



Fredericia Fjernvarme Living Lab: District Heating

ABOUT THE LIVING LAB:

The main perspective of the Fredericia District Heating Living Lab is to investigate the flexibility within the distribution network, using the distribution network as an energy storage to shift load in order to minimize production cost related to both the power market and the heat market.

Thus, the end goal of this Living Lab is to explore the flexibility of the thermal systems and in connection with a next generation of data-driven temperature optimization which uses meter data.

Facts about the living lab:

- ✓ Type of Living Lab: District heating DSO (connected to the TVIS transmission system)
- ✓ Number of supply areas: 6, Number of buildings: 10.500 (around 25.000 people)
- ✓ Heat meters: Diehl meters

RESULTS:

In the Fredericia District Heating Living Lab, we have established methods to use meter data for estimating the temperature and the conditions of the distribution network. This implies that meter data in the future can be used for temperature control and for optimization.

New methods for load forecasting using spatial and temporal hierarchies have been established. New methods for flexible temperature control for distribution nets using meter data have been developed.

A combination of delays in setting up the streaming data functionality at CDK as well as the time used for establishing a new SRO (IFIX) system at Fredericia District Heating, we have not been able to evaluate the savings etc. at Fredericia District Heating, but the methods are now implemented at a number of other district heating systems (HOFOR, Brønderslev, TREFOR, ...). Based on this we can conclude that:

- 1) Improvements in heat load forecasting from 10 to 40 pct.
- 2) Temperature optimization using meter data is now possible, gives also added flexibility.
- 3) Savings in reduced energy loss using the data-driven methods for TO is from 4pct to 20pct.

ENFOR and DTU have established methods for using meter data for operation of DH networks. Besides new methods for heat load forecasting, which takes advantages of spatial or temporal hierarchies in data.

ENFOR has established new methods for temperature optimization, which take advantage of meter data readings. And developed a method for actively using the flexibility in networks e.g., for solving grid issues and problems with bottlenecks.

DTU has established data-driven methods for identifying the thermal characteristics of buildings.

Fredericia District Heating has established a new SRO system, which allows for a two-way data communication via the Hub at Center Denmark. Furthermore, FDH has delivered data to build models for energy efficiency of buildings.

Center Denmark (CDK) has established a near real-time two-way communication platform. It continuously collects data in the form of measurements from meters in residential homes and district heating centrals alongside with optimized temperature setpoint and heat load forecasts. It enables measurements being accessible for ENFOR and transfers the setpoint and forecasts to Fredericia District Heating. Furthermore, collected data is stored in CDK data lake.



ENFOR



SDU



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ABB



PERSPECTIVES FOR THE FUTURE:

- ✓ A digitalization of district heating and the use of meter data lead to significant savings. The methods are already installed commercially at a number of district heating networks.
- ✓ District heating systems can provide an important part of the flexibility which is needed for an efficient integration of fluctuating renewables.

TECHNICAL SETUP:

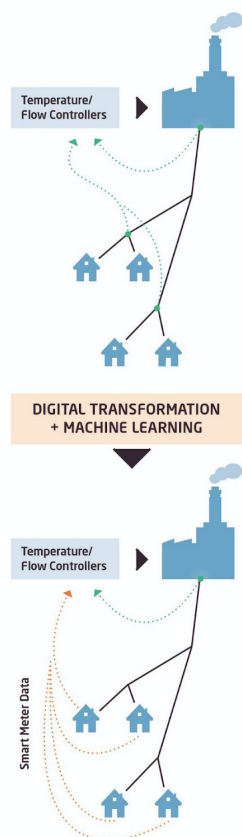
Fredericia District Heating: A iFIX system delivered by Frontmatic at FDH is used to collect the needed data from meters and from the interface to TVIS.

Center Denmark: Developed a platform which collects steaming data from FDH iFIX system via OPC UA, stores it and makes it accessible for Enfor via an API. Enfor request measurements from the CDK platform and delivers setpoint and heat load forecast to it via API. CDK stores and transfers them to FDH via OPC UA. A pipeline is setup, such that all data is stored historically in the CDK data lake.

The CDK platform is used for several other district heating companies, where different protocols and data formats are used to achieve the same functionality.

DTU Compute and ENFOR have developed a method for estimating the distribution grid temperatures using data from the Diehl meters.

MODELS:



FED is a Danish digitization project, funded by Innovation Fund Denmark, aimed at turning Danish power consumption flexible to enable utilization of excess power from wind turbines and solar cells.

The project brings together Denmark's foremost researchers, organizations, supply companies, software companies and a number of living labs that provide data for the project.

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