

## CENTRALIZED AGEING ASSET DOSSIER DATABASE OF THE ELECTRICITY NETWORKS IN THE NETHERLANDS

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### ABSTRACT

*The subject of this paper is the supporting of electricity network owners in the managing of the different ageing components in the networks.*

*Electricity networks in the Netherlands face the very significant challenge of an ageing asset base. Business decision on how to proceed with maintenance of ageing equipment and how to invest across a range of priorities remains one of the largest challenges for today's grid operators.*

*Within Ksandr, a foundation for both public and industrial owners of electricity networks, the Dutch decentralized distribution grid operators develop centralized dossiers for their ageing assets. In the Ageing Asset Dossiers (AAD's) the common knowledge of ageing components in the Dutch electricity networks is being collected, shared and retained.*

*Due to the collective gathering of the failure information and sharing knowledge, concerning maintenance and Life Cycle Management (LCM), the grid operators can bring their maintenance strategies for ageing assets to a higher level. AAD's are also being used for the cooperation with original equipment manufacturers (OEM) and for education and training of new personnel, which is involved in making asset management decisions regarding ageing assets, as well as personnel, which conducts maintenance of this ageing equipment. In addition, an AAD can also contribute to the expertise of current subject matter experts.*

*In order to maximize the AAD potential new improvements are being investigated and already executed for the current structure of AAD's.*

### COMMON CHALLENGES WITH THE AGEING EQUIPMENT

All seven Dutch decentralized grid operators face the same business decision challenges concerning maintenance, service and replacement of the ageing equipment. For a successful asset management (AM) decision process it is necessary to have support from the broad asset data over a large timespan. Due to the lack of the structured historical data, the Dutch distribution grid operators with small

equipment populations have often too limited data to make deliberate replacement decisions. Also due to the low touch frequency in case of small populations of equipment, only restricted experience is being built up. From this point of view the merging of data and the performing of combined analysis of the data from many different sources will help decision makers in making acceptable decisions.

### COLLECTIVE GATHERING OF THE FAILURE INFORMATION AND KNOWLEDGE SHARING

The challenges, as mentioned above, are acknowledged by all seven Dutch distribution grid operators. Because of the common interest these challenges were addressed within the Dutch knowledge centre Ksandr (an acronym for knowledge sharing and research). [Ksandr](#) is a non-profit organization for both public and industrial owners of electricity networks, that aims to sharing, securing and developing of knowledge about the electricity networks. From that capacity Ksandr provides a platform to gather data, (user)experiences and technical expertise to deal not only with the challenges, as described in this paper, but also with several other common challenges.

### Program, aimed to develop, share and retain knowledge of ageing components

Specifically for the ageing assets issue Ksandr has started a program in 2016, aimed to develop, share and retain knowledge of ageing components in the electricity networks. Within this program Ksandr develops centralized Ageing Asset Dossiers (AAD) for the ageing equipment of the Dutch electricity networks. An Ageing Asset Dossier is basically a structured database, based upon an uniform template for the collecting and recording of information, in relation to maintenance strategies and/or deliberate asset management decisions. An AAD offers a comprehensive view on assets and is supported by historical population and failure data (if available in sufficient quantities). An AAD also prevents the losing of valuable knowledge, caused by retirement of subject-matter experts. Ksandr actively invests in solutions to avoid this knowledge drain by facilitating initiatives such as developing of AAD's and by the setting up a

Knowledge Academy for educational purposes.

Recognizing and appointing the challenges was the first step to a durable solution. Prioritizing it on the Ksandr (long term) agenda was the second step. This has opened the door for initiating the first two pilot dossiers. Because of the extensive usage, relatively high maintenance needs and large quantities of operational active devices, two types of switchgear were chosen for the pilot dossiers. In the following dossiers and in the planning for the years to come, cable joints, secondary installations (e.g. safety relays, instrument transformers) and tertiary installations (e.g. batteries) have expanded the AAD scope. During the pilot project it turned out that the main challenge was the creating of a format, that is both accessible and maintainable without impairing the possibility to register the essential information. The ideal level of details was, and still is, an ever challenging quest that may differ by different asset types and/or the needs of the participating utilities. The AAD template, that was released as a result of the two pilot dossiers, reflects the requirements that were set in order to create a valuable product.

### Ageing Asset Dossiers

The core of an AAD consists of the failure mechanisms of the ageing asset. In order to understand and to master those failure modes a series of characteristics is logged. Examples are the root cause, potential indicators of the failure mode and stabilizing measures. In addition to the failure mechanisms we have also created an aggregated insight in the asset population (outlined by manufacturing year, type and/or generation), that ideally should be combined with the failure rates for further analysis. The awareness about the importance of registration and sharing failure rates of specific assets is improved by the AAD projects. The first two AAD pilots have illustrated that there is still a lot of potential value in collaboration of utilities to analyse and predict failures of ageing assets.

