Appendix 1.19: Distribution network planning and expansion policy

Regulatory proposal for the ACT electricity distribution network 2019-24
January 2018

Disclaimer: On 1 January 2018, the part of ActewAGL that looks after the electricity network changed its name to Evoenergy. This change has been brought about from a decision by the Australian Energy Regulator. Unless otherwise stated, ActewAGL Distribution branded documents provided with this regulatory proposal are Evoenergy documents.

evoenergy

Distribution Network Planning & Expansion – SM1198

Process Owner: Asset Strategy Manager
Date of issue: 6 Jun 2017
eIM Classification: Energy Delivery/Asset Lifecycle Management

Version: 2.0
Date of next review: 6 Jun 2022

1. Scope

This policy applies to all ActewAGL management, staff and contractors in relation to planning and expansion of the distribution network. This policy provides a framework for distribution network planning and expansion that applies to the electricity network's ten-year capital planning process for the development and implementation of the network augmentation program and projects. This document defines the overall network planning policy by incorporating different principles, drivers and guidelines which are applied across the entire planning process.

2. Purpose

The purpose of this policy is as follows:

1. to streamline a systematic planning process which provides certainty in relation to approval of network expansion and augmentation to provide the required capacity, security and reliability of electricity supply to consumers,
2. to provide principles and guidelines to make decisions that may offer alternative, cost-effective solutions for network augmentations to address emerging constraints,
3. to incorporate demand side management as an alternative to network expansion,
4. to ensure appropriate information is available for planners and external planning agencies.

3. Framework for Distribution Network Planning & Expansion

3.1 Planning Philosophy

The planning and development process for both transmission and distribution networks, is carried out in accordance with the National Electricity Rules (NER) Chapter 5 Part B Network Planning and Expansion. Planning for the transmission network is carried out in accordance with the NER Section 5.12 Transmission annual planning process and for the distribution network in accordance with the NER Section 5.13 Distribution annual planning process.

The primary objective of planning is to ensure that customers are able to receive a sufficient and reliable supply of electricity now and into the future. ActewAGL's planning standards are set to ensure that peak demand can be met with an appropriate level of backup should a credible contingency event occur. A credible contingency event is the loss of a single network element, which occurs sufficiently frequently, and has such consequences, as to justify the NSP to take prudent precautions to mitigate. This is commonly referred to as an N-1 event. Typically there is a high level of redundancy applied to electricity networks. This reflects the implications of network service failures, noting that communities and businesses have a low tolerance to electricity supply interruptions.

ActewAGL's planning standards are determined on an economic basis but expressed deterministically. ActewAGL uses probabilistic planning techniques when carrying out economic analysis. When assessing the economic benefits of a proposed solution to an issue, we calculate the probability of an event occurring that would result in an interruption of supply to customers. This probability is used as part of the economic analysis to determine whether the benefits of the proposed solution exceed the costs. For example if the supply demand to a part of the network could not be met fully in the event of a contingency, existing assets may be upgraded or new assets may be installed if justified economically. Changes to system losses are included in the economic evaluation of a project.

The early identification, consultation and monitoring of emerging network limitations and prospective network developments is aimed at providing proponents of non-network solutions adequate time to prepare proposals.

ActewAGL's planning approach to addressing load growth or network constraint issues, is to use probabilistic analysis techniques coupled with fully exploring non-network solutions such as demand-side management, before investing in network augmentation. This approach takes into account the combination of demand forecasts, asset ratings and asset failure rates to identify the severity of constraints and the required timing of solutions.

ActewAGL runs a load flow model of the network using a computer software program known as ADMS (Advanced Distribution Management System). This system is linked to our Supervisory Control and Data Acquisition (SCADA) system and obtains and analyses data such as the status of network assets (e.g. positions of circuit breakers), current flows and voltage levels throughout the network, in real time. This system is used to identify issues such as power flow constraints or voltage level issues on the network, and is used to model what-if scenarios such as the effect of a new load or generation connection. Using this tool, ActewAGL is able to identify existing and emerging constraints which form the basis of our asset management and network development plans.

