ASSET STRATEGY AND PLANNING

Distribution Network Augmentation Standard

1. Purpose

The purpose of this Standard is to define the distribution network augmentation criteria for ActewAGL's distribution network planning and expansion. This standard supersedes a number of current standards, targets, guidelines and criteria being used by ActewAGL distribution network planning.

2. Scope

The scope of this document includes standards and targets that ActewAGL aims to comply with and the criteria to be adopted. The following key standards, targets and criteria are set in this standard:

1. Network Supply Security Standard,
2. Network Performance Standards and Reliability Targets, and
3. Rating Standard, Loading Limits and Augmentation Criteria.

This standard is mainly applied in the review of ActewAGL's distribution network capacity to identify network constraints and to develop ten year augmentation plan including network augmentation programs and projects.

This standard supersedes following documents:

1. SR016 - Network Supply Security Standard,
2. SR018 - Network Augmentation Investment Criteria, and
3. EN 4.04 P07 - Distribution Network Reliability & Standard Supply Arrangements.

3. Objectives

This standard aims at achieving following broader objectives:

1. To ensure sufficient capacity is available to meet the current and anticipated network demand,
2. To maintain adequate network reliability performance across the network, consistent with the nature of the load and customer base in the supply area,
3. To maintain Quality of Supply (QOS) to the customers as per National Electricity Rules,
4. To ensure demand side management options are considered as credible solutions to alleviate network capacity constraints and minimise the cost of electricity to the customers.

4. Network Supply Security Standards

This section specifies network supply security standard for each type of network element. The security standard for each category of network asset must meet the standard as set out in Table 1.

Table 1: Network Asset Element Security Standard

Network Element	Security Standard
Transmission Lines	N-1
Zone Substations	N-1
Distribution Subs – Commercial	N
Distribution Subs – Urban Residential	N
Distribution Subs – Rural Residential	N

Network elements with (N-1) security standards must have sufficient capacity to carry the expected maximum load under single contingency condition with no loss of load. HV feeder security is interpreted in Table 3 below.

5. Network Performance & Reliability Targets

This section specifies network performance and reliability targets that ActewAGL aims to achieve.

5.1 Network Wide Reliability Indicators

ActewAGL has set the electrical network reliability targets consistent with the requirements of Electricity Distribution (Supply Standards) Code 2000, as listed in Table 2.

Table 2 Network Reliability Targets

Reliability Indicator	Target
System Average Interruption Duration Index (SAIDI)	91 minutes
System Average Interruption Frequency Index (SAIFI)	1.2 interruptions
Customer Average Interruption Duration Index (CAIDI)	74.6 minutes

6. Rating Standard, Loading limits and Augmentation criteria

This section specifies rating standards, loading limits and augmentation criteria for each type of network elements in the distribution network. ActewAGL's Electrical Data Manual is the single source of information for ratings and loading limits for most of the distribution network assets. The Electrical Data Manual provides up to date ratings of the assets.

The continuous (thermal) and emergency operating ratings are specified for all network assets covering each type of network element in the network. These ratings define limit states of the assets and if the forecast demand based on 10% PoE exceeds these ratings more than a specified duration

then trigger a network constraint. The continuous & emergency ratings are fixed for individual asset and can be reviewed based on an asset specific technical analysis.

The firm rating is specified for all network assets covering each type of network element in the network. The firm rating is an operating rating assigned to a network element based on the network asset configuration and the load type. The firm ratings of the assets are adjustable and set at specific levels to ensure the required supply security and network performance is achieved.

6.1 Transmission Lines

6.1.1 Rating Standard

Each individual transmission line is assigned with a continuous and emergency rating for summer and winter operations which are documented in ActewAGL Electrical Data Manual. The continuous line rating is applicable to normal system operation. The emergency line rating is determined based on the probability of more favourable ambient conditions existing, such as higher wind speed, than is assumed for the continuous rating.

6.1.2 Augmentation Criteria

Transmission line capacity must be augmented if the forecast transmission line maximum demand based on 10% PoE under N-1 conditions is to exceed

- the continuous rating for more than 1% of the time, or a total aggregated time of 88 hours per annum, or
- the continuous rating by 20%.

