Connecting the DH value chain with smart meter data

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Consumption meters produce a lot of data

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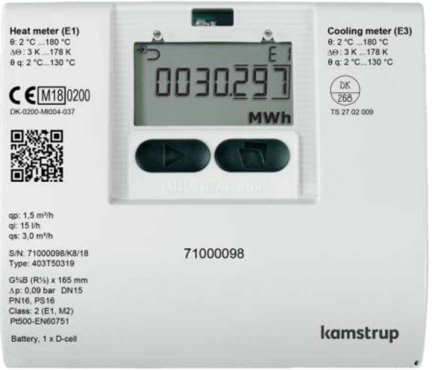
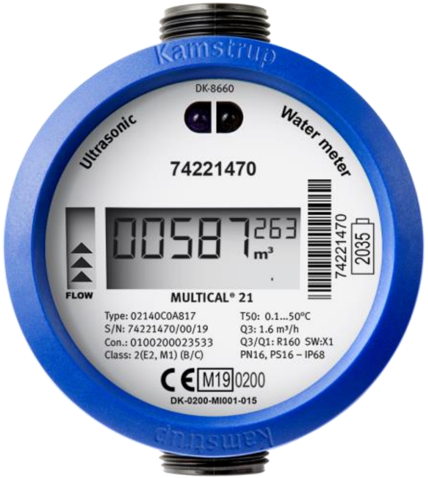
MULTICAL®
Heat/cooling meters



OMNIPOWER
Electricity meters



MULTICAL® and flowIQ
Water meters

District heating, basics

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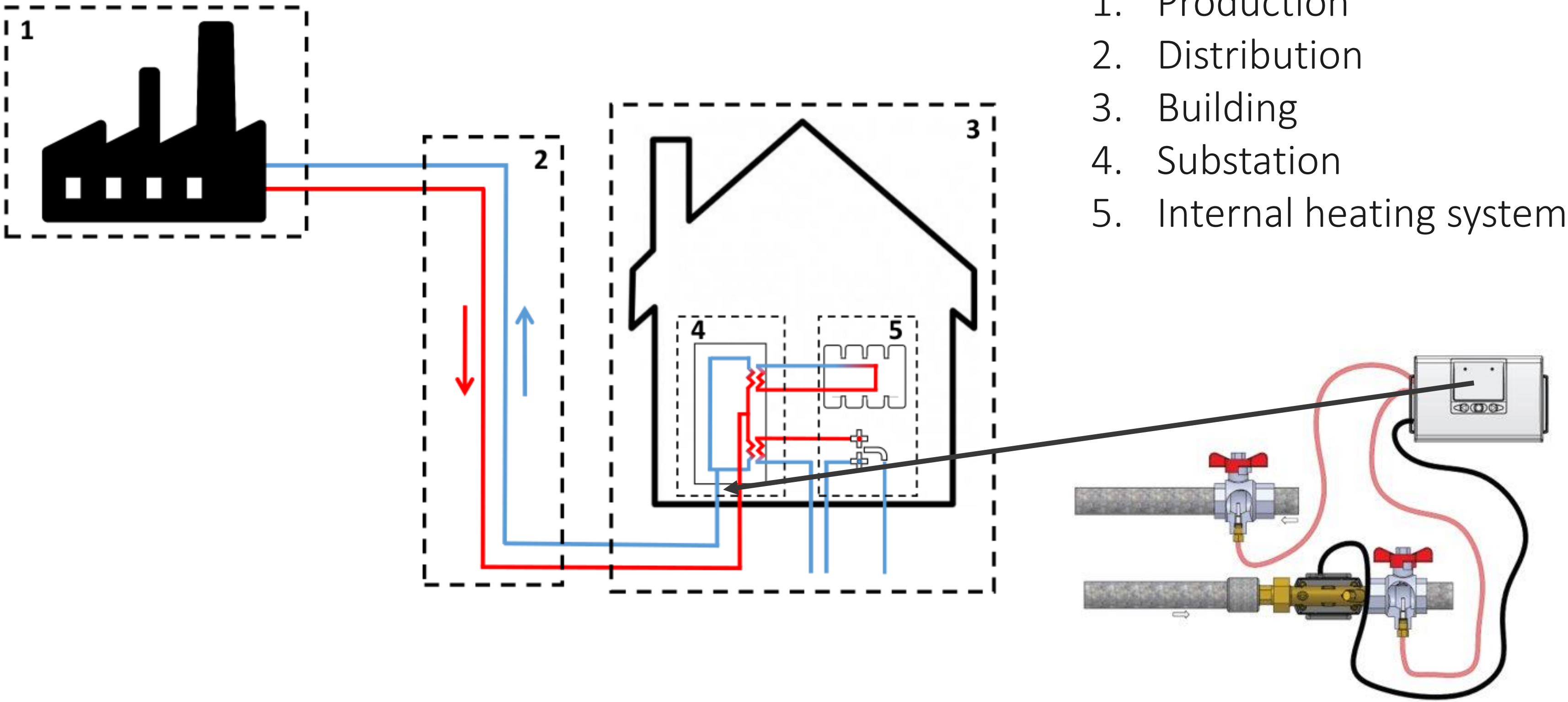
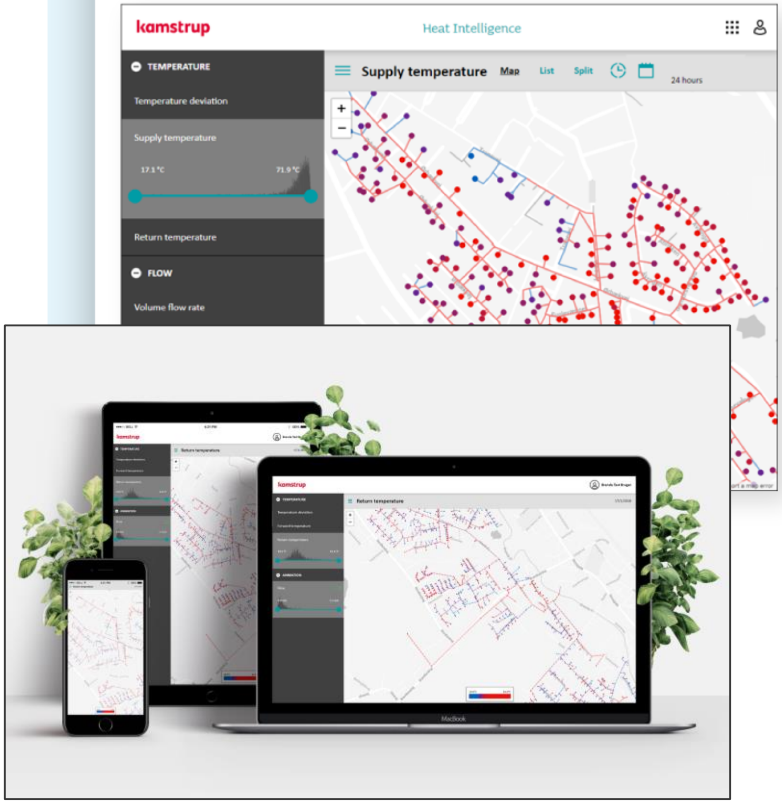
1. Production
2. Distribution
3. Building
4. Substation
5. Internal heating system



Månsson, S. (2021). Spot the difference ! On the way towards automated fault handling in district heating buildings.

