing to the cost of integrating more DER. Contracting with third parties (ESCOs and retailers) must be considered in the light of the rapid development of demand response aggregation and ‘behind-the-meter’ automation. Contracting with intermediaries encourages others to take responsibility for demand and generation aggregation, reducing risk that individual consumers may not respond as expected/contracted.

CCP14 strongly supported SAPN’s initiative to hold a Network of the Future briefing to the market. We believe that this was only half the story, and it is now essential for SAPN to extend the engagement to ‘listen’ and seek market feedback as to what options are available and what are the requirements for the market to be actively involved in addressing the matters expressed not only by SAPN but also those expressed in the recent ENA / AEMO paper.

3 SUMMARY OF RECOMMENDATIONS

In making these recommendations, CCP14 acknowledges that SAPN is likely to have already undertaken some or most of the work noted below. Since we raised these concerns with SAPN, SAPN has indicated to CCP14 that it has done much of this work. It is critical, however, that such considerations are transparent and well communicated to key stakeholders including the SAPN Customer Consultative Panel in the process of determining the favoured outcome. In the spirit of true customer engagement, the process of working through the analysis should include collaboration with stakeholders, including customers and the wider industry.

CCP14 recommends:

1. That the role of distribution networks (and the costs to energy consumers in particular jurisdictions) in addressing the concerns of wider network stability and operation of the NEM be discussed between the AER and AEMO, and the risks highlighted to policymakers including the SA Government and Essential Services Commission. The matter of government renewable energy policy, incentives and grants and the cost to address any potential risks can be considered at policy level.
2. That SAPN seek to provide forecasts of DER growth that can be socialised and validated in the SA renewable energy sector and wider community of energy consumers. These forecasts should include information relevant to energy consumers and include discussion on the locational, demographic and commercial impacts that underpin the assumptions.
3. The 'problem statement' should be articulated in terms of network areas, demographics and expected rate of emergence, so that the consideration of solutions can reasonably consider local forms of mitigation, a phased approach, multiple mitigation strategies and targeted consumer engagement. Such a 'problem statement' can be socialised amongst the industry and energy customers to focus the engagement and assist in stakeholders appreciating the need for a 'solution'.
4. That SAPN present the risks presented by the forecast growth in a more formal risk analysis framework, and also carry out sensitivity analysis to better define the risks and possible variations of the timing and nature of growth in the uptake of DER.
5. That SAPN consider a wider range of potential technical, commercial, pricing, contractual and legislative solutions to the impacts of DER growth; including low-cost local approaches and a range of targeted solutions.
6. The problem statement, range of solutions and their cost–benefit analyses are presented to the SAPN community council which can then form the basis of further consumer engagement.
7. As part of the analysis of the impact of the growth of DER, the wider market of aggregators, retailers and new market service providers should be actively engaged to determine what role these market entities can undertake as the uptake of DER continues. SAPN should seek synergies that will support and address the technical and commercial issues faced by SAPN because of wider DER adoption.
8. That SAPN consider a connection agreement framework that supports the intent of 'causer pays', with connection agreements that balance the constraints of the distribution network with the needs of the embedded generator. The customers themselves should be presented with a options that signal the cost of connecting DER and the proposed operation of the generator.
9. Ensure the 'customer view' is integral in this analysis, where the customer impacts and the expected role of customers in any solution are considered and tested through public and specialised engagement. Issues such as direct and indirect costs to customers to participate, technical requirements, contractual matters and similar are to be addressed.