Appendix 1.5: Asset management system - description

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

Asset Management System - Description

Version Number Version 5.0 Effective date: 12 Jan 2018

Table of Contents

1 Overview of the asset management system

The asset management system (AMS), in common with all systems, is a collection of functionally related elements working together towards a purpose. Simply put, the purpose of the AMS is to manage corporate assets in such a way as to comply with corporate policy. The cornerstone document within the AMS is the asset management policy, which is itself informed by the corporate asset management policy and strategy. The asset management policy provides the corporate requirements and expectations on how assets will be managed, and under that document is the asset management strategy which explains how those requirements and expectations will be implemented.

This document also meets a key requirement towards certification of the asset management system to ISO 55001 requirements.

The asset management strategy is implemented by the asset management plan, which for ActewAGL Distribution, is composed of a number of asset specific plans (ASP). These ASPs are very detailed in their description of the assets they cover, as well as their attributes and all the planned activities and costs associated with those assets. The ASPs individually, and in concert with each other provide the plans which will inform:

1. A detailed program of works for all corporate assets
2. A forecast of capital and operating expenditures
3. A budget for planned and unplanned maintenance, condition monitoring and refurbishment
4. Augmentation plans
5. Health of assets, and risk of asset failure
6. Assurance of transparency and “line of sight” from boardroom to workshop. Senior managers can be confident that corporate policy is being implemented, frontline workers can be confident that they are empowered with the resources and information to meet corporate requirements.
7. Assurance that alternatives and priorities on asset management have been set to best meet corporate goals.
8. Feedback on the effectiveness of the asset management plan on achieving targets

2 Decision Support System

This decision support system (DSS), in common with all systems, is a collection of functionally related elements working together towards a purpose. Simply put, the purpose of the DSS is to support ActewAGL’s asset management system (AMS) in such a way as to comply with corporate policy. To ensure the asset specific plans generated by our DSS are aligned with our corporate policy, we have developed a hierarchy of aligned documents from corporate policy to asset management policy, strategy, objectives and our asset specific plans.

Our asset management strategy is implemented by an overall asset management plan, which for ActewAGL Distribution, is composed of a set of asset specific plans (ASP). These ASPs are very detailed in their description of the assets they cover, as well as their attributes and all the planned activities and costs associated with those assets. The ASPs individually, and in concert with each other provide the plans which will inform:

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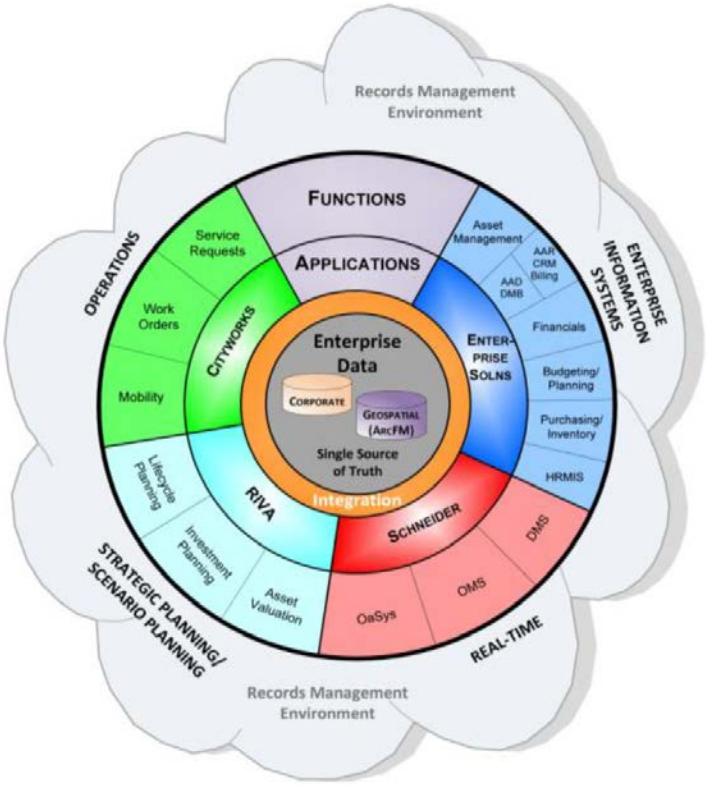
8. Feedback on the effectiveness of the asset management plan on achieving targets.

DSS is ActewAGL's asset management analysis and decision support software and has a range of functions, including its role as the forecasting tool for most of the significant capex and opex projections made by ActewAGL.

Connection of a geospatial database for all assets managed by ActewAGL, is key to enabling the capability to construct for an Asset Specific Plan (ASP) for each and every asset type. The following data is collected for each asset maintained in the DSS:

1. Asset condition
2. Forecast useful life
3. Value to the organisation
4. Discoverability
5. Probability of failure
6. Consequence of failure
7. Replacement cost
8. Cost of asset



Riva also pulls information from the works management system for up to date maintenance history data, ensuring work schedule projections are based on relevant data and trends.

At its core, Riva uses this data to as input to a series of algorithms that provide for an optimal capex replacement/augmentation program and maintenance work schedule. This is fundamentally a function of risk and cost.

3 Preparation of the asset specific plan template

The key to successfully building asset specific plans is preparation and consistency. A lot of time was invested in designing an ASP template with the following attributes

1. Detailed description of the asset and its functions
2. Reliability and availability targets
3. Quantitative information on asset population
4. Current and future health and risk reporting
5. Asset criticality
6. Deterioration drivers and failure modes
7. Source and quality of information on asset
8. Planned activities and alternative strategies
9. Disposal strategies
10. Program of planned works and budget

The template is a combination of descriptive text fields, tables, graphs, and an appendix of planned program of works with associated budget for that asset. In practice, the components of the template are stores in the asset management application that ActewAGL uses “DSS”, and these fields are assembled on command to produce the final ASP. A lot of preparation time was used in generating and populating the data fields for each asset to ensure the accuracy of the final ASP.

4 Asset data consolidation and analysis process

Complete and accurate asset data is a requirement for an effective asset management plan as it enables:

- A holistic and integrated planning approach with all asset data available for analysis
- Full and detailed data avoids the difficulty of making assumptions on critical attributes
- Analysis of conditional data will help predict failure.
- System wide data helps place asset roles in context, for example criticality or support functions

5 Step by step description on requirements to build up the ASPs

5.1 Step 1: Build corporate inventory

The asset management policy and strategy documents will define what assets will be included in the corporate asset management plan, and the first step will be to assemble a complete and accurate inventory of those assets. Prior to developing the asset management system, asset inventories were kept in a number of different systems, therefore a lot of time and effort was invested in creating the centralized single inventory, which contains as much physical information about each asset as possible.

The single inventory improves confidence in determining the scope of projects and plans.

It would also be advantageous to record exactly where these assets are physically located. Having all point and linear assets in a GIS would aid in filtering activities based on proximity, or when looking for opportunities to do more in a specific location to reduce total costs. This integration is planned in a future upgrade of ActewAGL Distribution's operational systems, where asset information is stored within a centrally accessible data base, to be used by a number of asset related activities.

In some cases, for example the pole inventory, date of installation information is lost, or never existed in the first place. In those instances, assumptions are made about asset age based on other characteristics of the asset, or where it is located. As data collection improves over time with inspection and/or works history, inventory accuracy will improve.

Any data gaps in physical characteristics may be completed by applying assumptions to the asset inventory from advice provided by experienced personnel who have been working with those assets.

These core physical characteristics form the foundation for constructive analysis and contribute meaningfully to the Asset Management Plan.

5.2 Step 2: Extend asset data

When the basic asset inventory is complete, this provides the opportunity to extend on that knowledge with more analytical data.

