

NRS 093:2018

Edition 1

ASSET MANAGEMENT OF ELECTRICITY INFRASTRUCTURE

This document is not a South African National Standard



This rationalized user specification is issued by
the Technical Governance Department, Eskom,
on behalf of the
User Group given in the foreword
and is not a standard as contemplated in the Standards Act, 1993 (Act No. 29 of 1993).

Table of changes

Change No.	Date	Text affected

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Foreword

NRS 093 was prepared on behalf of the NRS Mancom and approved by it.

NRS 093 was prepared by a working group which, at the time of publication, comprised the following members:

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Ratema D	National Energy Regulator of South Africa

Reference is made in the definition of “critical asset” to “statutory considerations”, in 4.3.6.4 to “statutory and environmental issues” and in 3.3.1.2, 4.3.5.8, 4.3.8.1, 4.4.1.2 and 4.6.1(a) to “statutory requirements”. In South Africa this is the Government Immovable Asset Management Act, 2007 (Act No. 19 of 2007) (as amended from time to time) and the Public Finance Management Act, 1999 (Act No. 1 of 1999) as amended by the Public Finance Management Amendment Act, 1999 (Act No. 29 of 1999) (as amended from time to time).

Introduction

NRS 093 has been prepared as a guideline to establish and promote uniform requirements for implementation of asset management of electricity infrastructure. ISO 55000 has replaced PAS 55 as the International Standard on Asset management and may be adopted by the South African electricity industry.

Asset management is about realising value from our assets whilst managing these assets from conceptual stage to disposal ('Cradle to Grave') of the asset. The concept of 'Cradle to Grave' includes the function of Planning, Design, Acquisition, Operations, Maintenance and End of Life Management. Several authors and Organisations have applied the 'Cradle to Grave' concept in various ways.

The application of an asset management system provides assurance that those objectives can be achieved consistently and sustainably over time. The adoption of ISO 55000 series as the international standard enables an organization to achieve its objectives through the effective and efficient management of its assets.

This document provides context to the following:

- a) the elements of ISO 55000 series;
- b) the functional 6 life cycle stages, and
- c) a roadmap for Asset Management

These guidelines are based on the ISO 55000 series.

The NRS Mancom expresses the wish that all supply authorities adopt the contents of NRS 093.

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ASSET MANAGEMENT OF ELECTRICITY INFRASTRUCTURE

1. Scope

NRS 093 sets out guidelines for the implementation of asset management of electricity infrastructure.

2. Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the SABS Standards Division.

ISO 55000:2014, *Asset management — Overview, principles and terminology*.

ISO 55001:2014, *Asset management — Management systems — Requirements*.

ISO 55002:2014, *Asset management — Management systems — Guidelines for the application of ISO 55001*.

3. Terms, definitions and abbreviations

For the purposes of this document, the following terms, definitions, abbreviations and concepts will apply.

3.1 Terms and definitions

asset: plant, machinery, property, building, or other item or related system that has a distinct function or service in the electricity infrastructure

NOTE This definition includes any software code that is critical to the delivery of the function of the asset.

asset management: systematic and coordinated activity and practice through which a utility optimally manages its assets, and their associated performance, risks and expenditures over their life cycle for the purpose of achieving the utility's organizational strategic plan

asset system: set of assets that interact and are interrelated (or both) so as to deliver a required business function or service

capital expenditure; CAPEX: expenditure used to create new assets, to replace assets beyond their expected useful life or to increase the capacity of existing assets beyond their original design capacity or service potential

NOTE CAPEX increases the value of an asset.

corrective action: action that is taken to eliminate the cause of a detected non-conformity or other undesirable situation

NOTE 1 There can be more than one cause for non-conformity.

