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Tang, Camilla; Rosshaug, Per S.; Kristensen, John B.; Albrechtsen, Hans-Jørgen

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by Camilla Tang | Per S. Rosshaug | John B. Kristensen | Hans-Jørgen Albrechtsen | Technical University of Denmark | HOFOR | NIRAS | Technical University of Denmark

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It is generally agreed that centralised drinking water softening has positive socioeconomic and environmental effects in areas with high water hardness. Softer water reduces the formation of lime scaling, decreases the use of detergents and soap, and increases the lifespan of household appliances. Consequently, centralised drinking water softening has been implemented in e.g. Germany, the Netherlands and Sweden, and is currently being implemented in Denmark for the first time. Several technologies exist for softening (e.g. pellet softening, membrane filtration, electrolysis and ion exchange) each with different design options and possibilities for implementation in an existing water treatment train. Choosing the optimal technology and design is complex and may involve water quality, and capital and operating costs, but may also consider e.g. human health effects, the environmental impact of the softening process and the interactions with the existing water treatment processes. Sub-optimization and choosing an optimal solution for one of the aspects may turn out to be less optimal when all the indicators are considered in a holistic assessment.

Some design indicators can directly in- or exclude technologies. For example, pellet softening and ion exchange increase the water sodium concentration. Thus, if softening water with an already elevated concentration of sodium, the drinking water guideline may be exceeded after softening and other softening technologies should be chosen. Likewise, the water loss associated with some softening technologies may be too high for water utilities with a limited amount of source water. An overview of this type of indicators will allow an initial screening that can reduce the number of design options from an early design phase and reduce the time required for further assessments.

Other design indicators may be less critical with the risk of overlooking these during the design phase. This is e.g. the possibilities for reusing by-products from the softening process (e.g. pellets from pellet softening) or the environmental impact from resource, energy and chemical use. Nonetheless, including these indicators may increase the overall environmental and economic feasibility of the softening process.

No overview exist of all the indicators that should be considered when implementing

drinking water softening and their importance. Therefore, the aim of this study was to identify a comprehensive list of indicators that should be included when designing the softening process. In addition, the study aimed to identify critical indicators that can be considered in an early design phase to reduce the number of potential technologies and indicators that can be included in a holistic assessment to optimise the implementation of softening. We reviewed existing scientific literature and combined this with experience from full-scale softening in the Netherlands and the start-up of full-scale softening at Brøndbyvester waterworks in Denmark. The presentation will focus on answering the following questions:

- *How can centralised drinking water softening be implemented from a holistic point of view taking both technical, environmental and economic indicators into account?*

- *How can critical indicators reduce the number of potential technologies in an early design phase?*

We expect that the results can be applied by water utilities when implementing drinking water softening to ensure efficient, transparent and comprehensive decision making. Ultimately, this may serve as inspiration when generally implementing new technologies in existing water treatment processes.