5.2.1 Condition

Of prime importance is the condition of the asset, preferably indicated by reference to an inspection record. The age of the asset in not considered a reliable indicator of asset condition, and wherever possible, the most recent inspection record should be the reference for asset's true state of repair.

5.2.2 Forecast useful life

Also very important is the expected useful life of the asset. Manufacturers will provide guidelines, however the actual life span will be based on many factors. Engineering and works crews will be able to provide evidence on how assets are performing in situ, leading to more realistic evaluation of potential investment requirements.

5.2.3 Value to the organisation

It is also important to determine the actual value of that asset. Costing can be done on a unit cost basis for most assets, or determined based on size or capacity. Alternatively, there could be a detailed estimation or insurance valuation. In any case, the real value of an asset to the organisation is not its depreciated acquisition cost, it is the remaining value of the asset's replacement cost, based on condition.

5.3 Step 3: Asset base profiles

Because each asset in the inventory has an age (or approximation), how much it will cost to replace, how long it could potentially last, and what condition it is in, it is possible to conduct analysis on that inventory to form the basis of asset management plans.

5.3.1 Inventory Report

A report can be generated on the entire inventory at once, across all asset types. A base count by asset type for all assets forms the initial part of the asset specific plan template.

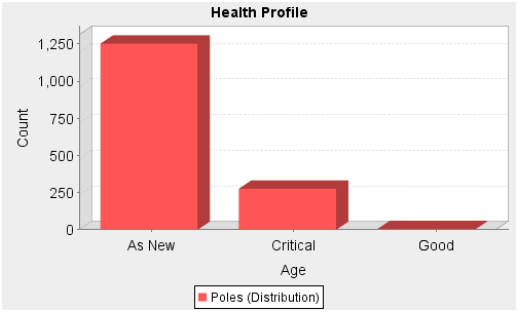
5.3.2 Age Profile

It is also possible to produce an age profile, by asset type, or by replacement cost, alternatively a consumption profile, showing how much of our assets' lives are used up.

5.3.3 Health Profile

Health profiles are also available now, the inventory is able to provide the breakdown of assets by their condition.

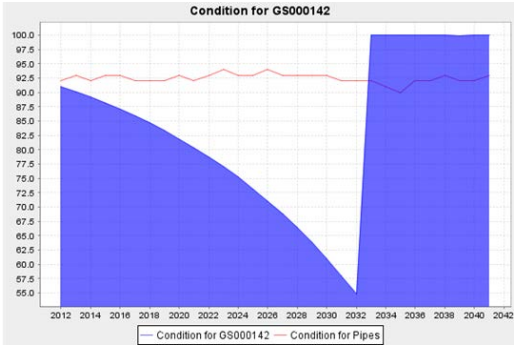
This provides the starting point for projects.



5.3.4 Condition Profile

A condition profile can be generated for individual assets, or entire asset inventories, which shows the value or condition of assets in aggregate into the future.

By having a common data base, and applying consistent rules for generating extended analytical results, it is possible to forecast the state of the asset base at any given time



5.4 Step 4: Asset risk analysis

Risk is the ultimate measuring stick for gaining the biggest impact, and consideration of the important assets in determination of investment plans. Determining risk across all asset types is the ultimate goal of the asset management plan.

RISK, simply put, is the product of the PROBABILITY of an asset failing and the IMPACT of that failure, less any mitigation strategies that we may have in place.