Heat Intelligence, combines the distribution grid (GIS-data) with meter data



Live and updated daily

The Heat Intelligence calculates exactly how heat travels in your infrastructure and what this means for your heat supply. Visualised on an intuitive map of your supply area, this gives you an understanding of the hydro dynamics in your distribution network.

When you know what happens underground, you are able to better target your efforts and resources.

Heat Intelligence is automatically updated and recalculated daily with the latest data from your distribution network. The platform is web-based.

Data used as basis input for Heat Intelligence

GIS data

Pipe diameter, Casing diameter, pipe type, etc.

Device information (addresses / coordinates)

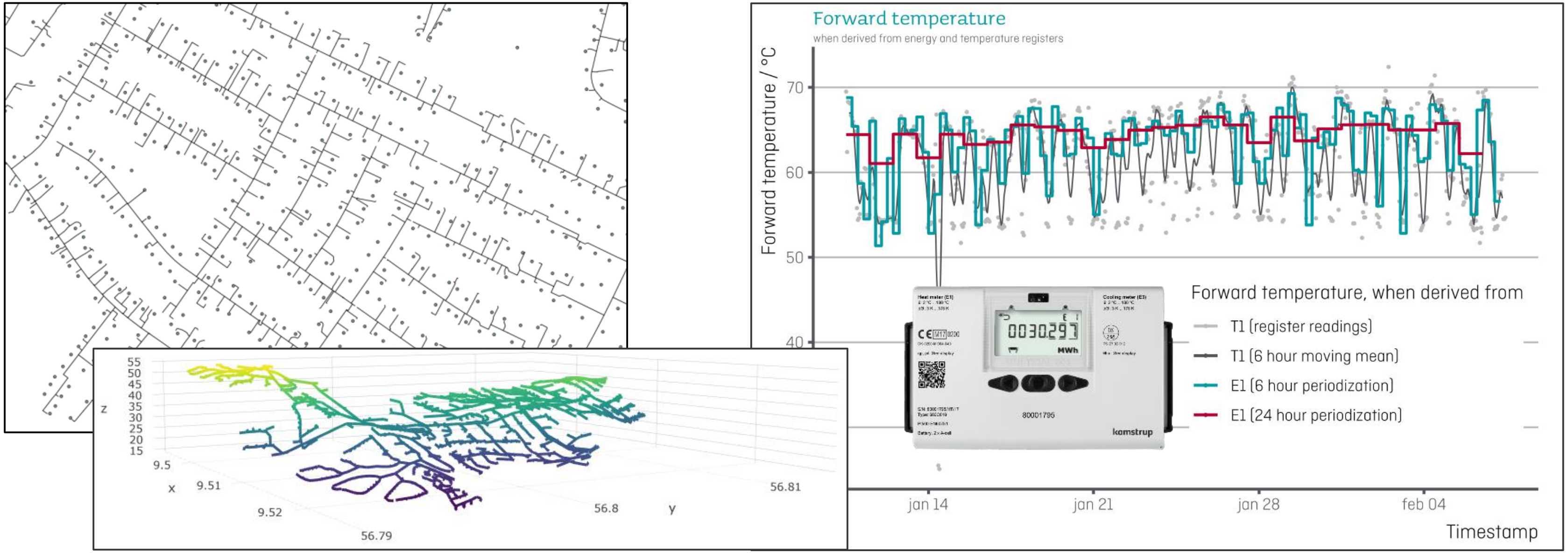
Energy meters

Bypass valves, Pressure meter

External data sources

Elevation data, ambient temperature

- **Meter data (typically hourly values)**
  - Flow (volume) data
  - Volume or energy weighted forward/return temperature (accumulated value) - E8/E9
  - Forward and return temperature (instantanous value) - T1/T2:
  - Pressure data



Buildinging a digital twin of the distribution network

- **Meter data**
  - *flow, temperature and pressure*

- **Distribution grid (GIS-data)**
  - Pipe dimensions and network topology

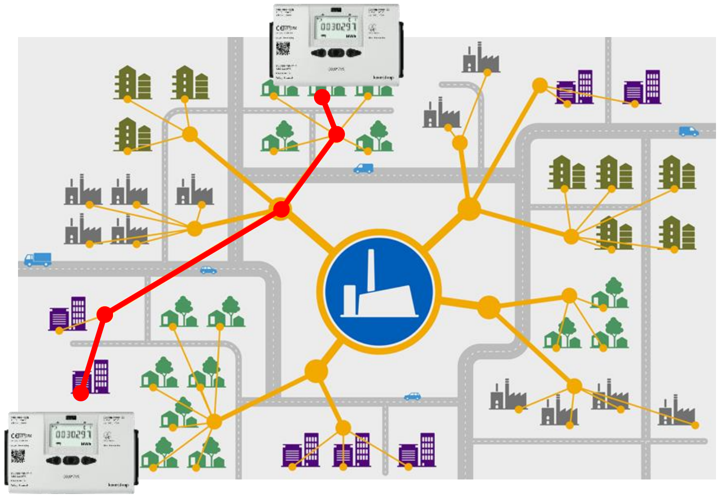
- **Numerical model, to estimate network state:**

  - Flow, temperature and pressure…

  - To identify outliers:
    - *flow in circulations*
    - *Leaks*
    - *Flow dynamics and stagnating flow*

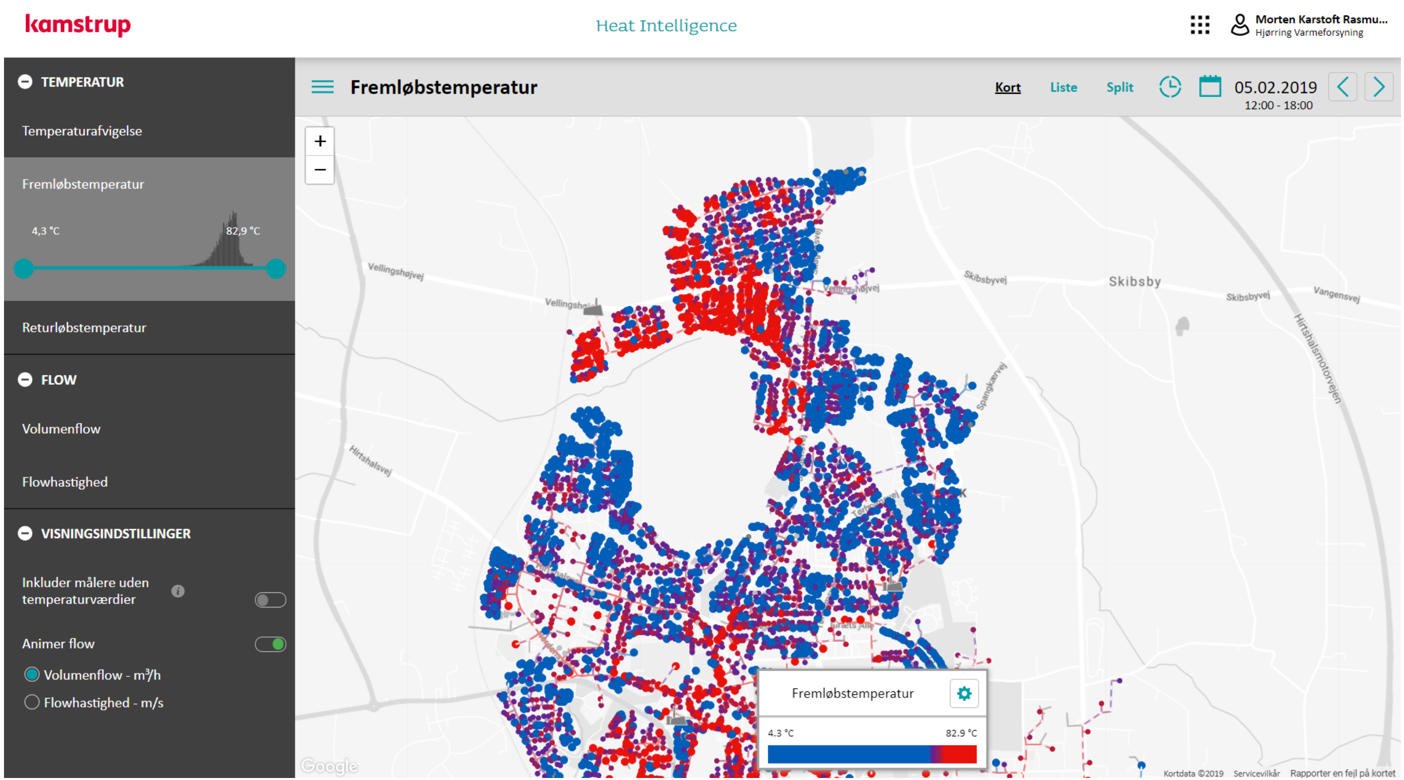
    - *Heat loss in service pipes*
    - *Faulty meter installations*

$Q_{\mathrm{f}} = 0.34\ \mathrm{m}^3/\mathrm{h}$
$T_{\mathrm{f}} = 71.1\ °\mathrm{C}$
$T_{\mathrm{r}} = 35.7\ °\mathrm{C}$

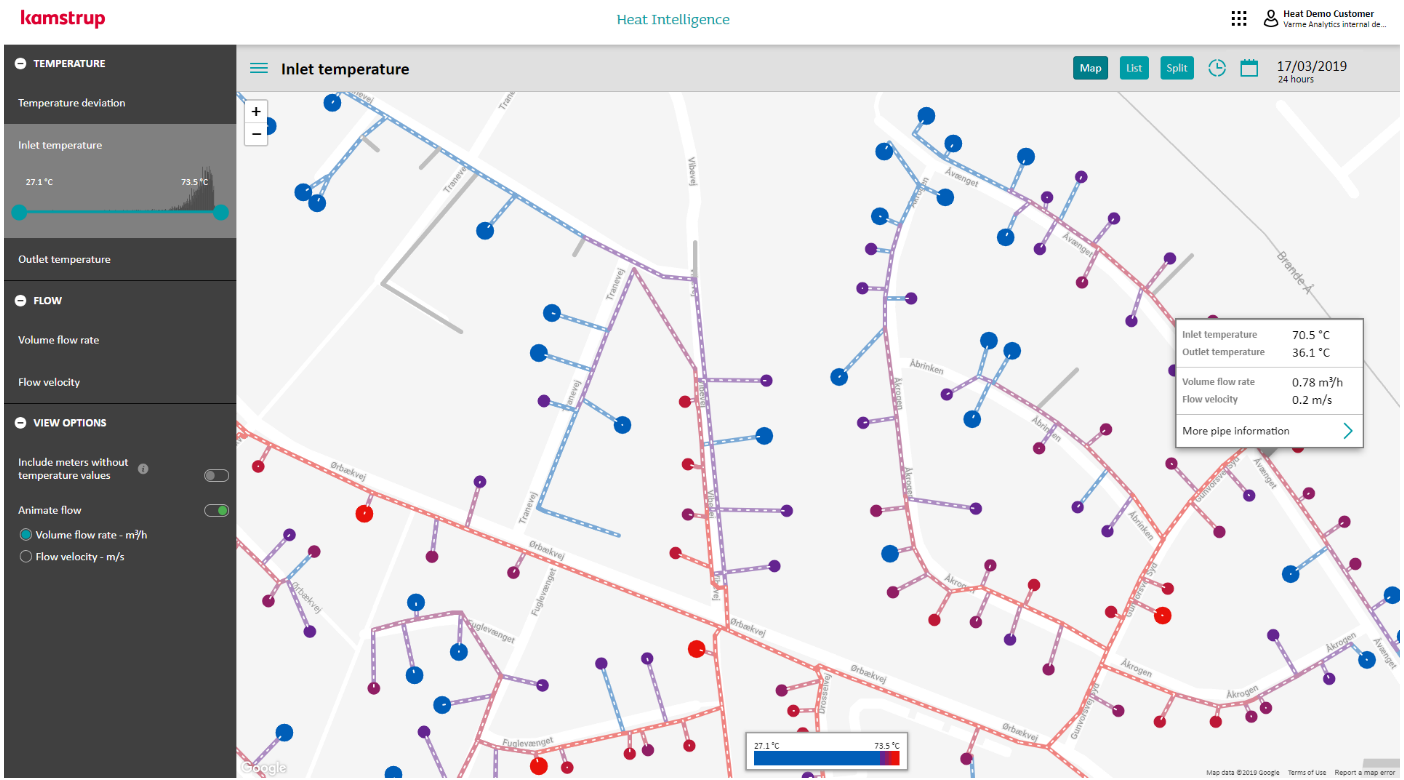


$Q_{\mathrm{f}} = 0.26\ \mathrm{m}^3/\mathrm{h}$
$T_{\mathrm{f}} = 69.4\ °\mathrm{C}$
$T_{\mathrm{r}} = 41.1\ °\mathrm{C}$

Easy overview of data from thousands of metering points …



… and zoom in to investigate the heat flow in any region of the network



Find outliers – to identify problems

Case: Temperature optimization, HI combined with intelligent bypasses

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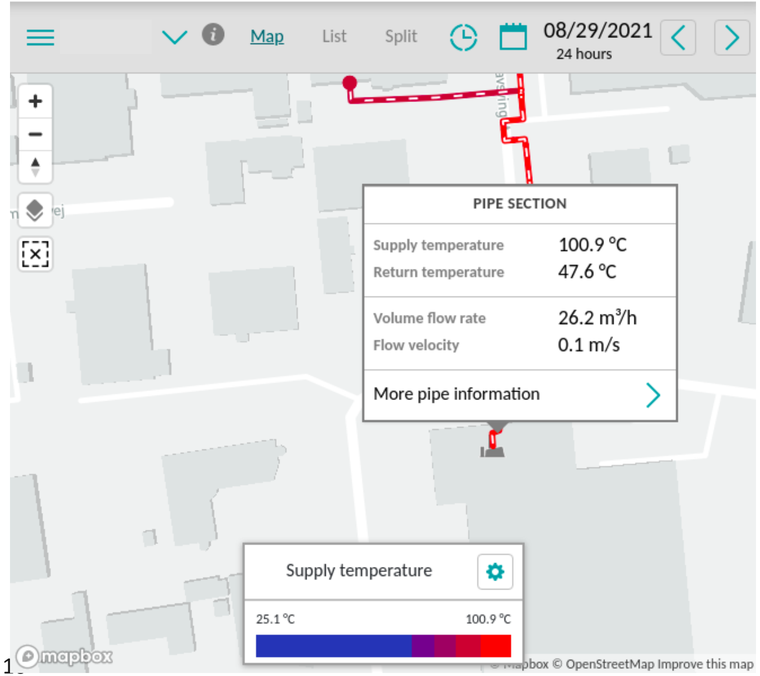

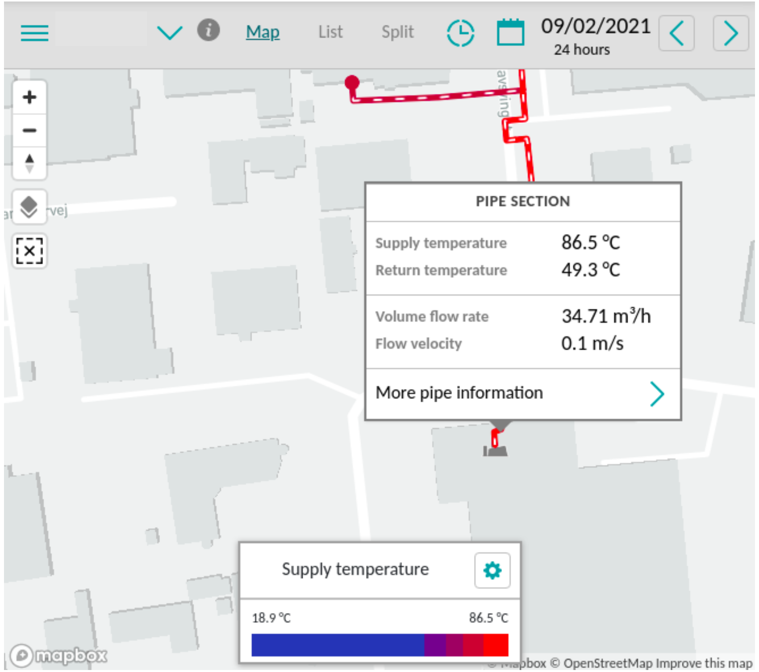

Forward temperature

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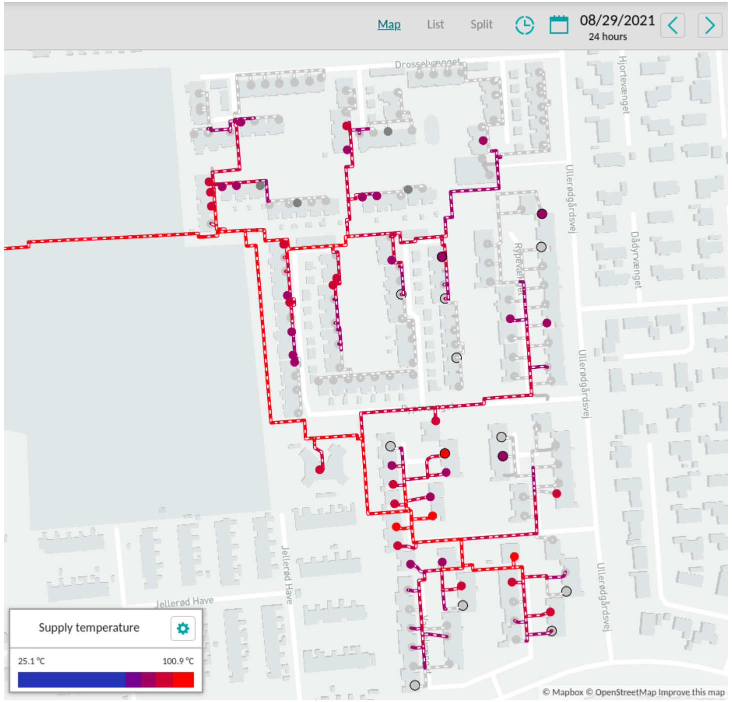
Before: ~100 °C forward @ production

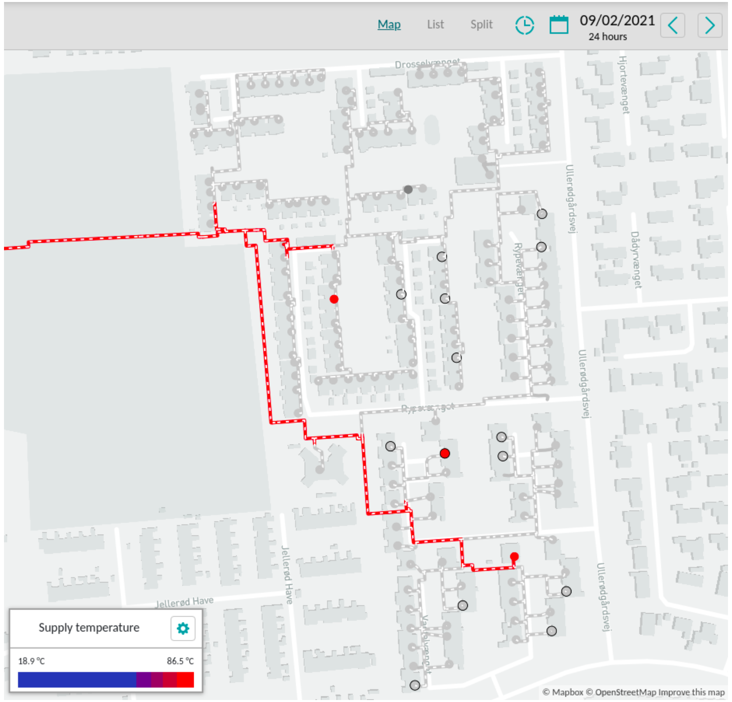
filter pipes above 80 °C



After: ~85°C forward @ production

Temperature is still sufficiently high in branch pipes

filter pipes above 80 °C



Return temperature

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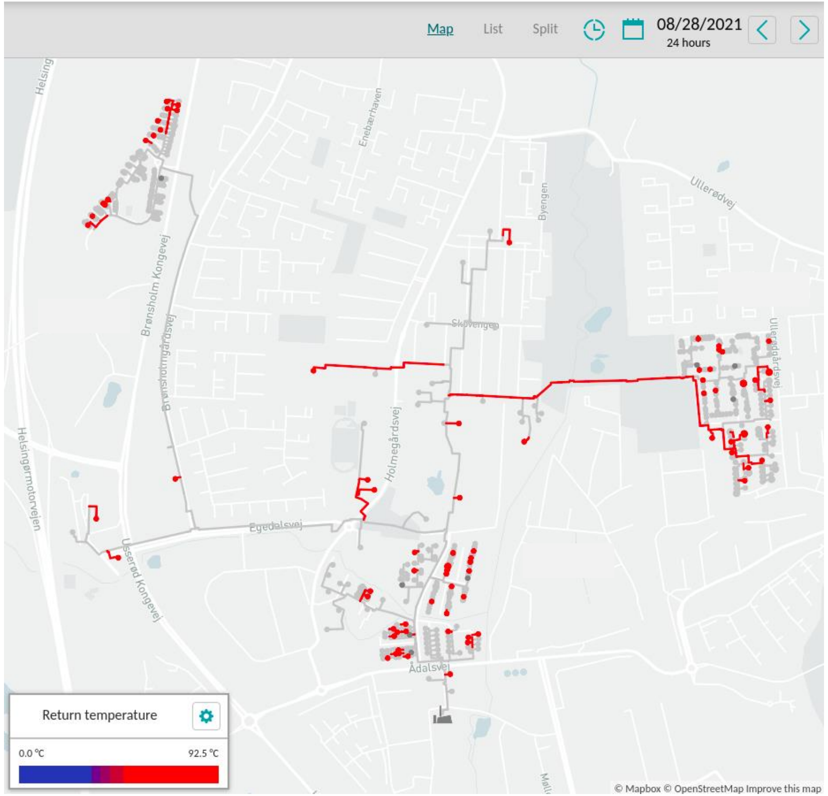
Before: ~100 °C forward @ production

filter pipes above 60 °C



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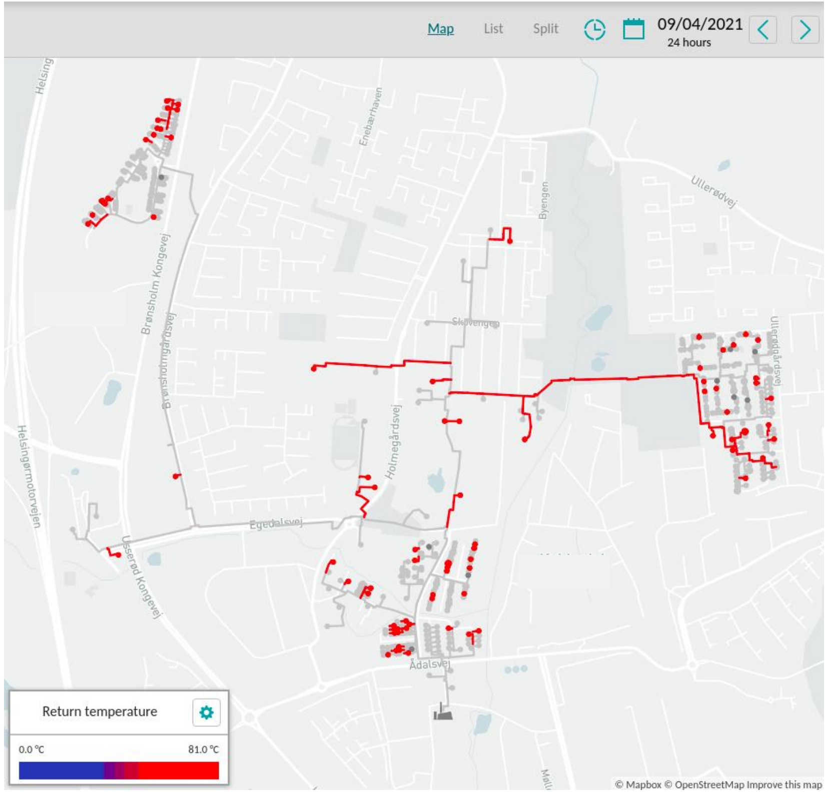
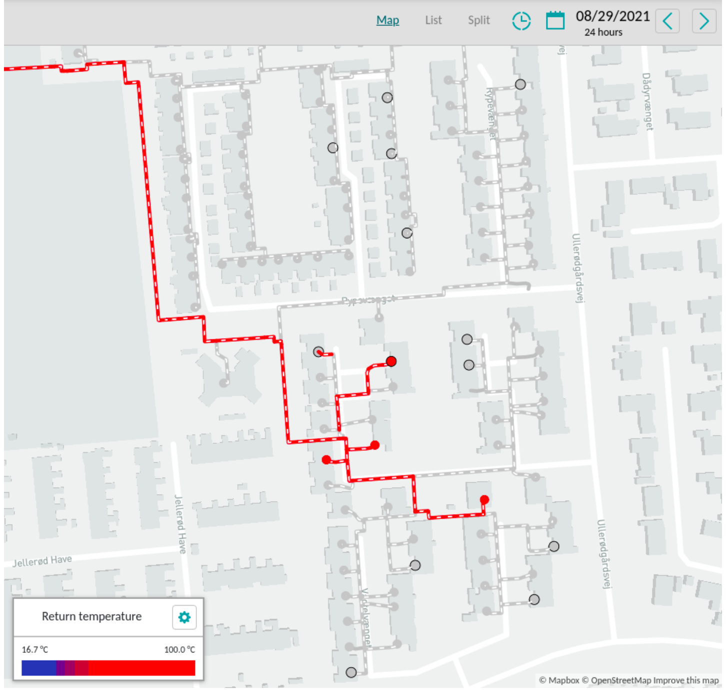
filter pipes above 60 °C



Return temperature

Before: ~100 °C @ production

filter pipes above 60 °C



After: ~85°C @ production

Bypasses starts to influence the system

filter pipes above 60 °C

Pressureloss estimation, locate supply bottlenecks

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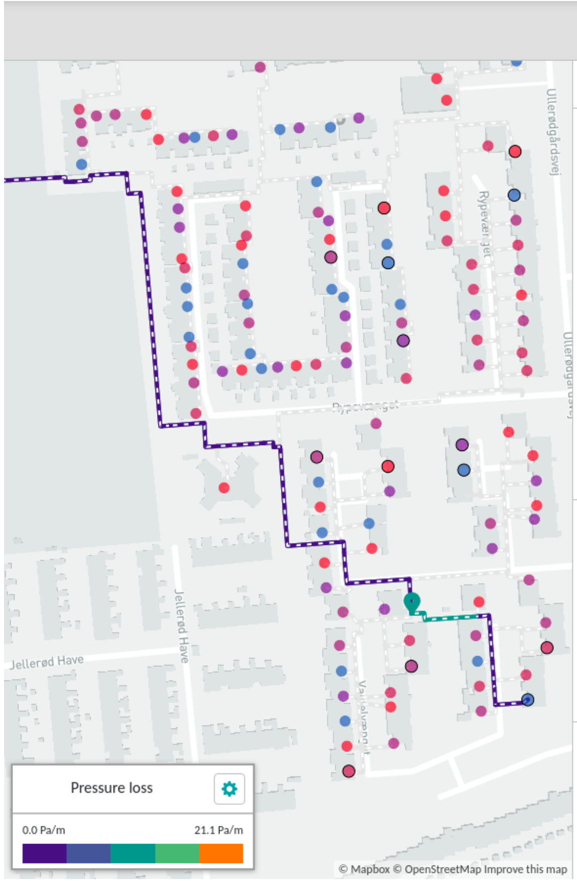
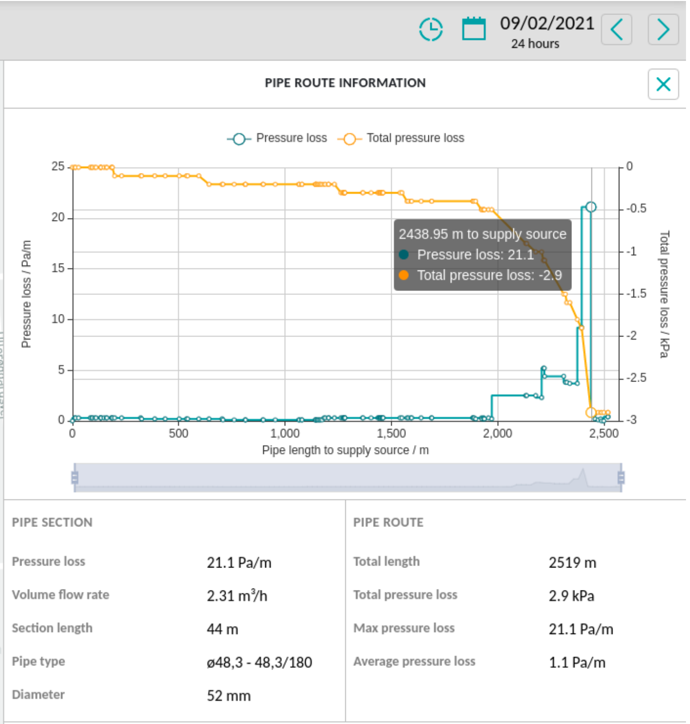
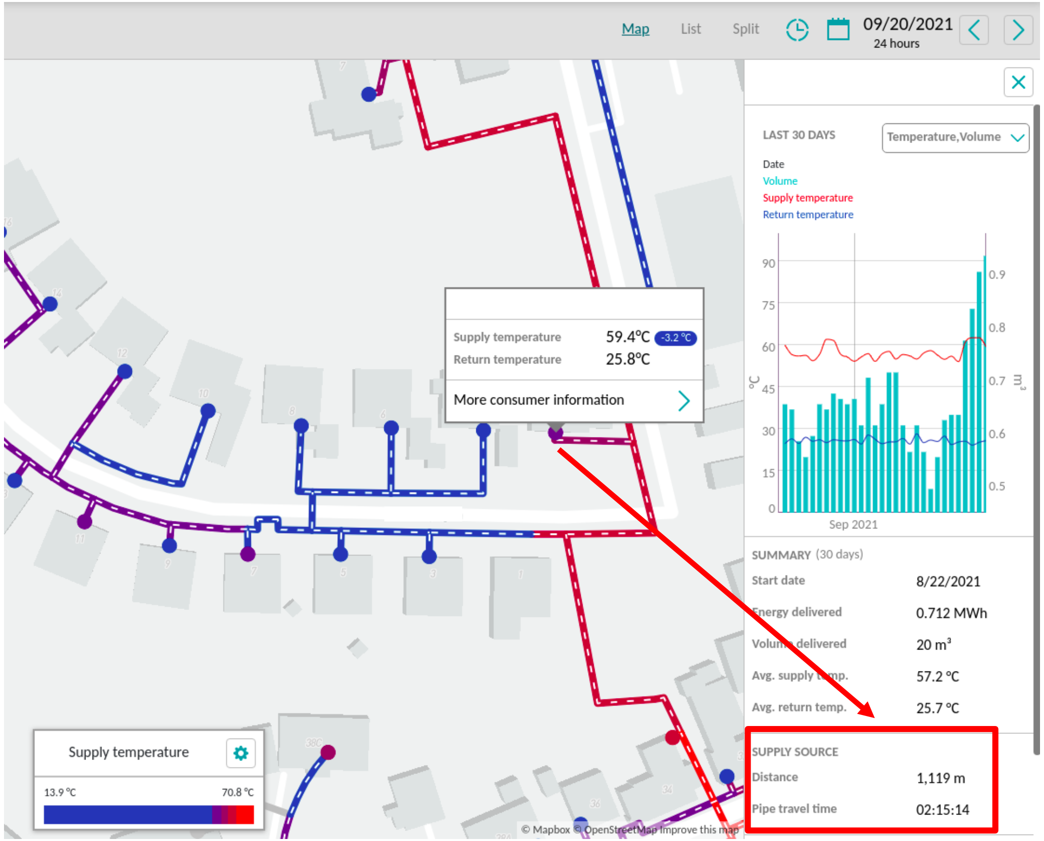


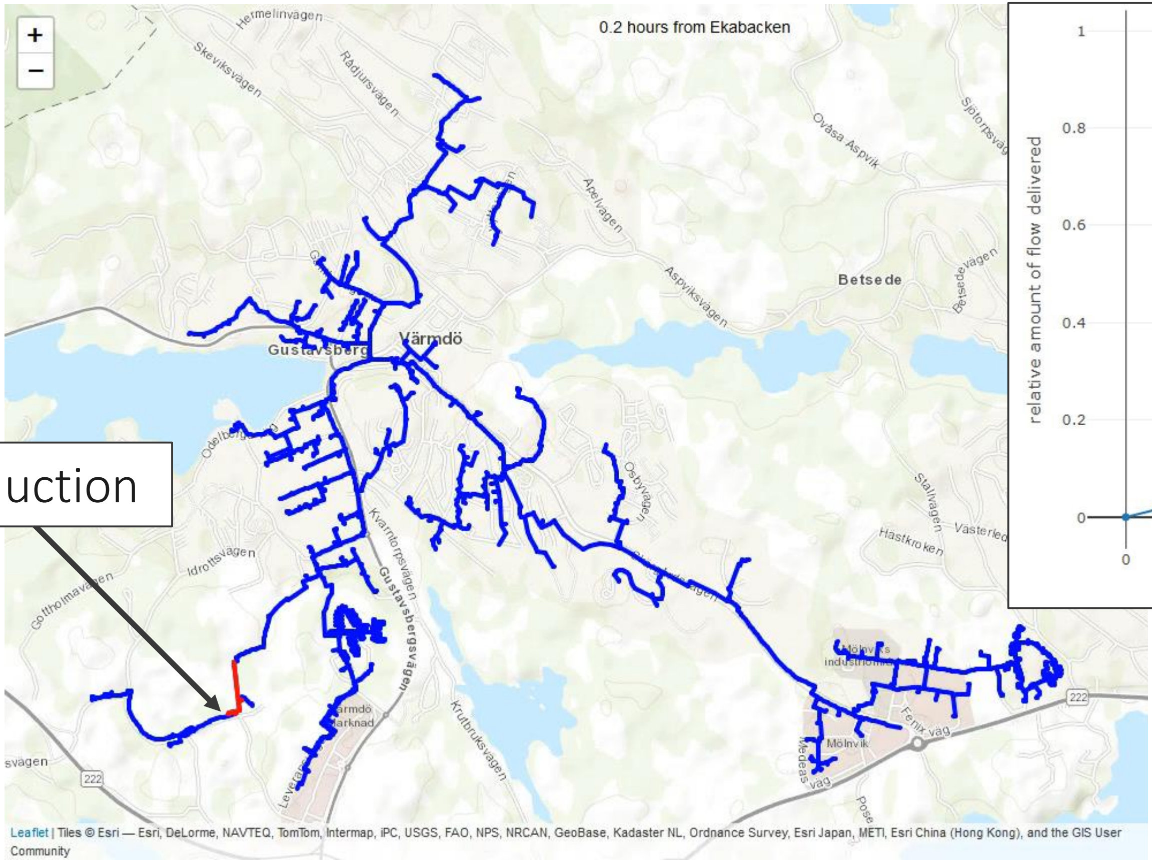


35% flow increase --> network still has sufficient capacity.

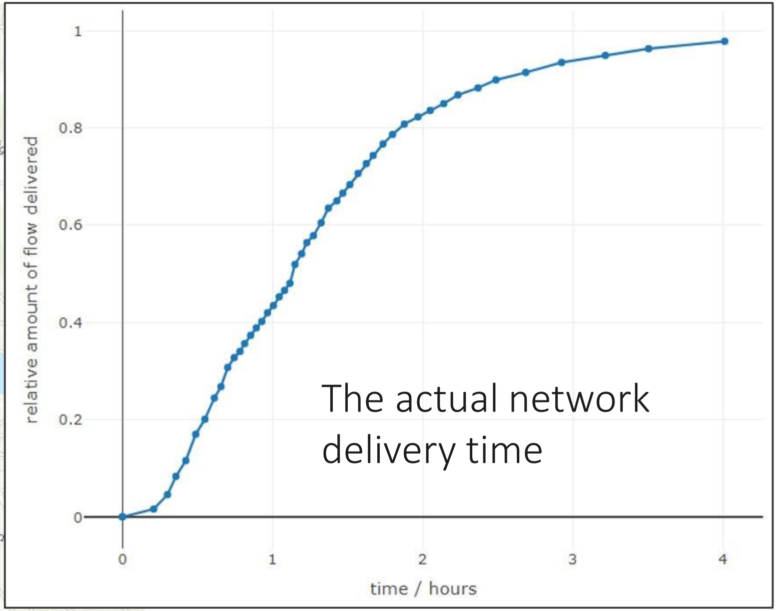
Network transport time and distance



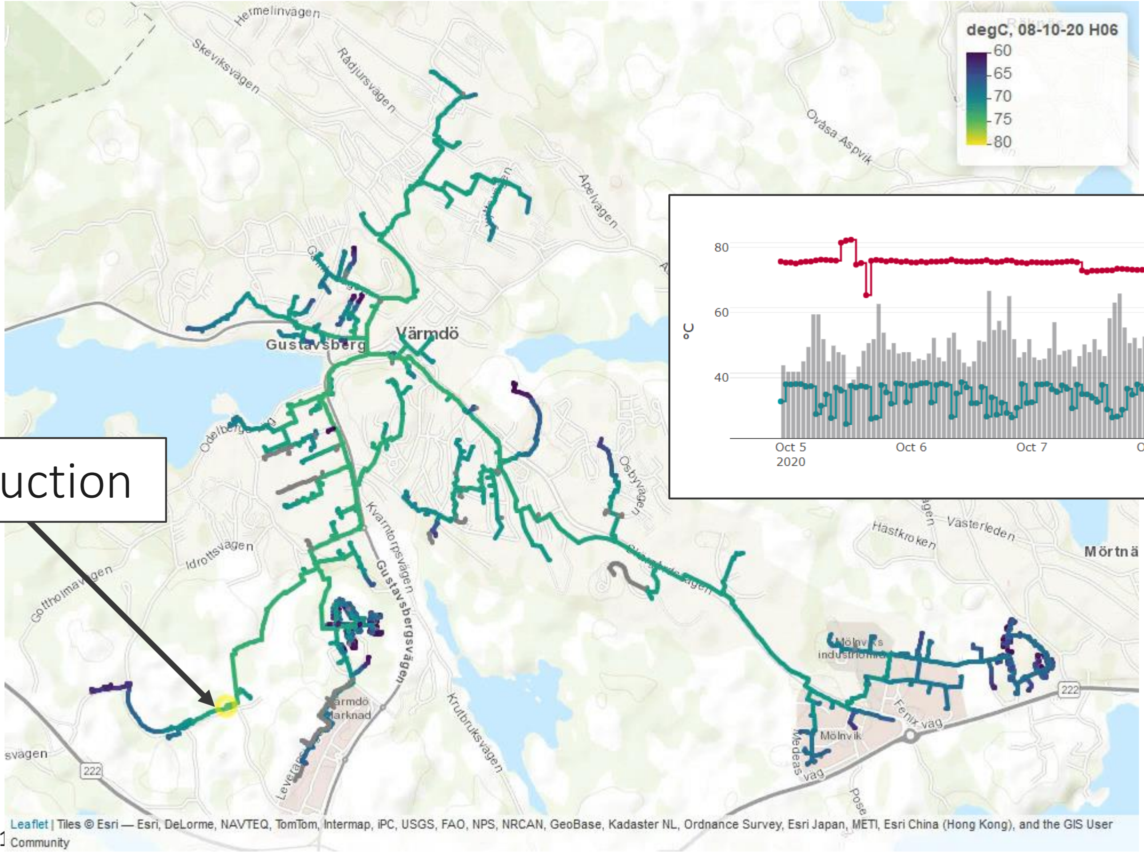
Prototype: Transport time, based on meter data