Certain events may trigger multiple contingencies, such as bushfire causing outage of multiple lines in the same corridor. In such cases, the need for sub transmission line augmentation will be assessed notwithstanding the above criteria.

6.2 Zone Substations

6.2.1 Rating Standard

Each zone substation is assigned with continuous and emergency ratings for summer and winter operations and the ratings are documented in Electrical Data Manual.

6.2.2 Augmentation Criteria

Zone substation capacity must be augmented if the forecast zone substation maximum demand based on 10% PoE under N-1 conditions is to exceed the two-hour emergency rating.

Major zone substation augmentation such as installation of additional transformer will not be considered unless other constraints that limit the transformer loading are removed.

6.3. Distribution Feeders

6.3.1 Rating Standard

Feeders in urban areas must have a minimum of two effective feeder ties to meet two-for-three arrangement where it is economically achievable. A firm rating is assigned to each feeder based on its thermal rating and the number of feeder ties available. The firm ratings of HV feeders are determined according to Table 3.

Table 3 Feeder Firm Rating standard

Feeder configuration	Firm rating as percentage of thermal capacity
Two or more feeder ties	75%
One feeder tie	50%
Feeders operating in parallel	{(N-1)/N}% [1]
Partial feeder tie	100% or less [2]
No feeder tie	100%

6.3.2 Augmentation Criteria

Distribution high Voltage feeder capacity must be augmented or demand management solution provided if the forecast feeder maximum demand based on 10% PoE is to exceed the firm ratings as given in Table 2.

6.4 Distribution Substations

6.4.1 Rating Standard and Loading Limit

Under normal operation, substation load must not exceed the limit expressed in percentage of transformer nominal rating in Table 4.

Table 4 Distribution Substation Rating Standard & Loading Limit

Substation Type	Commercial load[3]	Residential load in winter	Residential load in summer
Indoor substation	100%	130%	100%
Kiosk substation	90% [4]	115%	100%
Pad mount substation	100%	130%	100%

The loading limit set out in Table 4 applies to existing distribution substations for operational and augmentation purposes. It does not apply to the design of new distribution substations, where capacity is required for anticipated load growth.

[1] "N" represents the number of feeders operating in parallel.

[2] A partial feeder tie refers to a tie with limited back feeding capacity. The firm capacity of a feeder with a partial feeder tie may be set below 100% its thermal capacity.

[3] Commercial load is assumed summer peaking.

[4] Rating reduced as transformer in Kiosk was not rated and heat tested within the enclosures.

6.4.2 Augmentation Criteria

Distribution substation capacity must be augmented if the forecast load or the existing load is to exceed the loading limit set out in Table 4 under normal operation condition.

7. Supply Upgrades – Special Requirements

In the circumstances, where an interruption of supply could result in damage, loss or danger to life, health or property - the standard supply arrangement may not be sufficient. Consideration should be given to the load type, load size and location. The customer should be advised to balance the risks of supply interruption against the cost of providing increased supply reliability or on-site emergency generation.

7.1 Onsite Emergency Supply

The need for an emergency backup supply will depend on the design of the primary supply and the assessment by the customer of a risk resulting from the interruption of supply.

ActewAGL does not provide onsite emergency backup generation. Customers are responsible for making an assessment whether an onsite emergency supply is required. The onsite emergency supply is to be provided at the customer's cost.

ActewAGL recommends that the customer should provide an adequate onsite emergency supply when an interruption of network supply may result in significant loss or risks to life or property.

7.2 LV (415 V) Back up Connection

For a single transformer supply, a low voltage alternative supply should be provided from an adjacent substation as part of the standard supply arrangement if it is technically and economically viable. Generally, the provision of the low voltage alternative supply is considered economic, if it increases the cost of supply by no more than 10% of the total project cost. For residential loads, additional conditions are specified in the Underground Distribution Standard for inter-circuit LV ties.

The capacity of the low voltage alternative supply connection depends on a number of factors such as cable and conductor size, Voltage drop, capacity and load of the substation from which the supply is provided. Therefore, no guarantee of a back up capacity level can be given to the customer. During an emergency, the customer is required to reduce the load to match the available LV back up supply.