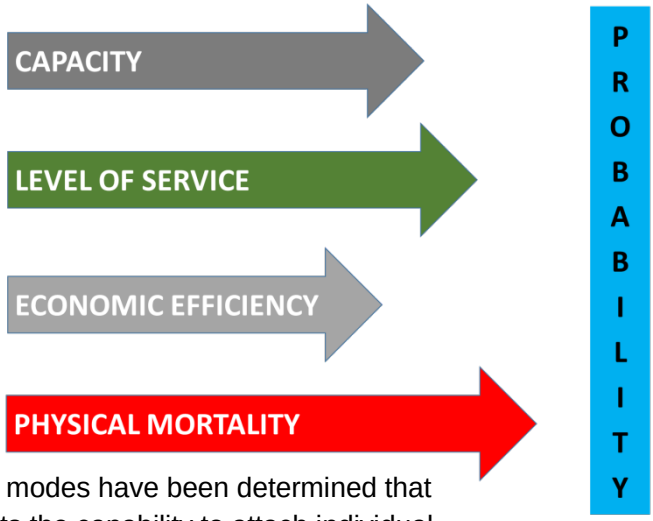
5.4.1 Probability of failure (POF) and failure modes

Asset fail, but they can fail in different ways, at different stages of their life, for different reasons. The objective is to make a prediction of failure far enough in advance to plan for it. The simplest way of determining the probability of failure of an asset is to inspect the condition curve. POF will be greatest when condition is at a minimum. A more useful method for managing risk is to look at failure modes.

The first step in figuring out the Probability of Failure of an asset is to sit down with the people who actually look after them and list out all the reason's they need to replace those types of assets. Do they get hit by cars, fall down on their own, use too much power, cost too much to fix again?

There are four key modes of failure:

- A failure of capacity, like a distribution network that cannot cope with demand.
- A failure in the level of service, when an asset fails to deliver the minimum acceptable customer experience.
- A failure due to economic efficiency, like an asset that costs more to operate than it does to replace.
- Finally, and most common, physical mortality, when the asset simply ceases to function.



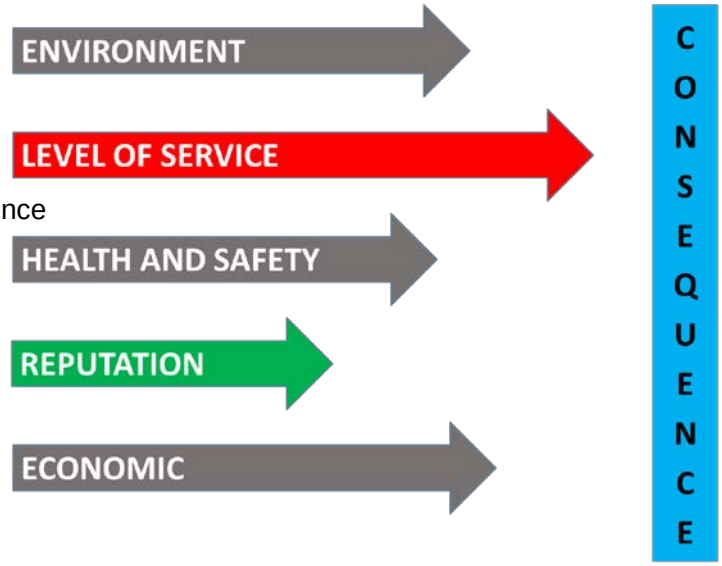
For each major asset group in ActewAGL, failure modes have been determined that apply to assets within that group. There also exists the capability to attach individual failure modes to high-risk or high-visibility individual assets. These failure modes help to determine the probability of the asset failing at any given point in its planning cycle. The most dominant failure mode is determined, and then also which one is most imminent. This provides a grasp of the current and future probability of failure likelihood for each asset.

5.4.2 Consequence of failure (COF)

Having determined how an asset can fail, and how likely it is at any given time, it then remains to determine just how much impact that failure will have on the organization. The organizational objectives and overall asset management strategy are a great reference when quantifying that impact.

Typically, start by looking at an asset's failure impact by creating several scales, and ranking the impact of a failure on those scales.

