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Measuring the effects of central softening of drinking water in households and industries in Brøndby, Denmark

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\textbf{Introduction}

- Drinking water hardness affects the economy, environment and convenience experienced by the water user.
- We want to provide actual measurements of the effects before and after introducing central softening in Brøndby, Copenhagen.
- In Denmark economic cost-benefit analysis (CBA)\textsuperscript{1,2} and environmental life-cycle assessment (LCA)\textsuperscript{3} show significant benefits from introducing central softening at waterworks where water hardness levels are above 250 mg/L as CaCO\textsubscript{3}.
- Most CBA and LCA conclusions are based on theoretical assumptions.

\textbf{Methods and participants in the project}

- Measurements are carried out before (371 mg/L) and after (205 mg/L) introducing central softening. A comparison of the two sets of measurements shows the effects of water softening.
- Participants and measurements:
  - 30 private households: Consumption of descaling agents, dishwasher salt, laundry detergents, fabric softener, time for removing scaling.
  - 4 Industries: Water heating efficiency, salt consumption (ion exchanger), precipitation in tap aerators and toilet cisterns.

\textbf{Preliminary results – Private households}

- Consumption of: laundry detergent; descaling agents for kettle and coffee maker; and salt addition in dishwasher is reduced with softened water.

\textbf{Preliminary results - Industries}

- Efficiency of one central heating installation before and after softening:
  - Heat efficiency decreases 0.8% with softened water compared to 8% with very hard water during a 4 month period between services.

\textbf{Salt consumption in ion exchanger}

- Consumption of salt for decentralised water softening devices is decreased.

\textsuperscript{1}COWI (2011). Central blødgøring af drikkevand.
\textsuperscript{2}Ramboll (2017). Blødt vand i en cirkulaer økonomi.
\textsuperscript{3}Godskesen et al. (2012). Life cycle assessment of central softening of very hard drinking water. J.env.man.(105) 83-89