# Title: Development of Asset Management Plans for RE O&M – bringing ISO 55001 closer to real assets

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## 1. Introduction

The global Asset Management standard, ISO 55001:2014, is finding increasing traction across many industries, in many countries. This is reflected by 164 organisations that have achieved formal ISO certification, of which 35 are in the electrical energy business. Implementation of an ISO compliant management system follows a top-down approach, with strategic level elements being completed first to provide guidance for a rational deployment. The positive effect of organisational alignment is undeniable, and it is well reported in industry. However, when implementation has to extend to operational levels, where the physical assets are in action, the process and artefacts proposed by the standard are not so well defined and methods not so clear.

This paper is a case study of the development of Asset Management Plans (AMPs), as called for by clause 6.2.2 of the standard, as it was developed for a local RE IPP asset owner and operator. It covers the required objectives for the AMPs, the process to find agreement on appropriate content and the method and format of documenting the information in order to deliver a live, useful tool, for effective application by the engineers on the ground.

## 2. Asset Management Systems

According to ISO 55000 (Overview, principles and terminology):

“The organisation shall establish, document and maintain asset management plan(s) to achieve the asset management objectives. An asset management plan is documented information that specifies the activities, resources and timescales required for an individual asset or grouping of assets. It is common practice for such a plan to contain a rationale for AM activities, operational and maintenance plans and capital investment plans (overhaul, renewal, replacement, enhancement and disposal), and financial and resource plans.”

Figure 1 below shows the position of the AM plans as one of the key elements within the larger AM system .