At ActewAGL, the following are the COF scales that are in place:

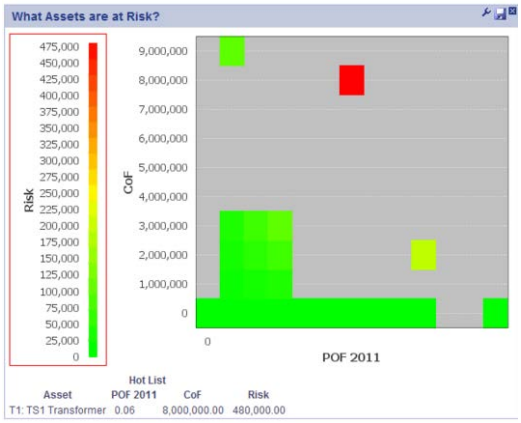


- Financial
- Reputation
- Environment
- Legal/Compliance
- Operations
- Safety
- Stakeholders
- Program/Project

The critical thing is that the scales are relative, so that they can be applied across the asset inventory. This is the key step – allowing comparison of apples and oranges, wires and transformers, substations and properties, all on the same scale.

5.4.3 Ranking by risk

Once we have probability of failure, and consequence of failure, they can be combined to come up with a risk priority. Each asset can then be ranked according to the exposure that the organization would experience if the asset failed, based on multiple causes of failure. The end result is a risk priority number (RPN) value for each asset in the inventory.

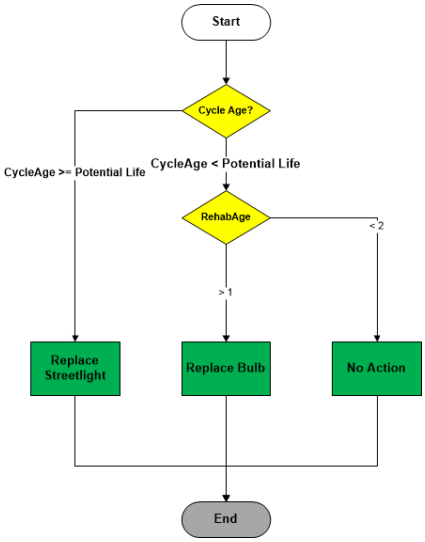


This value can be used to drive inspection frequency, insurance valuations, environmental mitigation strategies, and other regulatory activities, and also rank competing events and activities.

By having a clear grasp on our asset data, it is possible to gain enormous clarity in understanding the scope of our activities. Not only does reporting become simpler, but it is possible to quickly answer questions about current valuation, condition and risk exposure. This flows automatically into the updated Asset Management Plan. The result is the ability to separate out the most critical assets, and act on them as a matter of priority.

5.5 Building asset strategies

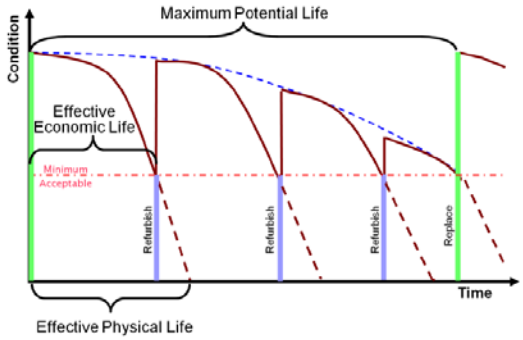
Knowing what can be done is critical to managing asset performance. Knowing when and when not to do it is just as critical. Managing asset inventories is the art of balancing operating and capital costs, determining the best point on an asset's lifecycle to inject activities or interventions to keep the costs over the asset's life at their minimum, while maintaining the value of that asset to the organization.