ActewAGL's planning process is an annual process and covers a minimum forward planning period of ten years. The process commences with a comprehensive analysis of all indicators and trends to forecast the future load on the network. A detailed analysis of the network is then carried out to identify performance and capability shortcomings, i.e. constraints.

ActewAGL uses a two hour emergency cyclic rating for all its zone substation power transformers. ActewAGL has adopted the use of two hour emergency ratings and normal cyclic ratings, and uses the ADMS system to regularly record and reassess the cyclic loading capability of zone substation equipment, based on equipment manufacturer's recommendations and relevant Australian and international standards. ActewAGL maintains a high level of zone substation power transformer utilisation by using the two hour emergency cyclic rating, and effective load balancing between zone substations wherever possible. Load balancing is an integral initial solution to network augmentation planning.

If the augmentation or replacement cost of a proposal exceeds $5 million, we undertake a Regulatory Investment Test in line with the requirements of the NER (section 5.16 for transmission RIT-T and section 5.17 for distribution RIT-D). The purpose of the Regulatory Investment Test is to identify the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market. A preferred option may have a negative net economic benefit (that is, a net economic cost) where the identified need is for reliability corrective action.

ActewAGL ensures the following prior to committing to any large investment:

- Investments are cost effective and consider whole-of-life costs associated with a new asset.
- Timing of the new investment is such to meet the requirement of the need when it reaches the point that the need cannot otherwise be met.
- Appropriate investment procedures are followed, including business case and Board approval, and execution of RIT-T or RIT-D if required.
- Works are timed to ensure smooth capital and replacement cash flows, and availability of resources.
- Works are coordinated as required with other utilities and/or network service providers, and to meet customer needs.

3.2 Deterministic versus probabilistic planning approaches

Planning requirements are generally set as "deterministic" requirements, where rules or standards require investment to meet N (or N-0), N-1 and N-2 contingency criteria, where "N" is a single infrastructure element such as a transformer, transmission line or cable. These criteria basically

define the level of reliability and security to which a network is designed. These requirements are intended to ensure that the network can withstand periods of plant outage, without leading to load shedding. The strict use of deterministic planning criteria that consider only supply side options, however, may preclude demand side management options.

Under the “deterministic” planning approach, the timing of augmentations is determined on the basis of peak demand exceeding the planning criteria. If the deterministic planning approach is applied strictly, network investment to augment capacity would be required prior to the year when peak demand exceeds capacity. Deterministic criteria like N-1 and N-2 also assume that network investment occurs in discrete units, with known levels of reliability. It therefore effectively assumes that investment in infrastructure is used to meet planning criteria. This can be a barrier to demand management as demand management projects are not always available in discrete blocks to balance against network investments in infrastructure such as transformers and line upgrades.

The “probabilistic” planning approach is an extension of the deterministic planning approach in the sense that it provides a method of assessing the economic value of network reliability to customers. This can be used as a way to prioritise competing projects. In doing this, probabilistic planning also provides scope for non-network demand management alternatives to reduce load by introducing the economic value of supply for customers, which is the basis for all demand management projects.