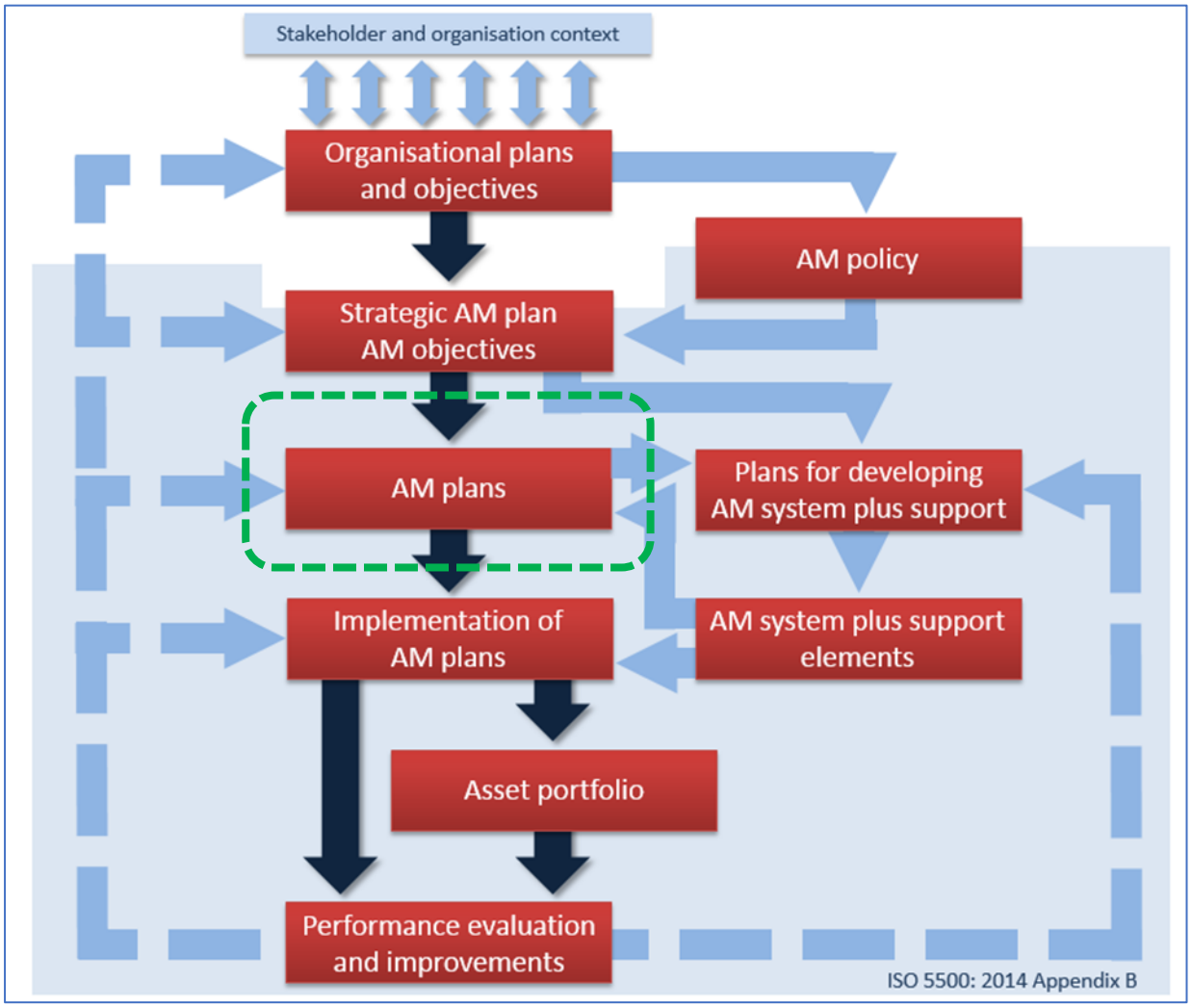


Figure 1: Key elements of AM system (ISO 55000:2014, Annex B)

Further to the guidelines and requirements of the ISO standard, the wisdom of global large asset owners were considered during the planning and scoping for the development of AM plans for the project described in more detail below.

Typically, they asserted a need at Business Unit level to establish Asset Management Plans for critical assets within the context of the long-term business plan for such assets to optimise the planning and budgeting processes and help to drive down the total cost of ownership over the life of these assets while effectively manage risk contributors.

Asset Management plans are documented information that specifies the activities, resources and timescales required for an individual asset, or a grouping of assets, to achieve the organisation's asset management objectives. The grouping of assets may be by asset type, asset class, and asset system or asset portfolio.

However, it was determined that AMPs should not be self-contained printable documents, but rather a folder structure that may again contain subfolders containing documents that

cover the elements of the AMP or link to associated content. The actual content is typically a mix of text documents, schedules, models plans, and libraries of reference documents such as photos, manuals etc. It becomes a reference source for all information about and associated with the equipment. The AMP contains and refers to all relevant information to support the management of the physical equipment through all its life cycle phases, from addressing the design, procurement, installation and commissioning aspects through operation and maintenance into the final decommissioning and disposal. The disposal phase defines the disposal requirements of the equipment which often runs in parallel with the next acquisition phase to put the next generation of equipment in place. This is typical for operations where the business lifecycle is longer than the equipment life span.

Effective management and application of AMPs should support the following business outcomes:

- It provides a clear link between the business service level expectations and the equipment's performance.
- It presents an understanding of the present and future demands on the equipment and an estimate of the long term financial commitments.
- Presents a clear and up to date status of the equipment's performance, condition and health.
- It supports optimal life determination and life cycle budgeting.
- Defines risks and contain risk mitigation plans.
- Summarise the appropriate strategies to address issues in relation to both the shorter term operations and maintenance and the longer term strategic planning of the assets.
- An information source capable of spanning organisational changes and the transfer of responsibilities between successive organisational roles.
- Modelling of future costs and asset performance and process to identify future work and staff needs.
- It integrates all the information and processes associated with the equipment in a logical structure.
- It is a mechanism to introduce discipline to enhance the execution of the intent of the various plans and activities.
- It is a tool to communicate to stakeholders, customers and other parties about the organisations asset management activities.
- It provides a reference basis for continuous improvement as it is effective in highlighting gaps in information and processes.

# 3. Developing AMPs for an SA REIPP

## 3.1 Project background

The authors were the lead Asset Management consultants in a project for the asset owners and operators in the local renewable energy (RE) industry. The assets under management are located on one wind farm and two solar PV plants, all constructed in the REIPPPP round 1. The plants all went commercial during April 2014. At the time of the project roll-out, all the operational assets (or equipment items) were in their third year of a 20-year lifetime (governed by the duration of the Power Purchase Agreement with the contractual energy buyers). The EPC warranty period of typically two years had expired, thus the asset owners were facing a period of eighteen years during which they will be responsible and accountable for asset performance, cost and risk.