5.6 Capturing asset behaviour

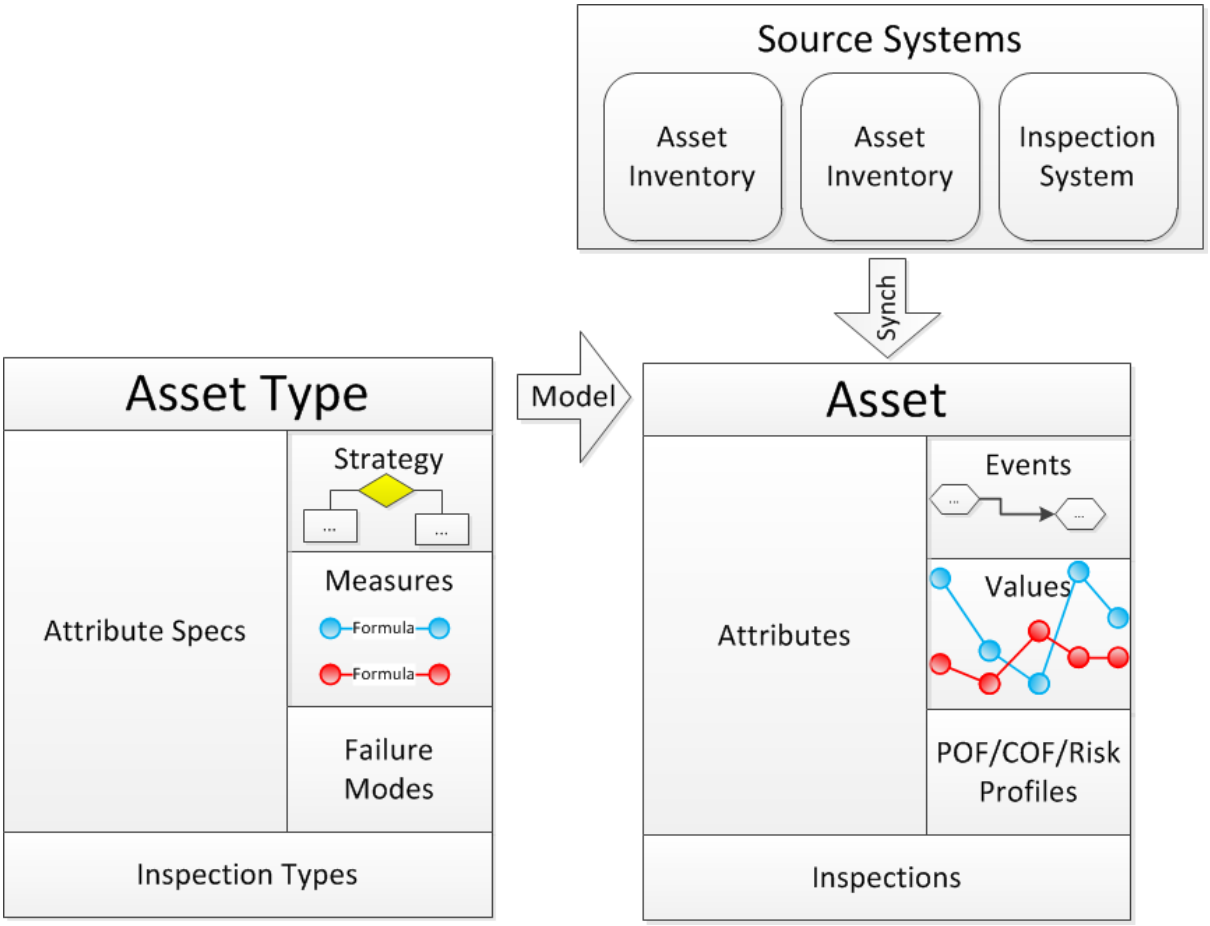
The key to developing these strategies is to work directly with the asset managers, and extract the institutional knowledge they have about how those asset actually perform, and what can be done to them in order to keep them performing, in the real world.

That provides two advantages: a great start in building a decision tree to predict future investment requirements, and it captures that institutional knowledge on how best to maintain those assets.



Once documented, it will serve as the starting point for new staff as they come onboard, shortening their ramp-up time dramatically. The resulting decision logic, when applied to individual assets, generates a lifecycle forecast of what can be done to the asset over the course of its life, complete with costing, risk impacts, and value contributions.