NOTE 2 Corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence.

critical asset: item of plant, in the absence of which power delivery is still possible, but supply quality, statutory (see foreword) and regulatory and safety considerations are compromised to varying extents

depreciable amount: cost of an asset or another amount that replaces the cost price in the financial statements, less its residual value

depreciated replacement cost: measure of current value of an asset, based on its current replacement cost less an allowance for deterioration of condition to date (based on the fraction of the remaining useful life or expected useful life)

depreciation: wearing out, consumption or other loss of value of an asset whether it arises from use, passing of time or obsolescence through technological and market changes

NOTE Depreciation is accounted for by the allocation of the historical cost (or re-valued amount) of the asset less its residual value over its useful life. (GAMAP/GRAP: The systematic allocation of the cost of an asset less its residual volume over its useful life.)

expected useful life: extent of life of an asset over which it can be expected to comply with the required performance given its operational environment and over which it will be productively used

NOTE The operational environment will include design parameters such as climate, soil conditions, topography, utilization, and operations and maintenance regime.

preventive action: action that is taken to eliminate the cause of a potential non-conformity or other undesirable potential situation

NOTE 1 There can be more than one cause for a potential non-conformity.

NOTE 2 Preventive action is taken to prevent occurrence whereas corrective action is taken to prevent recurrence.

3.2 Abbreviations

EDI: electricity distribution industry
GAMAP: generally accepted municipal accounting practice
GRAP: generally recognized accounting practice
HV: high voltage
KPI: key performance indicator
LV: low voltage
MV: medium voltage
NERSA: National Energy Regulator of South Africa
OPEX: operating expenses
SCADA: system control and data acquisition

4. Guidelines for an asset management system

4.1 An overview of the ISO 55000 series

4.1.1 ISO 55000:2014 provides an overview of asset management, its principles and terminology, and the expected benefits of adopting asset management. It also provides the context for ISO 55001 and ISO 55002.

NOTE 1 This International Standard is intended to be used for managing physical assets in particular, but it can also be applied to other asset types.

NOTE 2 This International Standard does not provide financial, accounting or technical guidance for managing specific asset types.

NOTE 3 For the purposes of ISO 55001, ISO 55002 and this International Standard, the term "asset management system" is used to refer to a management system for asset management.

4.1.2 ISO 55001 provides requirements for how to operate the system within which activities are defined, organized, and managed. This International Standard specifies the requirements for the establishment, implementation, maintenance and improvement of a management system for asset management, referred to as an “asset management system”.

This International Standard can be used by any organization. The organization determines to which of its assets this International Standard applies.

This International Standard is primarily intended for use by:

- a) those involved in the establishment, implementation, maintenance and improvement of an asset management system;
- b) those involved in delivering asset management activities and service providers; and
- c) internal and external parties to assess the organisation’s ability to meet legal, regulatory and contractual requirements as well as the organisation’s own requirements.

The order in which requirements are presented in this International Standard does not reflect their importance or imply the order in which they are to be implemented.

Further guidance regarding the application of the requirements within this International Standard is provided in ISO 55002.

4.1.3 ISO 55002:2014 provides guidance for the application of a management system for asset management, referred to as an “asset management system”, in accordance with the requirements of ISO 55001.

This International Standard contains explanatory text necessary to clarify the requirements specified in ISO 55001 and provides examples to support implementation. It does not provide guidance for managing specific asset types.

4.2 Summary of the elements of ISO 55000 series

The following is a summary of the elements of ISO 55000 series:

- a) Context of the organization;
 - i) Understanding the organisation and its context,
 - ii) Understanding the needs and expectations of stakeholders,
 - iii) Determining the scope of the asset management systems, and
 - iv) Asset management system.
- b) Leadership;
 - i) Leadership and commitment,
 - ii) Policy, and
 - iii) Organisation roles, responsibilities and authorities.
- c) Planning;
 - i) Actions to address risks and opportunities for the asset management system, and
 - ii) Asset management objectives and planning to achieve them.
- d) Support;
 - i) Resources,
 - ii) Competence,
 - iii) Awareness,
 - iv) Communication,

- v) Information requirements, and
 - vi) Documented information.
- e) Operation;
- i) Operational planning and control,
 - ii) Management of change, and
 - iii) Outsourcing.
- f) Performance evaluation; and
- i) Monitoring, measurement, analysis and evaluation,
 - ii) Internal audit, and
 - iii) Management review.
- g) Improvement.
- i) Nonconformity and corrective action,
 - ii) Preventive action, and
 - iii) Continual improvement.

