

Friction reducing additives

- District heating (and cooling) is changing – the distribution is becoming the bottleneck
- Summary of experimental results with friction reducing additives – Maksym Kotenko
- Friction reducing additives as part of the solution
- The next steps

Carsten Bojesen

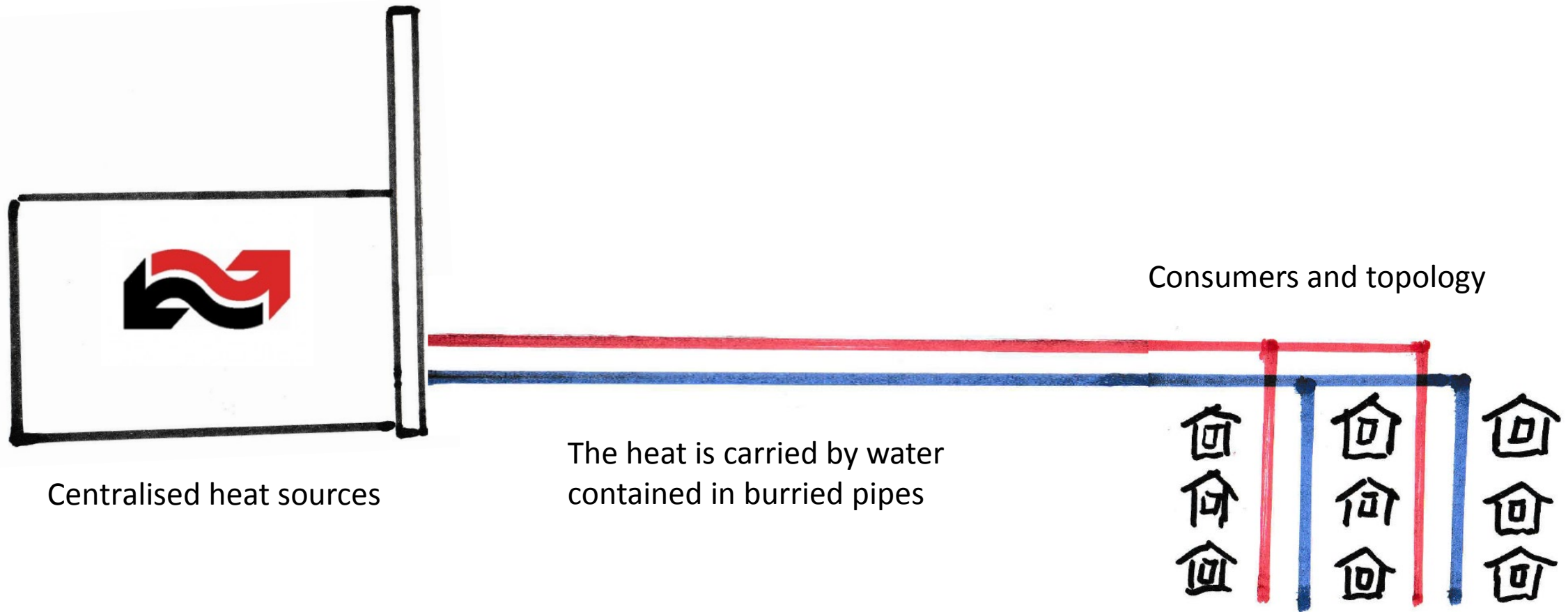
Associate professor, Department of Energy
Technology
Aalborg University