The product of this is the list of pending asset events and activities, based on everything known about the asset inventory, and using institutional knowledge.



5.6.1 DSS's Asset Model

The above diagram depicts an asset model.

The process starts by defining asset types. These types contain the ATTRIBUTE definitions for those types, like height, voltage, useful life.

The type also contains the STRATEGY used to manage that asset, indicating what we can do and when we should do it for each asset of that type. It also contains the definitions of our performance measures, or what predictions we want to make about that asset in the future, such as RISK, CONDITION, AGE and COST. Finally, each type defines the failure modes for assets of that type.

Information is also required from source systems like WASP or GIS. Physical Asset records flow from these source systems into the asset model, and based on their type, to create a distinct asset.

Each asset contains all of the attributes defined for it, like age, in-service, material, diameter, voltage, etc.. It also contains a set of events and activities that have been

generated for that asset based on our strategy, predicted values of future measures, and probability, consequence and Risk profiles.

When structured in this way, continual improvements can be made to the asset type definition and strategy, and applied to the asset base, to get a better predictions and plans for the future.

It is also possible to set up alternative strategies, failure modes, and decision models to play “what if” scenarios with the asset base. The key output of all of this is the needs list, for next year, the year after, or 10 to 50 years out.

5.7 Elements of the Asset Management Plan

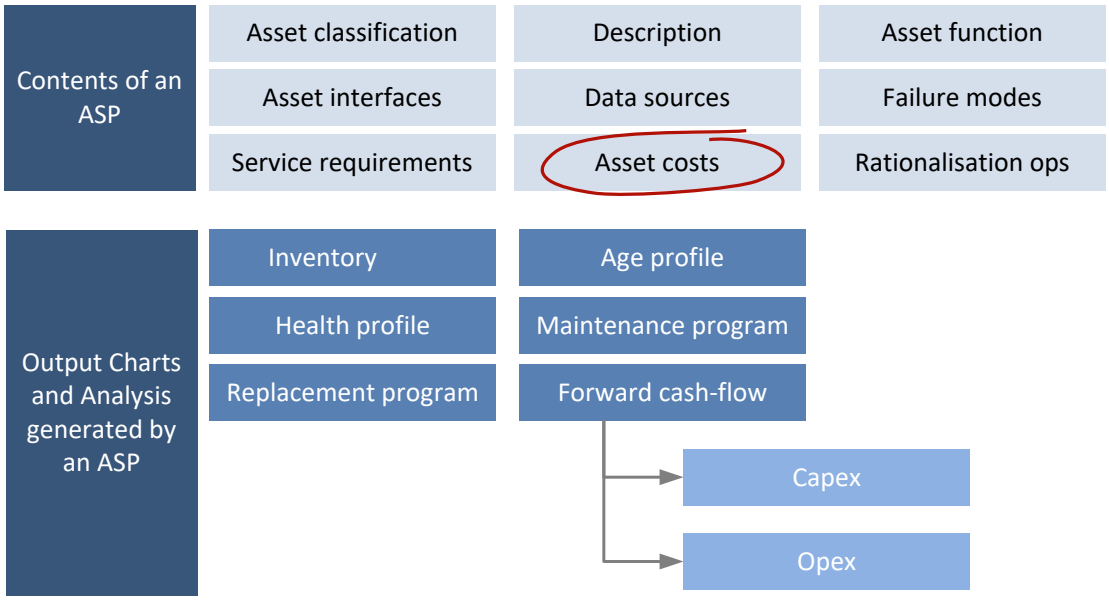
All of the components of the Asset Specific Plans are contained within DSS, and can be used to generate the plan at any time. These components include the textual entries that describe the current state of the Asset Group populating the plan, as well as the raw data that populates the tabular and graphical elements of the final plans.

DSS creates each plan at the time of request, using the current state of the asset inventory, analysis, needs, and activities.