4.3 Introduction to a functional approach to asset management

4.3.1 General

Asset life cycle stages are discrete phases of an asset throughout its whole life, from conception to final retirement and disposal. NRS 093 sets out six such stages as shown in figure 1

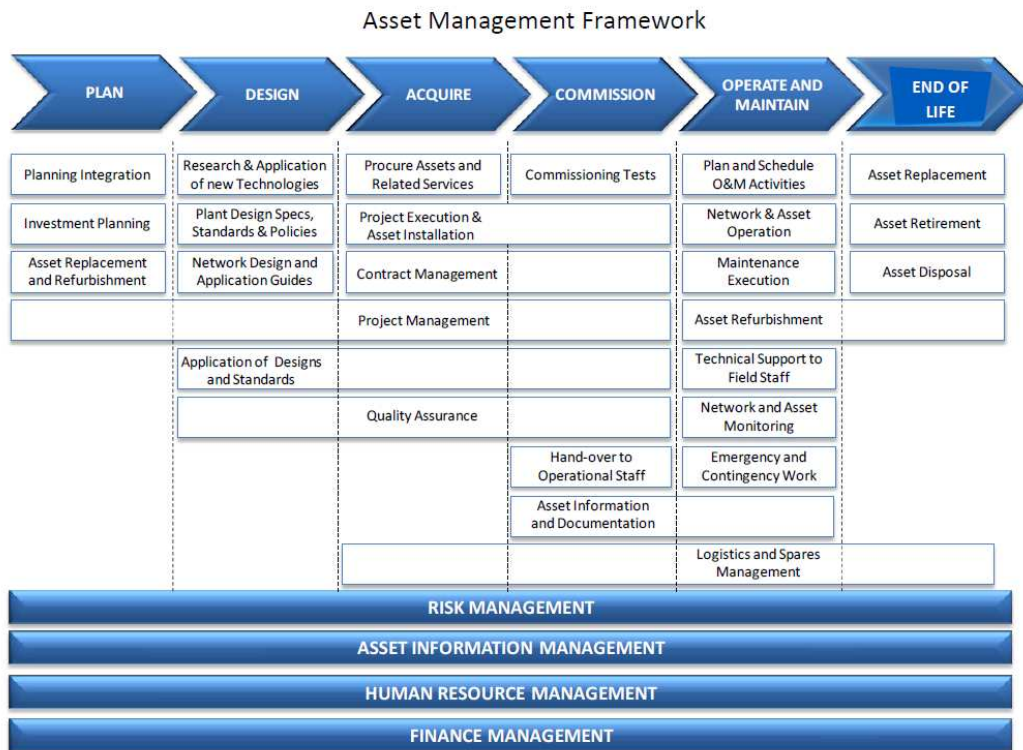


Figure 1: Asset life cycle stages

4.3.2 Plan

4.3.2.1 In this stage, asset planning focuses on the integration of asset objectives in line with organisational plans. Asset planning is responsible for ensuring that the expansion of the asset system is optimally provided for to sustain the demand placed on the asset system. The asset shall be expanded at just the right time to ensure optimal investment of capital while avoiding overloading. The asset shall continue to comply with quality, reliability, statutory and regulatory, safety and environmental requirements.

NOTE The planning philosophy prescribed by the South African Transmission and Distribution Grid Codes is that of least economic impact, i.e. life cycle cost.

4.3.2.2 Asset planning shall incorporate network capacity, availability and reliability requirements, as well as the service requirements of existing and future customers.

4.3.2.3 Planning shall focus on optimizing life cycle cost in line with the principles defined in the South African Grid Code

NOTE The whole life cycle cost should include creation or acquisition cost, costs for maintenance operations and cost for disposal.

4.3.2.4 Capital projects shall be formally prioritized based on the risk to availability and reliability, and impact on customer service. Operating and maintenance costs should underpin the prioritisation criteria.

4.3.2.5 Asset planning shall be integrated between key internal and external stakeholders.

4.3.3 Design

4.3.3.1 Design selection includes research and application of new technologies, widely accepted design specifications and standards and application guides.

4.3.3.2 Designs and standards shall incorporate the requirements from all the life cycle stages.

4.3.3.3 Designs and standards shall support continual improvement in asset performance, availability and reliability at optimized life cycle cost and minimum risk.

4.3.3.4 The design and selection of new and existing technologies shall be appropriate to the organisation's current capability in terms of resources, processes and knowledge.