Maksym Kotenko

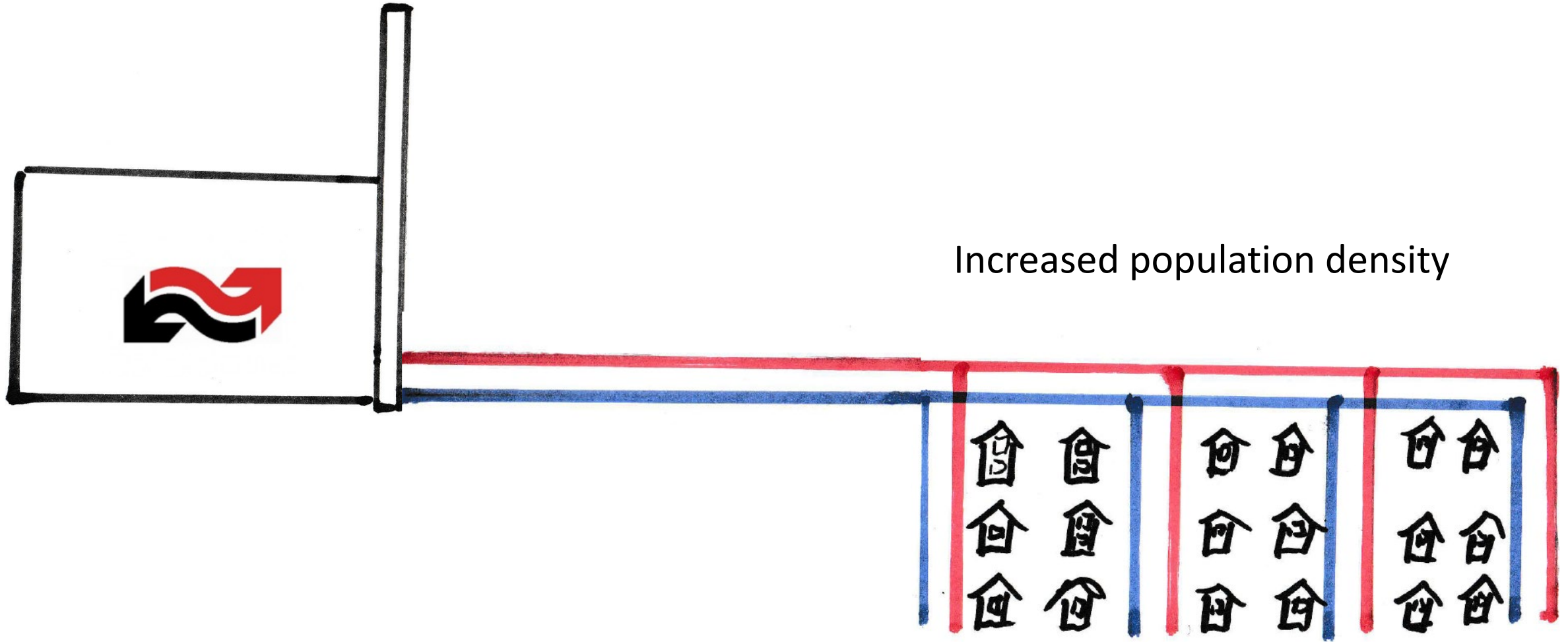
PhD Fellow, Department of Energy
Technology
Aalborg University