The operational equipment items of this type of operation can be divided in three major categories:

- Generation: those equipment items converting energy from renewable sources (wind and sun, in the case of this project) to electrical, typically at 400 to 700 VAC. This includes wind turbine generators, PV modules and inverters.
- Electrical Balance of Plant (EBOP): those equipment items transporting and transforming the generated energy to a point and form suitable for delivery to the Eskom transmission grid typically at 132 kV. This includes transformers, cabling, protection, monitoring, control and communication systems.
- Civil Balance of Plant: all other equipment items which provide the infrastructure and environment for effective operation, maintenance and management of the Generation and EBOP equipment. This includes buildings, roads, fences, water supply.

Given the youthfulness of the RE industry in South Africa, the required longevity and the high technology and foreign supply content of the Generation assets, the project employer opted for an extensive top-down management system development to achieve the dual objectives of short-term enablement and long-term sustainability of their business. With the extremely high asset-intensiveness of the business, ISO 55001 provided the ideal framework for this.

## 3.2 Project roll-out

With reference to Figure 1 above, the project roll-out was planned to establish the following deliverables in top-down fashion:

- Customised Asset Management framework, which would serve for gap analysis between “as-is” and “to-be” states of the organisation, and management system design,
- Operational Strategic Plan (OSP), to clearly formulate and document the inherent business strategy as it developed intuitively during the early period,
- Asset Management Policy,
- Strategic Asset Management Plans (SAMP, one per plant),
- Asset Management Plans.

A key mechanism to support Change Management in the organisation, was the establishment of a project Steering Committee. Where it is relatively easy for a project team, including consultants, to put deliverables on the table, the real challenge lies in shaping the culture of the organisation to internalise and apply the proposed wisdom. The harnessed support of the organisation’s top management played a major role to smooth the road.

The first four elements listed above are all strategic in nature. As such, while no one would doubt their place and value, they are fairly removed from the day-to-day operations and thus do not materially contribute to the perceived needs of the organisation’s resources who are held responsible and accountable for asset performance, costs and risks.

The AMPs, in contrast, were expected to address the asset portfolio consideration directly, thereby supporting the O&M resources in their activities and decision-making.

### 3.3 AMP development process

The project stakeholders placed a high premium on the inclusivity of the process to develop the AMPs, and the change management to be obtained by wide participation of the O&M resources. However, the same resources were heavily loaded with O&M responsibilities, and their time and availability to participate in the AMP development was constrained.

The nominal process followed, was:

- Find agreement on AMP contents and the format of information to be documented and included
- Consultants would source information from combination of options:
  - Plant as-built information and data (residing mostly on Sharepoint)
  - Organisation’s staff members (Plants, Operations, Commercial, Financial)
  - Subject Matter Experts (SMEs) external to the organisation
  - Suppliers and OEMs
  - General technical, engineering and financial literature (public domain, mostly web-based)
- Conduct detailed Failure Mode and Effect Analyses (FMEA) for each asset type in scope

- Conduct structured asset condition assessments, for at least pilot samples of the operational equipment in scope
- Construct and populate life cycle cost (LCC) models for the projected plant life of 20 years
- Document high-level information in AMP Master Document, and reference details stored in underlying folder structure
- Review progress regularly with as wide an audience as possible to confirm agreement on data included, statements made, conclusions drawn.
- Feature the AMP development process high on the agenda of the project Steering Committee.

The final AMP master document content is shown in Figure 2 below.

## TABLE OF CONTENTS



Figure 2: Final AMP Table of Contents

## 4. Conclusion

A set of five AMPs were completed in December 2017, one for each for the following major asset type/groups:

- Solar PV Inverters
- PV Modules
- Solar SCADA system
- Generation Step-up Transformers
- Power Transformers

With reference to the contents of the plans, at this early stage in the asset lives, the most valuable parts of the plans, from perspective of the O&M users, appears to be:

- Asset type characterisation, and particularly the asset condition assessments; as aid to life-cycle planning and decision making
- Financial, Life Cycle Costing (LCC); as aid to budgeting
- Risk Management, AM Risks, with mitigation plans
- Asset Life Cycle Management, and particularly the planned actions derived from the condition assessments
- Resourcing, as aid to organisation and competency development.

The challenge, after completing the initial versions of the AMPs, will be to keep the documents and underlying information alive and configuration control.

## 5. References


1. ISO 55000 series (ISO 55000:2014, ISO 55001:2014, ISO 55002:2014).
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4. C Saunders, Operations Manager, Globeleq SA Management Services.