4.3.3.5 Design shall take into account all relevant legislation.

4.3.4 Acquire

4.3.4.1 This life cycle stage includes the procurement/creation of new plant/components and equipment (based on specifications developed during the design stage), as well as the procurement of construction services. This is followed by the activities of contract management, construction and installation (or both) of the asset, and finally, quality assurance. The acquire life cycle stage is supported by the utility's commercial services and supply chain processes.

4.3.4.2 Commercial policies shall incorporate asset management principles and support optimized asset life cycle cost.

4.3.4.3 Commercial and procurement bottlenecks shall be removed to streamline asset procurement for projects.

4.3.4.4 External supply chains shall be developed and managed in accordance with the utility's requirements for the plant, equipment and professional as well as construction services.

4.3.4.5 Project management and execution shall be continually improved to ensure that projects are executed on time and within budget while complying with quality, health and safety, and with environmental requirements.

4.3.4.6 Service contracts with construction contractors and consultants shall be managed to ensure services are delivered on time at the right quality and within required SHREQ parameters and within budget.

4.3.4.7 Quality assurance plans shall be put in place for products as well as services to ensure compliance with the utility's standards and specifications.

4.3.5 Commission

4.3.5.1 In an asset management context, the commission phase starts when the contractor has completed the design implementation and indicates that the asset or system is ready for utilisation. Final testing of the installation is carried out, the as-built data is recorded and captured, and the maintenance and operating staff are informed about the maintenance and operating requirements of the new plant. The phase ends when the new asset is handed over to Operations and Maintenance and put into commercial operation.

Operational and maintenance manuals are to be stored in a technical library (manual or electronic) and shall be properly managed.

All maintenance and inspection schedules shall be recorded in the Enterprise Asset Management System (EAMS).

4.3.5.2 All new or refurbished/retrofitted assets (or both) shall comply with the relevant design specifications, and this shall be verified during commissioning.

4.3.5.3 Commissioning tests and procedures shall be formalised and shall not unduly reduce the life time of an asset.

4.3.5.4 Commissioned assets shall be formally and properly transferred to the utility's relevant operation and maintenance department, and shall be supported by the necessary production equipment and transfer of skills.

4.3.5.5 As-built asset information and commissioning test results shall be captured during commissioning and the information shall be properly managed.

4.3.6 Operate and maintain

4.3.6.1 During the operate and maintain life cycle stage, the physical asset is expected to perform its designed function at, or above, the specified performance and reliability targets. The manner in which the asset is operated and maintained directly determines the performance, reliability and life expectancy of the asset. The best performance of the asset will be experienced when the operators and maintainers work in harmony at the optimum cost. If either operations or maintenance work is given preference over the other, deterioration and poor performance will result. The effect of good management of assets during operate and maintain stage will extend expected life (refurbishment), reduce overall life cycle costs and ensure good availability and reliability.

4.3.6.2 Assets shall be operated and maintained optimally to continually improve Assets availability and reliability over time.

4.3.6.3 Maintenance planning and scheduling shall be optimized based on reliable asset information that includes asset condition and performance data. Equipment manufacturer requirements / recommendations as well as international best practice should also be considered.

4.3.6.4 Asset condition and performance shall be appropriately monitored and managed.

4.3.6.5 Assets (including servitudes) shall be operated and maintained in a manner that optimises system life cycle cost with due consideration of technical risk.

4.3.6.6 Spares-holding strategies shall be revised and optimized to ensure that there are sufficient spares for critical and strategic plant. (for failures, corrective and preventive maintenance).

4.3.6.7 Asset life extension shall be executed in accordance with asset life extension plans. In evaluating the useful life of an asset even though it has exceeded its initial useful life but is still in excellent condition and can be utilized for years, should not be replaced unless economically viable, taking into account obsolescence, spares, skills, etc.

4.3.6.8 The power network shall be remotely monitored and controlled through SCADA in accordance with the criticality of substations.

4.3.6.9 Assets shall be operated and maintained in such a manner that safety to the public and personnel can be assured. Measures shall be put into place to ensure compliance with statutory and regulatory requirements.

4.3.6.10 Organisational capacity to operate and maintain. This will be performed by competent personnel where the right mix of competent and motivated people are developed and retained to improve our maintenance capability. Maintenance shall maximise performance of our assets over their life, taking into account the trade-off required between cost and risk.