The dynamically generated elements of each plan include:

- Asset Base (inventory counts by asset sub-type)
- Asset Failure Modes (failure modes for each asset type within the group)
- Asset Costs (Unit costs for replacement, maintenance and monitoring)
- Projected Inventory (Graphical representation of asset counts for next 10 years)
- Age Profile (Graphical representation of asset age by year)
- Consumption Profile (Graphical representation of the percentage of asset life consumed)
- Health Profile (Graphical representation of asset base condition)
- Maintenance Program (Graphical representation of asset OPEX projections for next 10 years)
- Planned Replacements (Graphical representation of Asset replacement events for next 10 years)
- Future Cash flow (Graphical representation of OPEX and CAPEX investments for the next 10 years)

Asset Specific Plan (ASP) document structure



6 Reporting for regulatory requirements

6.1 Forecasting requirements

The Australian Energy Regulator (AER) is Australia's independent national energy market regulator for electricity and gas. Under the National Electricity Rules (NER) and the National Gas Rules (*NGR*) one of the primary roles of the AER is to regulate the energy networks (including ActewAGL) that transport and distribute energy to promote the long term interests of consumers.

The AER is implementing the 'Better Regulation Program', following changes to the National Electricity and Gas Rules announced on 29 November 2012 by the Australian Energy Market Commission (AEMC). The Better Regulation Program will be published in a series of guidelines due by 29 November 2013.

ActewAGL is currently preparing regulatory proposal to the AER for ACT electricity distribution network for the regulatory control period 2014/15 to 2018/19 . Under the updated NER's, ActewAGL is required to submit the following document to the AER for the 2014/15 – 2018/19 regulatory period.

- Methodology for forecasting capital and operating expenditure (clause 6.8.1A of *NER*).

6.2 Forecasting Methods

6.2.1 Zero-based vs base year

There are two predominant forecasting approaches used in the utilities sector, zero-based and base year methods. Zero-based assumes a nil budget as the start point, adding the projects or activities required that year in a ‘bottom-up’ construction of the cost. Base year uses a comparable financial year as the starting point, removing projects or activities no longer relevant and conversely, adding projects or activities required during the forecast period that weren’t in the base year.

6.2.2 Forecasting approaches used

ActewAGL Electricity use a mixture of zero-based and base year approaches as summarised in the diagram below. Corporate overheads are the exception, being attributed between ActewAGL businesses based on an enterprise wide corporate attribution model. The following sections of the report analyse these approaches in more detail.

Costing approaches used

Type	*Cost category*	*System source*	*Forecasting/costing approach*
Capex	Asset renewal/replacement	RIVA	Zero based
	Customer initiated		
	Augmentation		
	Poles		
	Meters		
	Network IT systems and comms	FMIS	
	Other capital expenditure		Base year
Opex	Network operating	FMIS	Base year
	Network maintenance	RIVA	Zero based
	Vegetation management	FMIS	Base year
	Other operating expenditure		
	Corporate overheads	FPSC Model	Attribution

7 Capex forecasting

Refer to chapter 5

ActewAGL Electricity Distribution Network Expenditure Forecasting Methodology

8 Opex forecasting

Refer to chapter 6

ActewAGL Electricity Distribution Network Expenditure Forecasting Methodology

9 Glossary

AMS	Asset management strategy
AMP	Asset management plan
ASP	Asset specific plan
Base year	Using an efficient previous year's expenditure as the starting point for forecasting future years.
COF	Consequence of failure
FIT	Feed in tariff
FMIS	Financial Management Information System
FPSC	Fixed price service charge
MAMP	Metering asset management plan
NSP	Network service provider
NPV	Net present value
POF	Probability of failure
PP&E	Property, plant and equipment
SLA	Service level agreement
The Territory	Australian Capital Territory
UNFT	Utilities Network Facilities Tax
Zero-based	A bottom-up construction of the forecast assuming a nil budget starting point