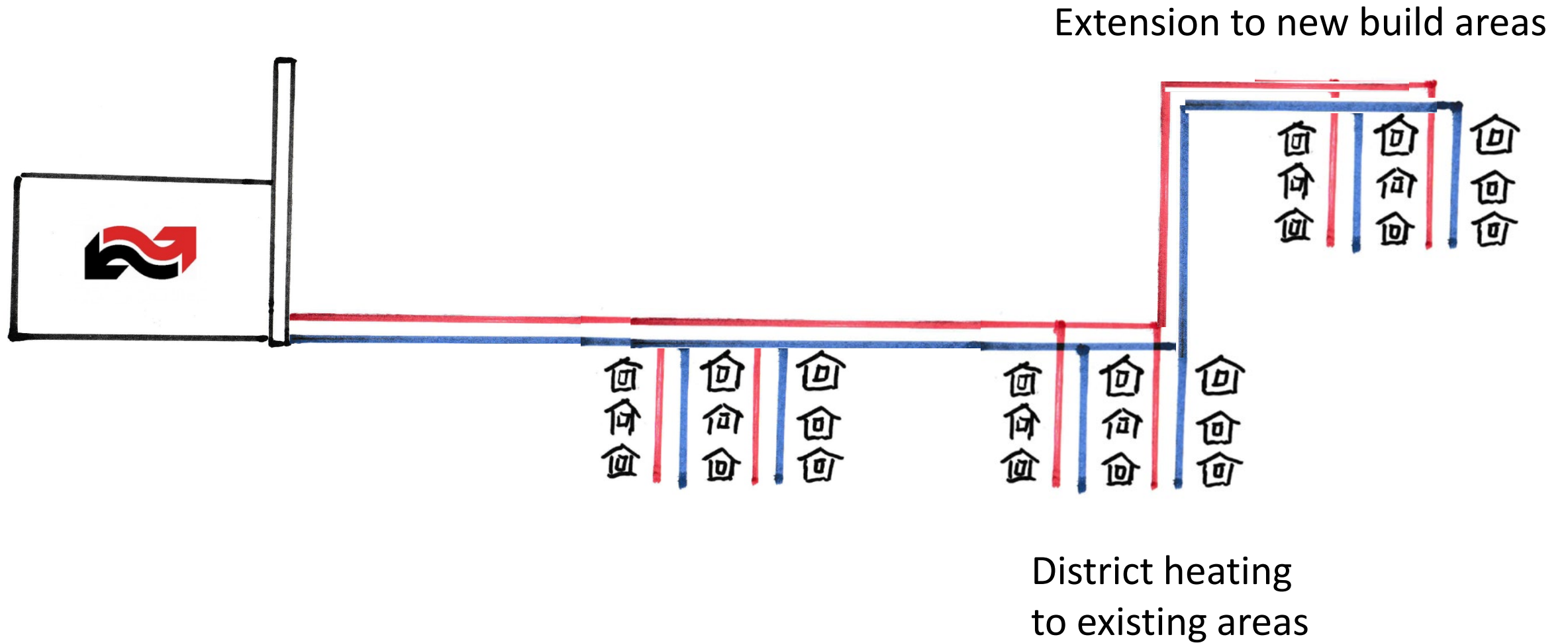
District Heating



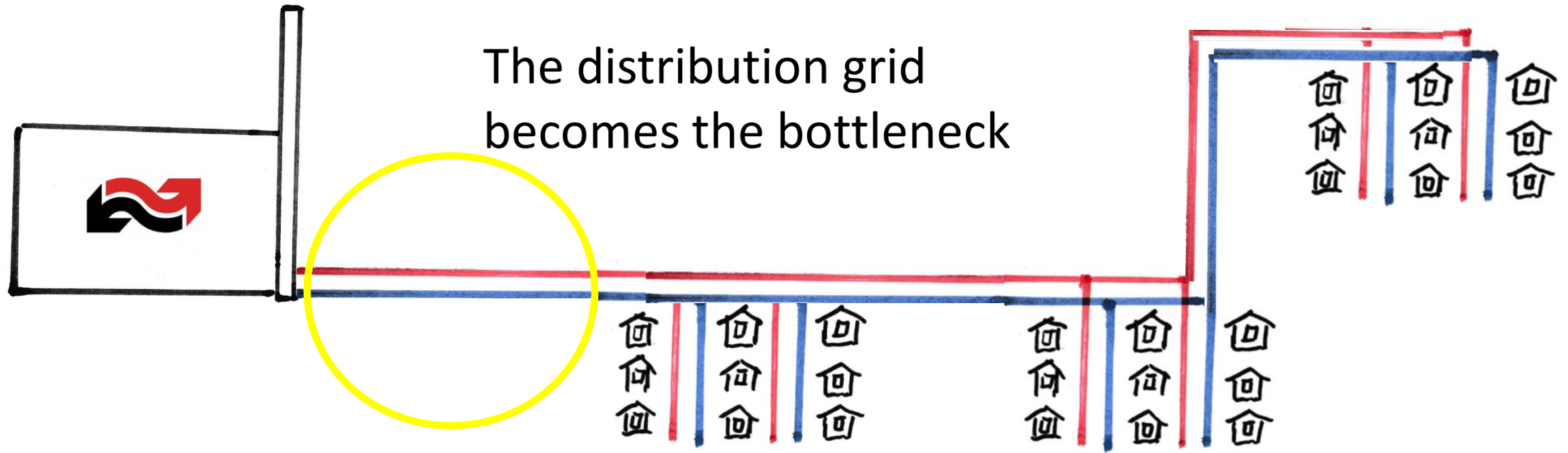
District heating is changing



District heating is changing

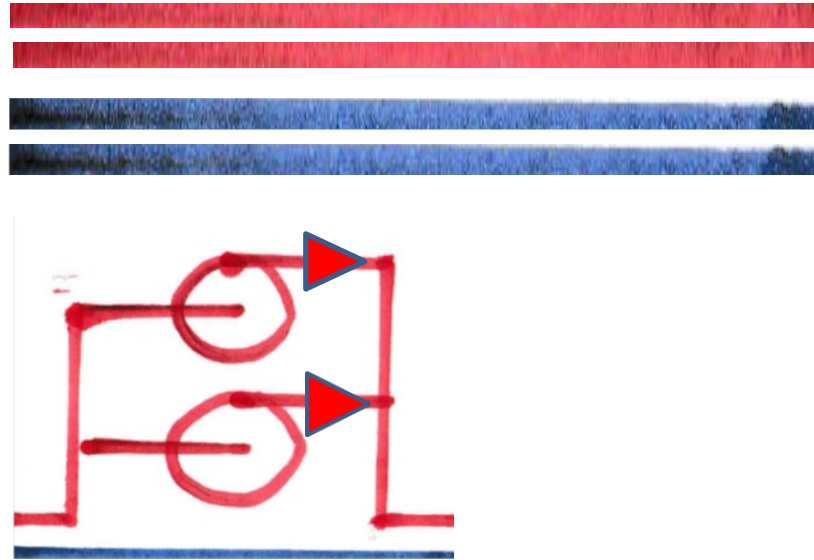


District heating is changing



District heating is changing

- Lay down additional or larger pipes
- Increase velocity and make more and/or larger pumping stations
- Increase the supply-return temperature difference
- Partly or fully *Islandic* district heating with *local* heating sources