The AAD template is a flexible concept that is being constantly adjusted, based on the latest insights and experiences. An AAD contains, at minimum, the combined knowledge of the participating utilities about:

- historical asset populations;
- environment and service conditions;
- historical failure records;
- failure mechanisms;
- failure (root) causes;
- possible failure effects;
- failure indicators;
- damage progression;
- maintenance methods and stabilizing measures as applied by electricity grid operators;
- maintenance methods and stabilizing measures as advised by the original equipment manufacturer (OEM).

Figure 1 represents an AAD example.

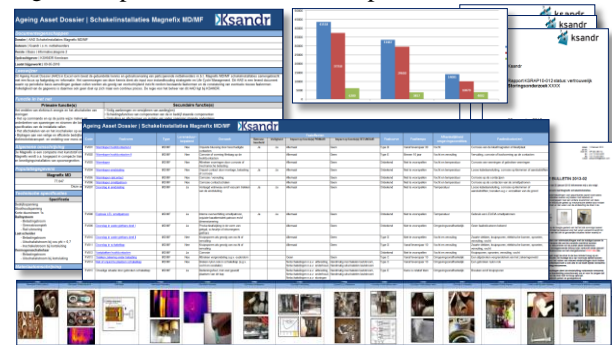


Figure 1. An AAD example

## **ADDED VALUE OF AGEING ASSET DOSSIERS**

An AAD in its current form is essentially a database in which the failure behaviour for a specific asset, accumulated by the participating grid operators, is brought together. This dossier contains information and insights, based upon decades of the combined user experience. Dutch electricity networks often contain the same assets, maintained by various grid operators. So why not to combine the knowledge and experience in order to maximize its use? That is basically what we've done with centralized AAD's: a simple but effective use of the existing resources to the benefit of all stakeholders. Grid operators with relatively small populations of assets are getting access to much larger data, experience and knowledge.

The centralized database of AAD's brings massive benefits to all stakeholders. The most important benefits are listed in the following section:

### **Better supported foundation for business decisions**

Due to the collective gathering of the failure information and sharing knowledge, concerning maintenance and Life Cycle Management (LCM), the grid operators can bring their maintenance strategies for ageing assets to a higher level. Furthermore, they have access to a better supported foundation for analyzing and predicting the lifespan and failure behaviour of their ageing assets.

### **Education and training of personnel**

AAD's are also being used for education and training of new personnel, involved in making asset management decisions regarding ageing assets, as well as personnel, which conduct maintenance of this ageing equipment. Experienced personnel also benefit from an AAD by refreshing and extending their knowledge level.

### **Knowledge exchange with the OEM**

Because of the structured and centralized way, in which

failure information is registered in an AAD, the cooperation with the OEM is better organized, less incident driven and based upon empirical data. The knowledge exchange between asset owners and OEM results in the best outcome for the asset owners as a mixture of the field experience of the utilities and the design knowledge of the OEM. An OEM can also improve the design of the latest component models by absorbing user experiences of current models.

### **Long-term tracking of faults**

AAD's can facilitate the long-term tracking of faults, allowing utilities to identify fault trends in particular items of equipment or particular usage scenarios.

### **ADDRESSING THE CONFIDENTIALITY OF SHARING DATA AND INFORMATION**

One of the most important barriers, we faced in getting started with the Ageing Asset Dossiers, was the reluctance of experts to share all their knowledge and data on behalf of their utility. Although the willingness of sharing information was high, the consequences though were unknown. Especially with regard to sharing failure information the risk for liability had to be excluded before we could start.

To tackle these issues we have created commitment at the highest level in the utilities with all the managing directors of the asset management divisions. With support of the legal experts of the utilities, one standard agreement for Ksandr and the utilities was drafted and was signed by all the managing directors of the asset management divisions of the participating utilities. This agreement covers all the rules and conditions to enable the sharing of data and information and has created formal conditions for the experts from utilities to exchange their knowledge.

In order to manage the whole AAD programme the utilities have also delegated their managers for the core team. Within this team we have also defined the conditions for parties that would like to join AAD projects in a later stage or for parties that are only interested in using the information from the dossiers without sharing their own experiences and information

Besides establishing the formal conditions, there is also an infrastructure created to enable authorised access to the two different information levels. Information level 1 is considered as highly confidential. It contains information about a certain utility or a location of a failure. Access to this information is only allowed to a small group of experts from utilities. Information level 2 contains only anonymised technical information and service bulletins from manufacturers. Access to this information is allowed for all employees of utilities. The core team determines the content of both information levels.

### **NEXT STEPS**

Even though the current AAD's have proven their benefits to all involved stakeholders, the AAD concept still has untapped potential. In order to maximize the AAD potential the next improvements are being investigated or already executed:

- appointing and mandating maintenance teams responsible for keeping the AAD's up-to-date and facilitating the possibility to discuss and analyse remarkable differences in approach and/or results;
- realizing a company overarching way of recording failures for a designated pool of assets for purposes of data analytics;
- embedding the participation of OEM's and other organizations (for example educational institutes) in the AAD concept to maximize the combined (technical) knowledge about a particular asset.

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