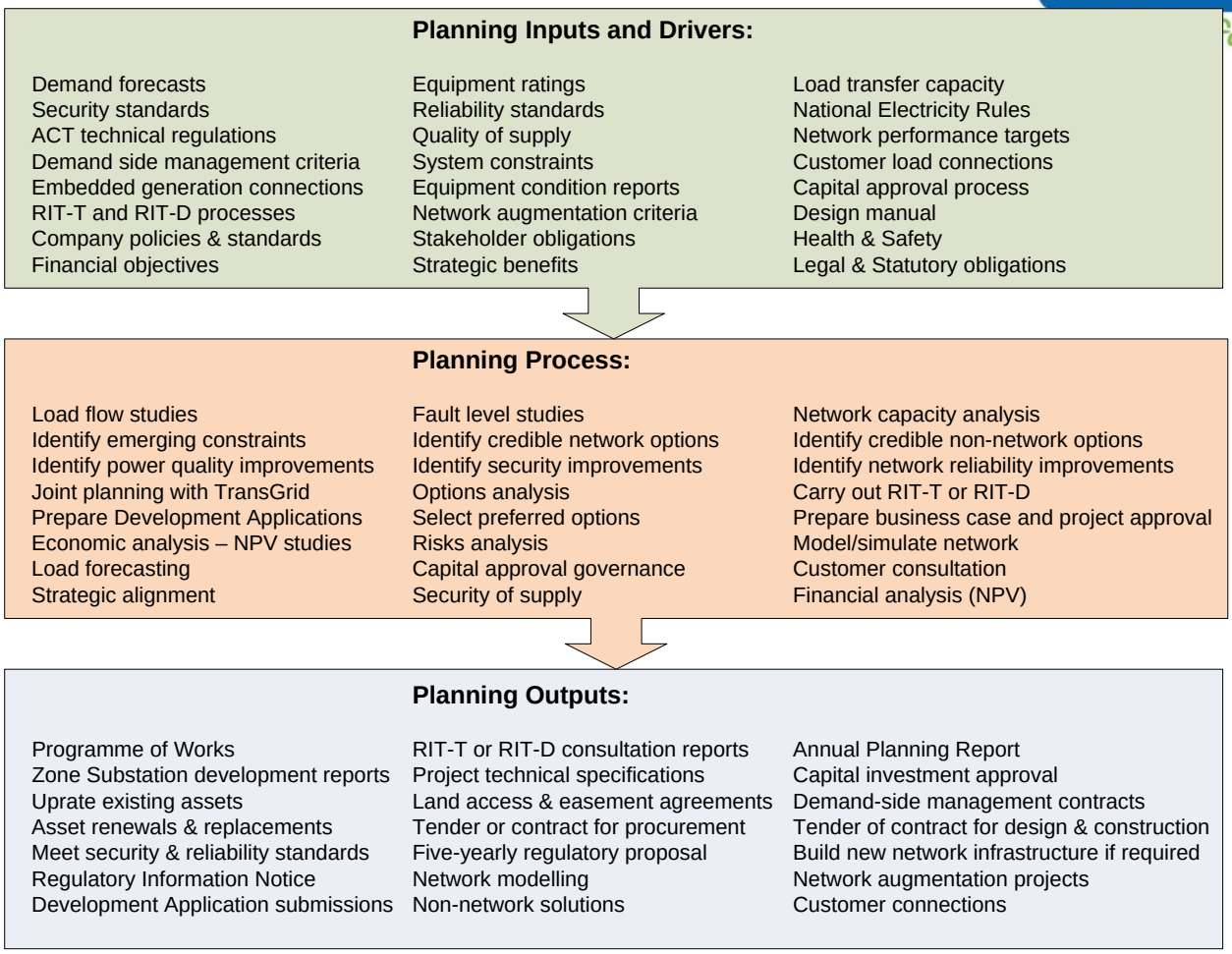
Customers will offer demand response capabilities when the reward for demand response is greater than the value they place on that supply. This can include accepting some degree of direct load control or capacity limitation. Deterministic planning criteria, strictly applied, do not facilitate NSPs offering this type of optimisation decision to customers, as it focuses entirely on the level of reliability and security of supply, not the value of that supply to customers. A probabilistic planning framework therefore may offer a different range of opportunities for demand management.

3.3 Planning Drivers & Guidelines

ActewAGL’s network development and expansion is influenced by multiple internal and external planning drivers. The requirements of these drivers come at an economic cost to customers and therefore ActewAGL endeavours to maintain a balance between what is considered an appropriate level of capacity, appropriate supply reliability and the cost of electricity to customers. ActewAGL has developed some guidelines and criteria and that in conjunction with external planning authority rules, guidelines and standards provide the framework for making decision across the entire planning process.