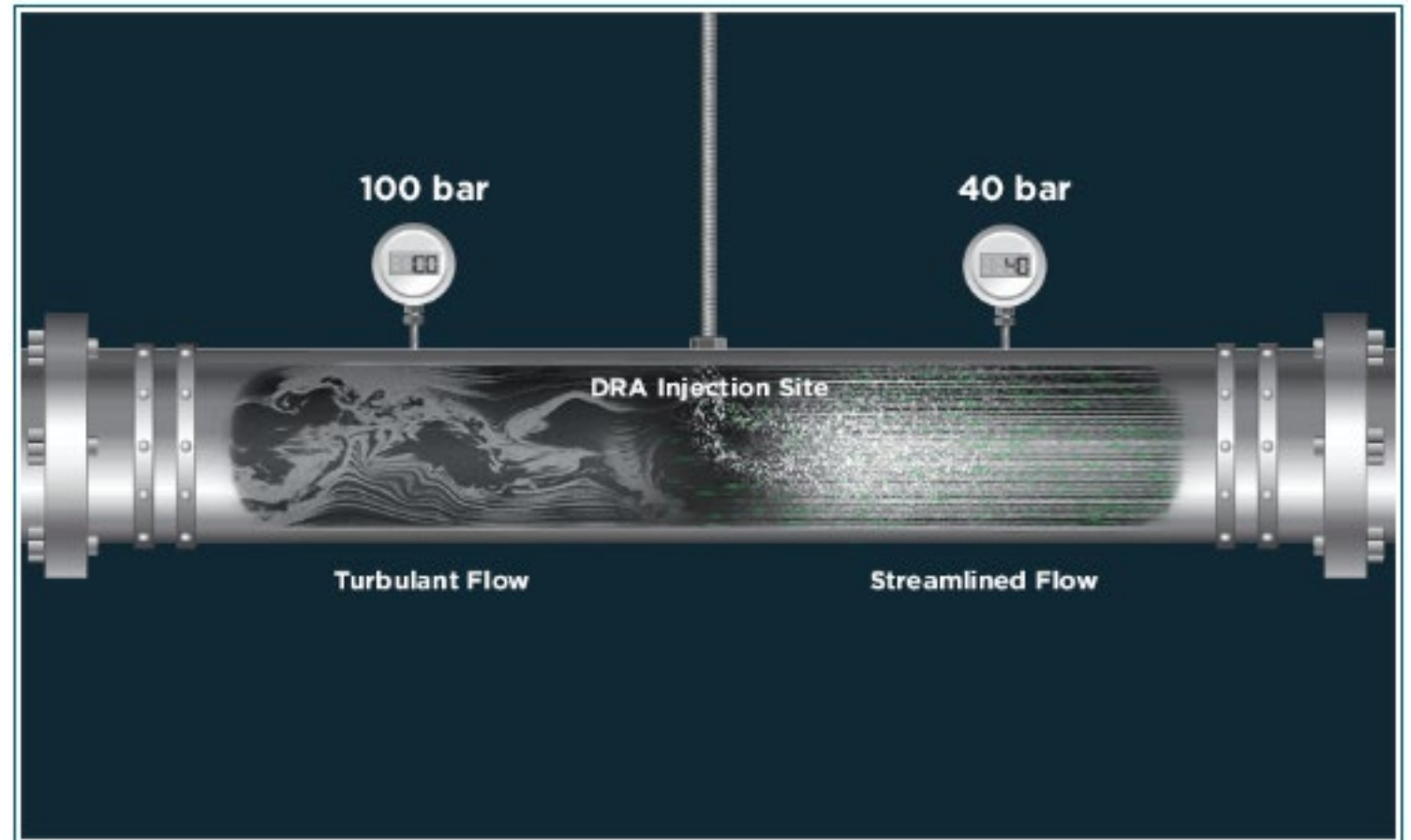
District heating is changing

A part of the solution could be adding of friction reducing additives to the DH water

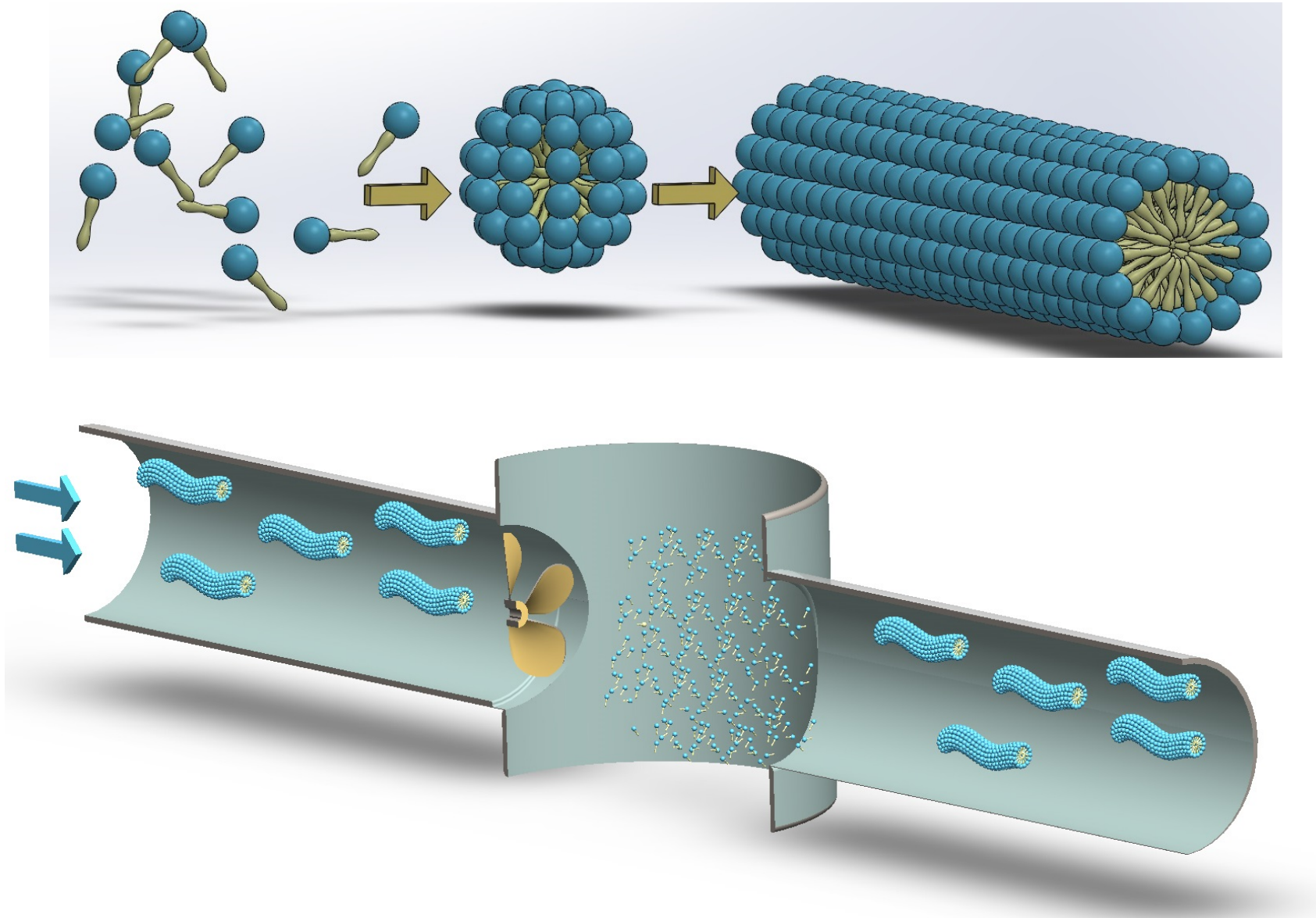
Presented by Maksym Kotenko

A part of the solution could be adding of friction reducing additives to the DH water

