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New approach for asset management in District Heating (DH) networks

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Abstract

Rehabilitation and renovation of district heating networks are mainly based on an event-based maintenance strategy. This means reactive removal of failures and damages and this also describes the uncertainties in the field of accurate lifetime assessment of district heating networks. However, utilities need evaluated estimation of the serviceability of the networks to define the best moment for reinvestment. Interval-based and condition-based lifetime assessment is used by utilities for lifetime assessment e.g. in the branch of sewer and drinking water-networks. First developments can be observed in the transfer of existing decision making tools from other branches to district heating branch. Nevertheless there are several important differences to be taken to account when lifetime assessment is carried out for district heating networks. On the one hand, inspection methodologies from other networks are not transferable because of temperature and pressure loads in DH-networks. Thus condition-based lifetime assessment needs another concept. On the other hand ageing of DH-networks highly depends on the used pipe system and the operation conditions.

The paper presents a new interdisciplinary approach for asset management in DH-networks that was developed by the authors. Different relevant ageing theories for DH-networks were put in order. By a Top-down and Bottom-Up approach these theories are characterized and set in relationship to each other. A first outlook for the next steps to activate these different theories mutually is given, that will make a sustainable rehabilitation planning possible and will lead to new business opportunities in the future.

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Keywords: asset management; rehabilitation planning; lifetime assessment; district heating

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1. Introduction

DH networks are a comparatively young part of the infrastructure. Whereas expansions of supply and disposal networks mainly took place within the last decades and century, DH networks are still expanding and newly built. This is especially true for small scale low-temperature grids uprising in rural and suburban areas. In addition and according to all empirical data available the DH infrastructure seems to be a robust system, fit for resisting high stresses over decades of operation.

Against this background, conclusive insights and findings on the technical service life of these networks are sparse. On the one hand, this is due to an operation of these systems mainly below 50 years, resulting in few empirical and statistical data on the development of the technical service life available. On the other hand, damages and cases of average are rarely occurring due to the robust design of these systems.

This context complicates the definition of a fundamental maintenance strategy for renovation in the DH sector. Statistical methods, utilized in other infrastructural sectors, are not applicable without modifications, as a high amount and quality of data is required. Furthermore, the technical service life is strongly depending on the quality of construction works, operational conditions as well as piping systems and materials utilized. Basing on expert interviews conducted by the AGFW, a general overview on the expected technical service lives of different piping systems is graphically given in Fig. 1 [1].

According to Fig. 1, the variations on the expected technical service lives are quite broad. Regarding the widespread preinsulated bonded pipe system according to EN 253 [2], the variation is between 35 and 70 years of operation, whereas the planned technical service life of these systems according to EN 13941 is just 30 years [3]. Thus, the planned technical service life of these systems is 5 years below the minimum technical service life according to AGFW FW 114 [1]. This difference may suggest that the planning and static design of these systems is quite conservative, e.g. by assuming higher static loads than in reality and therefore integrating major reserves.

Despite of the robust design of DH systems, questions concerning the actual time for renewals and renovations (maintenance) are to be answered [4, 5].

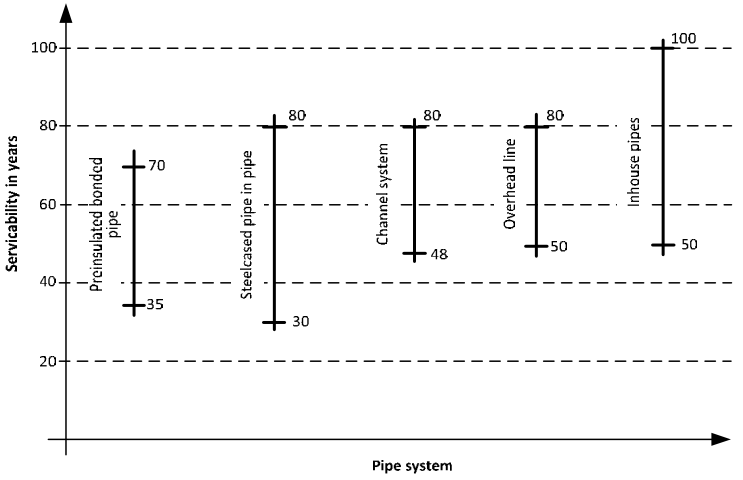

Fig 1. Expected technical service life of piping systems according to AGFW, FW114 [1].

Concluding, an integrated approach for calculating the technical service life or the ageing of DH systems and components within the context of a profound asset- and maintenance strategy is missing. Therefore, the authors reviewed the relevant literature on this topic in order to classify the different types of ageing models and defect mechanisms. The examinations revealed two fundamental approaches for ageing models: