

ENABLING A NATIONAL SERVICE PROVIDER MARKET FOR DISTRIBUTION NETWORK MAINTENANCE SERVICES

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ABSTRACT

There is an increasing awareness among distribution companies on developing maintenance strategies for the distribution system assets which take into account the different aspects of risk which the companies are facing.. This paper describes a framework for risk-based maintenance management, where standardized specifications of maintenance actions play an important role. These specifications help the communication between Asset Managers (AM) and Service providers (SP), allowing for the AMs to buy specified services in an open competitive market rather than through only in-house entrepreneur divisions – hereby making the competition between SPs influence on the price formation.

INTRODUCTION

Some of Norway's largest distribution system companies have in cooperation with a research company (SINTEF) and a utility owned consultant (REN) joined forces to establish standardized specifications of maintenance activities. One important motivation for this is to enable a national service provider market for distribution network maintenance services.

The standardized maintenance activities are used within a framework for risk based maintenance management.

This paper first describes a framework for risk based maintenance management. It further focuses on the development of standardized specifications of maintenance actions, and how these specifications are incorporated in a national database, laying the foundation for a national service provider market.

RISK BASED MAINTENANCE MANAGEMENT

During the last decade the electricity distribution companies have been increasingly focusing on the principles of asset management, as a basis for performing their business. Maintenance and reinvestments are important parts of the asset management scheme, as they are measures to control the different risks faced by the distribution companies, [4].

The risk consequence categories typically involve economy, safety, environmental concerns, company reputation and quality of supply [1].

The concepts of continuous improvement combined with risk assessment are the ruling paradigm within maintenance management in different industrial sectors throughout the world – see e.g. [5]. Based on this understanding of the maintenance challenges, some of the largest distribution companies in Norway have developed a common framework for their maintenance management, [2,3].

The components of the framework is illustrated in Figure 1, and described in the following.

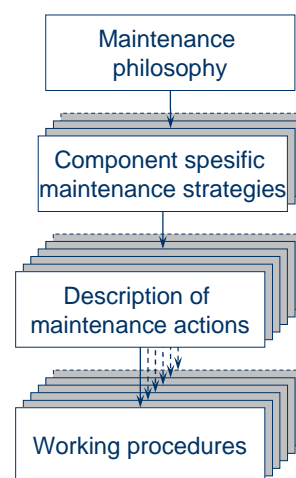


Figure 1 Hierarchy of the maintenance framework

- *Maintenance philosophy* is a high-level description of the overall maintenance management, providing a system of principles for the organization and execution of the maintenance [2].
- *Component specific maintenance strategies* are established through using the overall maintenance principles on dedicated component groups – e.g. MV overhead lines, MV/LV substations etc. The maintenance strategies provide a generic description of what maintenance activities to do and with what intensity to perform them [3].

- *Description of maintenance actions.* To ensure the unambiguous interpretation of what is meant by the different terms describing maintenance actions, standardised descriptions are needed. The descriptions are the asset manager’s specification of what should be achieved with the maintenance action.
- *Working procedures.* The working procedures are the service provider’s description on how to perform a specific maintenance action.

In the following we focus on the description of maintenance actions – which provides the interface between asset manager and service providers, and is a key feature in providing a functioning service market.

It should be noted that the question of the extent of sharing information to companies not participating in establishing the maintenance framework was addressed at an early stage. The conclusion on this subject was that the company-specific maintenance strategies was considered confidential for others, but it was in common interest that “standard” maintenance actions could be open to others, without exposing any company-sensitive information. I.e. the competitiveness of each company was assumed to lay in the development and implementation of a robust maintenance strategy, and that all parties involved would benefit from having a standardised market to buy maintenance services from.

STANDARDIZING MAINTENANCE ACTIVITIES

The first step in the early stages of the work was to establish a common terminology. When the work first started out, there were (at least) as many interpretations and names for the different maintenance actions as there were experts. Thus, a common terminology was developed based on the following international standards and norms:

- IEC©60050-191:1990 International Electrotechnical Vocabulary. Chapter 191: Dependability and quality of service.
- EN 13306:2001, Maintenance terminology
- EN 15341: 2007, Maintenance – Maintenance Key Performance Indicators

Based on this terminology, it was possible to give unambiguous definitions of what maintenance to be carried out on a certain type of equipment.

The next step was definition of the maintenance actions themselves.