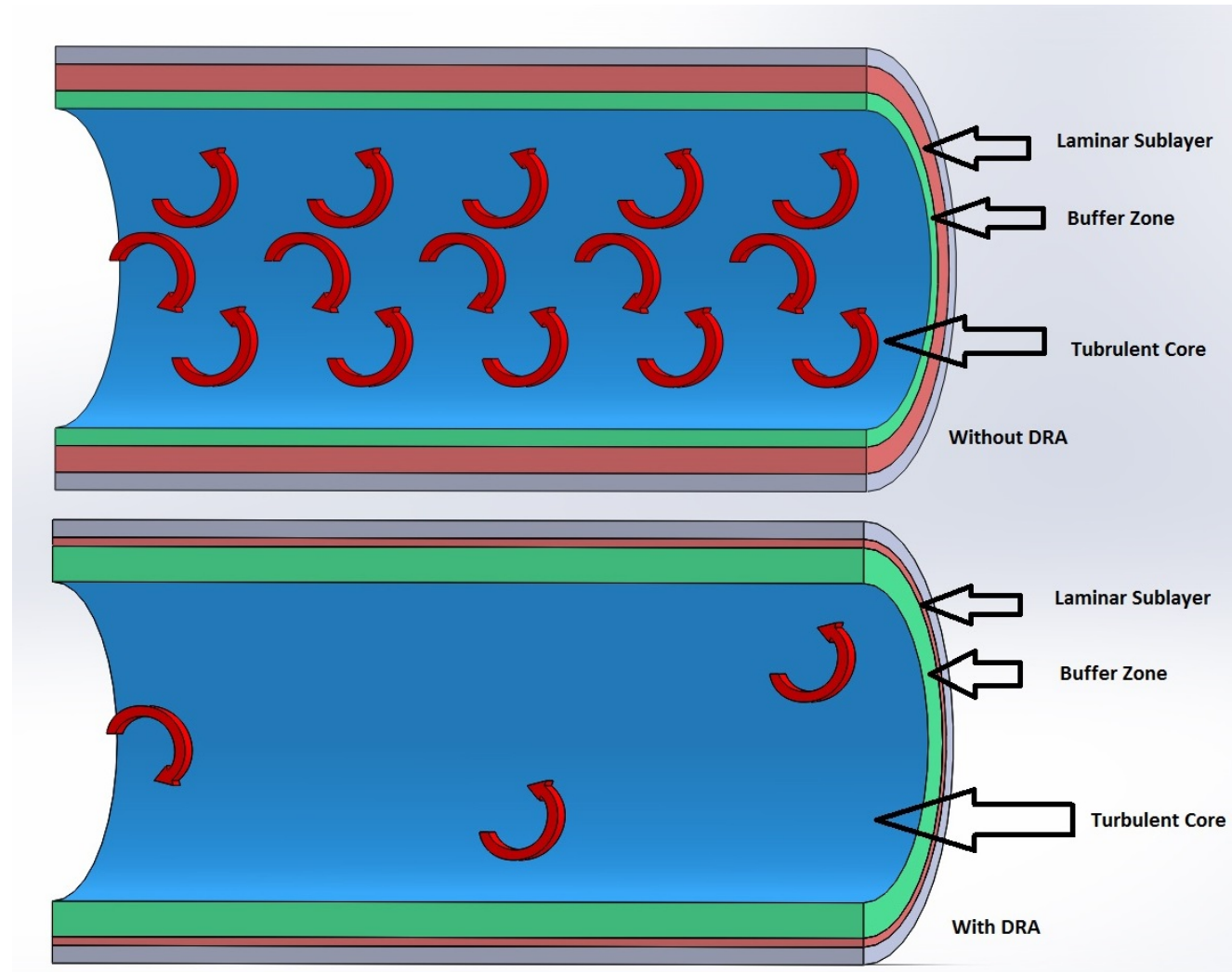
- **Fibers**
- **Polymers**
- **Surfactants**