4.3.7 End of life

4.3.7.1 This life cycle stage includes the following possible actions:

- a) **replacement:** the replacement of assets due to theft, vandalism, vehicle accident damage or for reasons other than expansion e.g. degraded performance experienced at the end of its useful life;
- b) **retirement:** the removal of equipment from service due to expansion, but retention of the asset for strategic reasons such as spares;
- c) **disposal:** the complete removal and disposal of an asset when it is no longer required;
- d) **strip/harvest spares:** no longer manufactured, but required to maintain similar equipment still in service, and scrap balance of asset taken out of service;
- e) **renewal:** works to replace existing assets with assets of equivalent capacity or performance capability; and
- f) **refurbishment:** works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its useful life, which may incorporate some modification.

4.3.7.2 Develop asset replacement strategies based on the criticality and life expectancy of assets with the focus on maximising asset life and minimising total lifecycle cost.

4.3.7.3 Short-term asset replacement and retirement plans and decisions shall be based on a comprehensive asset health review and risk considerations.

4.3.7.4 Retired assets shall be properly managed if retained for spares purposes.

4.3.7.5 Assets shall be disposed of in an acceptable manner that complies with all health, safety, financial, statutory and regulatory and environmental issues.

4.3.7.6 Investment planning shall include formal plans for asset refurbishment and replacement based on expected asset life.

4.3.8 Elements that apply to all the life cycle stages

4.3.8.1 Information

The management of asset information foundation relates to the capturing and management of asset-related information to enable decision making.

4.3.8.2 Risk

The management of asset risks consists of the following main activities:

- a) **risk identification:** asset risks are identified per individual asset, per class of asset, at a system or network level and also at portfolio level;
- b) **risk assessment:** the identified asset risks are quantified and ranked in terms of likelihood of occurrence and consequence of incident;
- c) **risk control:** the necessary steps are identified and implemented to control the identified risks according to the utility's risk tolerance; and
- d) **risk monitoring:** the effectiveness of risk control measures is monitored by means of inspection and audits.

NOTE New or previously undetected risks are also identified.

4.3.8.3 Finance

The management of finance includes the following main activities:

- a) **budgeting:** annual operational budgets that include the operational costs of managing assets during the operate and maintain life cycle stage;
- b) **accounting:** the utility's finance department shall track and report actual operational expenditure against the original budgets; and
- c) **asset valuation:** the finance department is responsible for regularly determining the depreciated financial value of all the utility's assets as detailed in the financial asset register.

4.3.8.4 Human resources

Effective asset management requires that personnel responsible for the planning, design, construction, operation and management of assets are appropriately qualified in terms of education, training and experience. The management of human resources consists of the following main activities:

- a) **requirements:** the requirements for human resources skills shall be identified as well as other resources to support asset management;
- b) **recruitment:** the necessary human resources shall be recruited;
- c) **training and development:** human resources shall be adequately trained and developed for their relevant roles and functions within the organization;

NOTE Skills transfer shall be done in an effective manner.

- d) **skills deployment:** human resources shall be optimally matched to the asset management functions; and
- e) **skills retention:** critical skills and experience shall be retained as far as possible.

4.3.8.5 Employees or third parties

Employees or third parties such as contractors and consultants shall be aware of the following:

- a) **compliance:** the importance of compliance with the asset management policy and procedures;
- b) **roles and responsibilities:** their roles and responsibilities in achieving compliance with the asset management policy and procedures;
- c) **requirements:** the requirements of the asset management system processes, including emergency preparedness and response requirements; and
- d) **consequences:** the potential consequences of departing from specified operating procedures.

4.4 A roadmap for asset management

The following steps are recommended for implementing an asset management programme:

- a) develop a framework for asset management – certain assumptions may have to be considered;
- b) conduct an asset management assessment by benchmarking the current status to clause 4.2;
- c) identify the gaps;
- d) develop a project plan to close the gaps;
- e) develop and implement a programme that focuses on the 'low hanging fruit' in the first few years;
- e) perform assurance on the implementation;
- f) develop KPIs for monitoring the implementation; and
- g) perform reviews for Continuous Improvement.