Figure 1 illustrates ActewAGL’s network planning process.

Figure 1: ActewAGL’s network planning process



3.4 Demand Management Options

ActewAGL's demand management strategy aims to identify demand management options and assess their potential to solve network limitations and constraints for broad based and more specific local situations. Demand management options may be to reduce demand or supply the increasing demand from alternative sources. Some practical demand management options have been identified and categorised into the following groups.

3.4.1 Demand Reduction

The following demand management options are examples of schemes that aim to reduce demand and may be applicable to residential, commercial and industrial situations.

1. Demand response programs – AAD are currently investigating a number of options for these including directly controlling customer installations, working with demand aggregators who will get us the desired response, and creation of a demand response trading platform that will enable an open market;
2. Power factor correction;
3. Pool pump controls;
4. Water heating load controls;
5. Air conditioning controls;
6. Under-floor heating controls;

7. EV charging station control - discharging EV batteries into the home at peak demand times or simply controlling when they do charge to avoid a new increased peak;
8. Automated feeder load sharing - this could be either permanent transfers or transfers done dynamically to relieve pressure during peak demand periods;
9. Interruptible load controls and pricing;
10. Critical load reduction controls and pricing;
11. Tariff realignment;
12. Use of stored energy – e.g. battery banks, reversible fuel cells (e.g. hydrogen), thermal storage;
13. On-site generation – e.g. gas micro turbine, photovoltaic cells, micro-wind turbines, diesel generators, co-generation and tri-generation;
14. Energy efficiency – e.g. replace all streetlight mercury vapour and high pressure sodium luminaires with LED dimmable streetlights;
15. Building management systems for office buildings and apartment blocks.

3.4.2 Alternative Supply

The following demand management options are examples of where demand may be shifted by using alternative sources of supply.

1. Fuel switching to gas to supply space heating, water heating, cooking appliances and evaporative cooling systems.
2. Energy and thermal storage using battery banks and fuel cells.
3. Standby electricity supply such as diesel generators or open cycle gas turbines.
4. Embedded generation such as rooftop PV.
5. Alternative fuel sources such as rooftop solar hot water heating or ground-source heat pumps.
6. On site / scheduled generation using co-generation and tri-generation.
7. Leasing generators by ActewAGL or non-network proponents.
8. Small, medium and large scale embedded generation.

Residential battery energy storage systems could assist demand management if controlled effectively. If batteries are charged during the day by rooftop PV they could reduce the ability of that generation to reduce the morning peak demand period. Ideally they would be charged during off peak or shoulder demand periods, then discharged during peak demand periods.

It is anticipated that customers and non-network proponents will be able to respond to demand management options and programs, or propose new innovative demand management options, by participating in the demand side management process.

3.5 Planning Outputs

ActewAGL's distribution planning activities develop different planning deliverables including reports, studies, submissions and actions to the proceeding stages of the streamline planning process.

4. References

The reference documents in Table 1 provide the basis and requirements of the planning drivers and guidelines for the network distribution planning policy.

The latest version of the reference documents are to be used for the network planning activities. The reference documents from external organisations can be accessed from their websites.

Table 1: Rules, Standards and Guidelines for Distribution Network Planning

Doc No.	Description	Source
1	Distribution Network Augmentation Standard	ActewAGL
2	National Electricity Rules	AER
3	Network Performance Targets	ActewAGL
4	Demand Side Management Planning Process	ActewAGL
5	ACTPLA Criteria	ACTPLA
6	TCCS Criteria	TCCS
7	Design Manual	ActewAGL
8	NPV Methodology	ActewAGL
9	RIT–(D) Process	AER
10	Federal Government Guidelines	SEWPEC