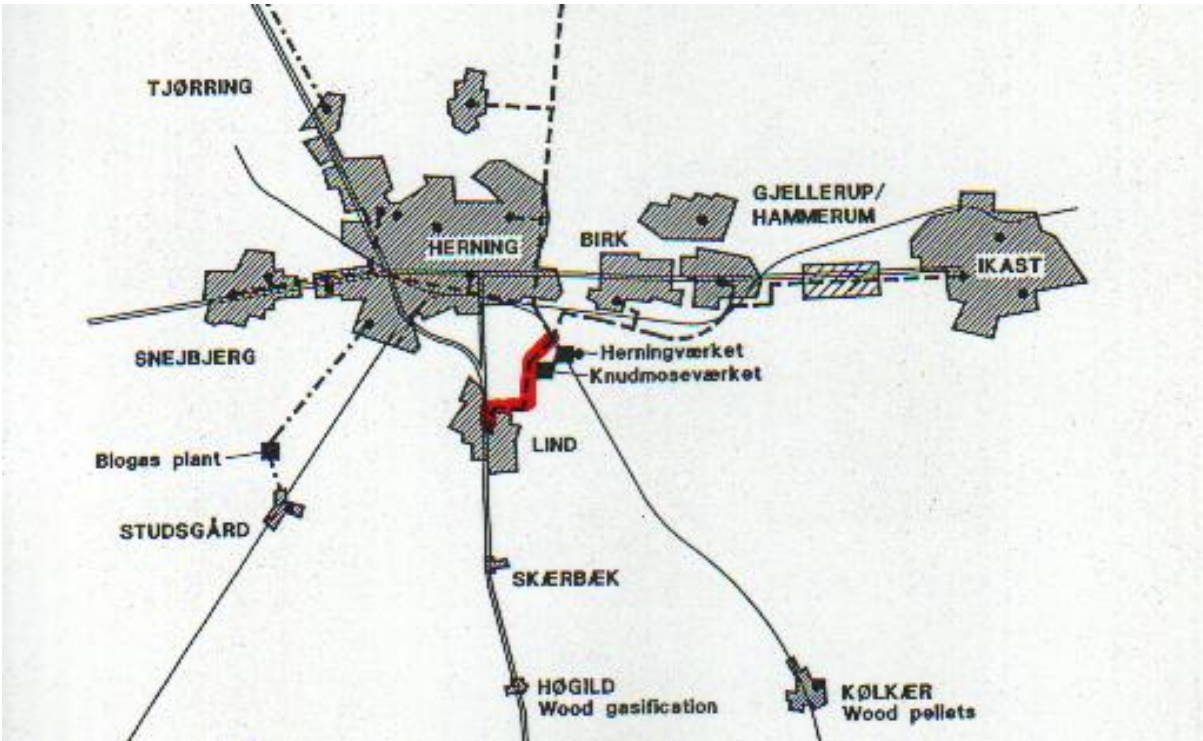
Friction reducing additives background



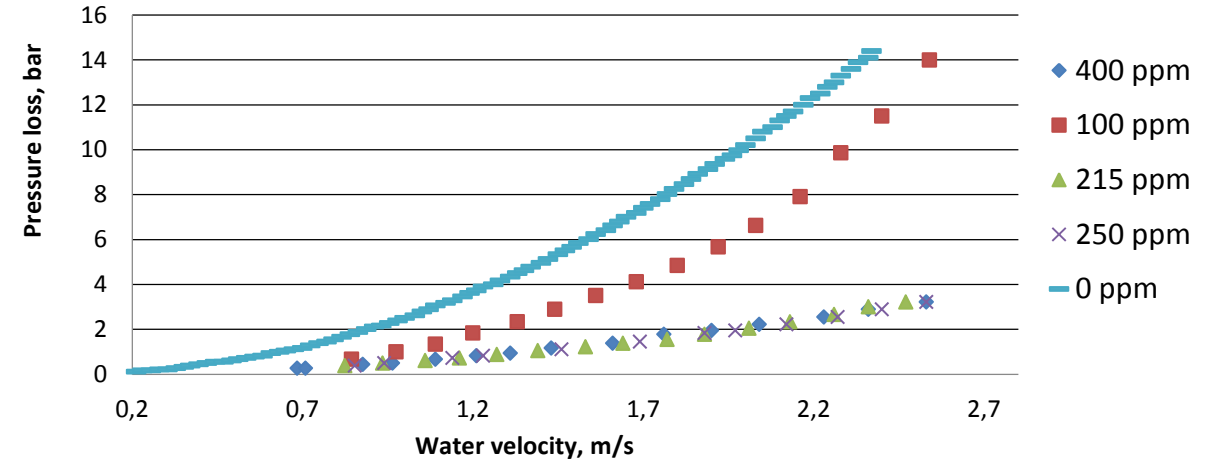
Friction reducing additives background



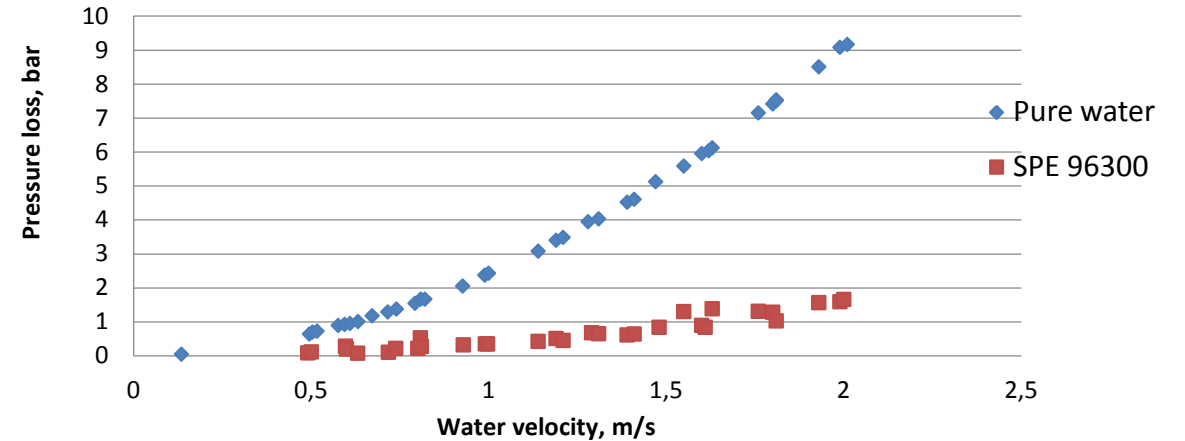
Previous experimental results in Herning