7.3 Special Network Supply Arrangement

Customers should establish whether the standard supply arrangement is adequate. If the standard supply does not meet customer's needs the supply may be upgraded to cater for special requirements. Any special supply upgrades are to be funded by the customer.

For particular applications, ActewAGL may recommend supply upgrade above the standard supply. ActewAGL recommended supply level should be clearly communicated in the written correspondence with the customer and all records retained for future reference. In the case when the standard supply is not sufficient, but the customer declines to upgrade the supply, the customer should indemnify ActewAGL against future consequences of the decision.

The supply upgrades may typically, include one or more of the following design modifications aimed at increasing security or reliability of supply:

- Additional transformer capacity,
- More than one transformer for loads above 1000 kVA,
- Additional 11 kV feeder connection,
- Low Voltage (415 V) alternative supply increase in the capacity of the low Voltage alternative supply,
- Parallel transformer operation,
- 11 kV flop-over facility,
- Low Voltage (415V) flop-over facility,
- Remote or automatic operation of switches/breakers,
- Remote load monitoring,
- Dedicated 11 kV feeder, and
- Duplicate 11 kV feeders (parallel feeders).

8. Responsibilities

Branch Manager Asset Strategy and Planning is responsible for the approval of this standard. Network Augmentation Manager is responsible for review and amendment to this standard as required. All staff involved in distribution network planning and expansion shall ensure compliance to this standard.

9. Definitions

10% PoE Forecast Load	Peak load forecast which has a 10% probability of being exceeded in any year (i.e. An upper range forecast likely to be exceeded only once every 10 years), based on normal expected growth rates and one in ten year extreme temperature condition
50% PoE Forecast Load	Peak load forecast which has a 50% probability of being exceeded in any year (i.e. A mid-range forecast likely to be exceeded once every 2 years), based on normal expected growth rates and one in two year temperature condition
Credible contingencies	A credible contingency is the loss of a single network element, which occurs sufficiently frequently, and has such consequences, as to justify the DNSP to take prudent precautions to mitigate. Commonly referred to an N-1 event
Commercial load	Load of commercial facilities, offices, industrial facility and utility infrastructures
Expected demand	Forecasted or expected summer or winter maximum demand
Feeder tie	Feeder interconnections that have adequate capacity for back feed operation
Firm Capacity	Capacity of supply during single contingency emergency. Usually, the most severe or restrictive faults and outages are considered when assessing firm capacity
Firm rating	An operation rating assigned to a feeder based on the feeder configuration and load type
Major storms	Severe storms affecting more than 10% of customers in the area subjected to storm
Momentary interruptions	Interruptions of short duration during protection operations, auto-reclose, and auto-changeover events, with a typical duration of 2 to 10 seconds
Partial feeder tie	Partial back up refers to ties with limited capacity to back feed
Recommended Supply	Supply arrangement considered to be adequate by ActewAGL after consultation with the customer and consideration of load type, availability of onsite emergency generation, risk of supply interruption and other relevant factors. The level of recommended supply shall be at, or above the standard supply
Residential load	Load of residential customers in either suburban or rural areas
Rural	Areas outside the urban area in the ACT
Thermal capacity	The rating of an apparatus limited by its thermal characteristics and load pattern
Urban	areas in the ACT occupied by residential suburbs, commercial centres, major industrial districts, education institutions, and transport hubs
CAIDI	**Customer Average Interruption Duration Index** – the ratio of customer interruption durations to the total number of customer interruptions. It is measured in minutes per customer and indicates customer average supply interruption duration
SAIDI	**System Average Interruption Duration Index** – the ratio of customer interruption durations to the total number of customers served. It is measured in minutes p.a. per customer and indicates system average supply interruption duration
SAIFI	**System Average Interruption Frequency Index** – the ratio of total number of customers' interruptions to the total number of customers served. This indicates the average number of interruptions an average customer experiences per annum
Single contingency emergency	A state of the network after single network component outage or network fault

10. References

Distribution Network Planning and Expansion Framework