Each maintenance action was defined by the following:

1. Result requirements
2. Execution requirements
3. Resource requirements

The numbering above indicates the priority, result requirements being the preferred. The idea behind the priority is to give freedom to the service provider to choose appropriate methods and tools when the result is clearly stated (and few or no other requirements are given).

1. Result requirements: For a given component such a result requirement can be e.g. “Bring the component back into a state as-good-as-new”, or for condition monitoring actions a specified list of the measurements to be taken.
2. Execution requirements: Result requirements are not always easy to state in a precise manner. In such cases the maintenance action will be defined by execution and/or resource requirements. Examples of execution requirements are use of special measuring equipment.
3. Resource requirements: For certain types of maintenance actions the asset manager wants to influence on the choice of methods or competencies. As an example this can be a requirement that the persons carrying out thermography is certified according to a national certification arrangement.

An extract of the definitions established is given in the tables 1 through 3:

Table 1: MV overhead line maintenance actions (extract)

Maintenance action type	MV lines
Condition monitoring	Inspection of MV overhead line
	Inspection of pole-mounted MV/LV substation
	Thermography of MV overhead line
	Rot control of wooden poles
Preventive maintenance	Earthing system measurements
	Tree trimming in MV overhead line
	Pole-mounted switchgear function testing

Table 2: MV/LV substations (on the ground) maintenance actions (extract)

Maintenance action type	MV/LV substations (on the ground)
Condition monitoring	MV/LV substation inspection
Preventive maintenance	Overhaul of MV/LV substation with air insulated switchgear
	Overhaul of MV/LV substation with epoxy insulated switchgear
	Cleaning inside safety distance
	Cleaning outside safety distance
	Oil-filling on distribution MV/LV transformer
	Oil-filling on cable terminations

Table 3: HV/MV substations maintenance actions (extract)

Maintenance action type	HV/MV substations
Condition monitoring	Substation inspection
	Oil and gas analysis
	Sample taking for oil and gas analysis
	Substation thermography
	Battery system overhaul
Preventive maintenance	HV Circuit breaker overhaul
	MV Circuit breaker overhaul
	Power transformer overhaul
	Tap changer overhaul
	Circuit breaker functional testing
	Disconnecter functional testing
	Substation cleaning

A necessary prerequisite for making the developed system work in practice is to make it available at the asset managers desktop. The way this has been solved is described in the following.

ENABLING A NATIONAL SERVICE PROVIDER MARKET

The specifications of the maintenance activities are implemented in a project system database provided by REN through an internet application. REN's project system has approximately 3000 users, and covers 98% of the distribution companies and all the largest service providers in the Norwegian market.

A typical application of the database will be that the AM designs maintenance jobs (consisting of one or more maintenance activities), e.g. overhaul of all circuit breakers in one area, or condition assessment of wooden poles along a given overhead line. The project system assigns resources to the standardized activities, providing the AM with cost estimates for the job.

The next step will be for the AM to make the job (or any collection of jobs) available for competition in the SP market. Obviously, the initial cost estimates will not be shown to the SPs. The specification of maintenance activities provided by the system makes sure that there is unambiguity between what the AM orders and what the SPs offer and hereby that different tenders are comparable regarding job content, deliverables and quality.

The project system database provides complete documentation of the job, i.e. minimum requirements regarding competence or methods applied, as well as serves as a source of reporting schemes for documentation of the work carried out.

CONCLUDING REMARKS

There is an increasing awareness among distribution companies on developing maintenance strategies for the distribution system assets which take into account the different aspects of risk which the companies are facing. In order to make the maintenance strategies practically applicable, it is important that the strategies are accompanied with specifications of the different maintenance activities. These specifications also help the communication between Asset Managers (AM) and Service providers (SP), allowing for the AMs to buy specified services in an open competitive market rather than through only in-house entrepreneur divisions – hereby making the competition between SPs influence on the price formation.

This paper describes a joint effort in enabling a national service provider market for distribution network maintenance services within a framework for risk based maintenance management.

Some of the lessons learnt are that synergy effects can be obtained through collaboration, but one has to be very clear on what to collaborate on, and what to keep in-house. Our experience shows that it is possible to have such an extensive cooperation and at the same time protect the company's competitiveness.

The descriptions of maintenance actions – with their specifications and cost estimates - have been incorporated in a national web database, making them available for all users of the database. This is an important contribution to opening the national service provider market, and making competition more easily achievable.

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