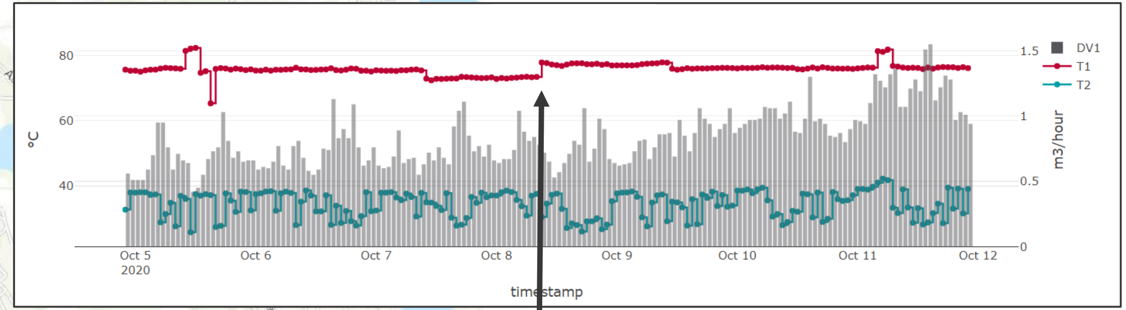
Production



Prototype: Temperature propagation visualization, based on hourly meter data



Production



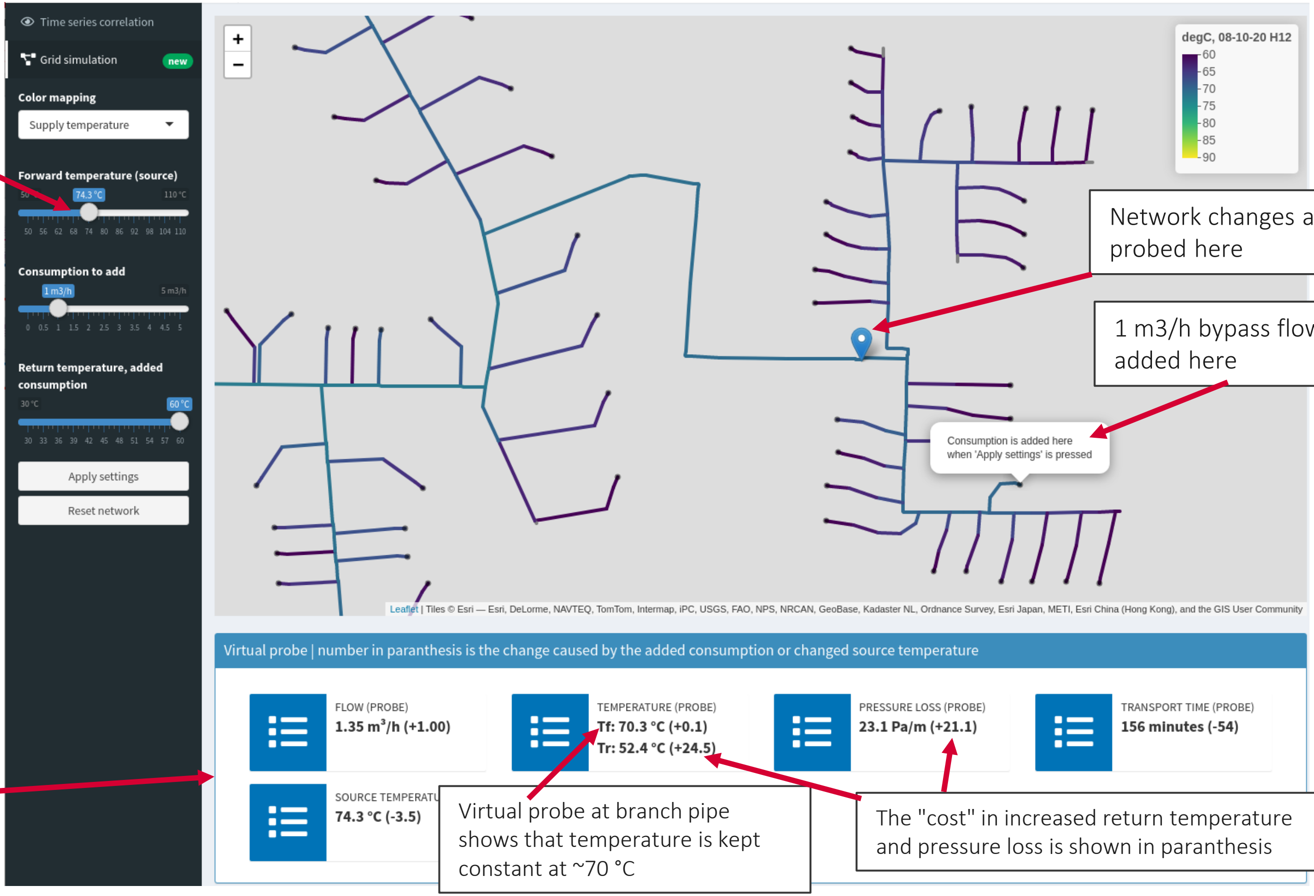
Tracking temperature change

Prototype: grid simulation, what-if scenarios

starting point is based on meter data --> network perturbations...

Production site temperature is lowered by 3.5 °C to 74.3 °C

Decrease temperature at production site, but keep forward temperature constant in branch pipe by introducing a bypass



Network changes are probed here

1 m3/h bypass flow added here

The "cost" of decreasing the production site temperature with 3.5 °C, while keeping the branch pipe forward temperature constant at the virtual probe, is shown in paranthesis

Virtual probe at branch pipe shows that temperature is kept constant at ~70 °C

The "cost" in increased return temperature and pressure loss is shown in paranthesis

It's time to know ...