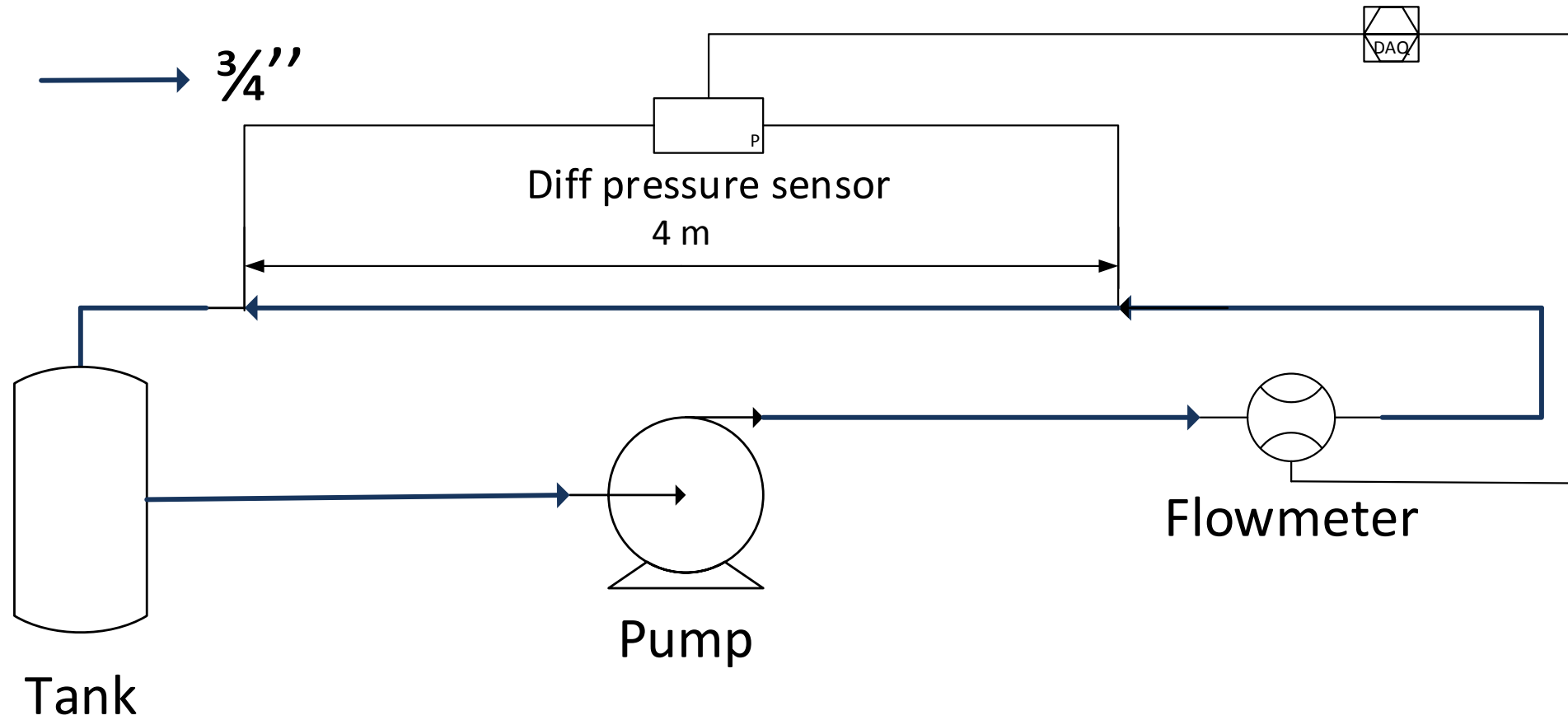
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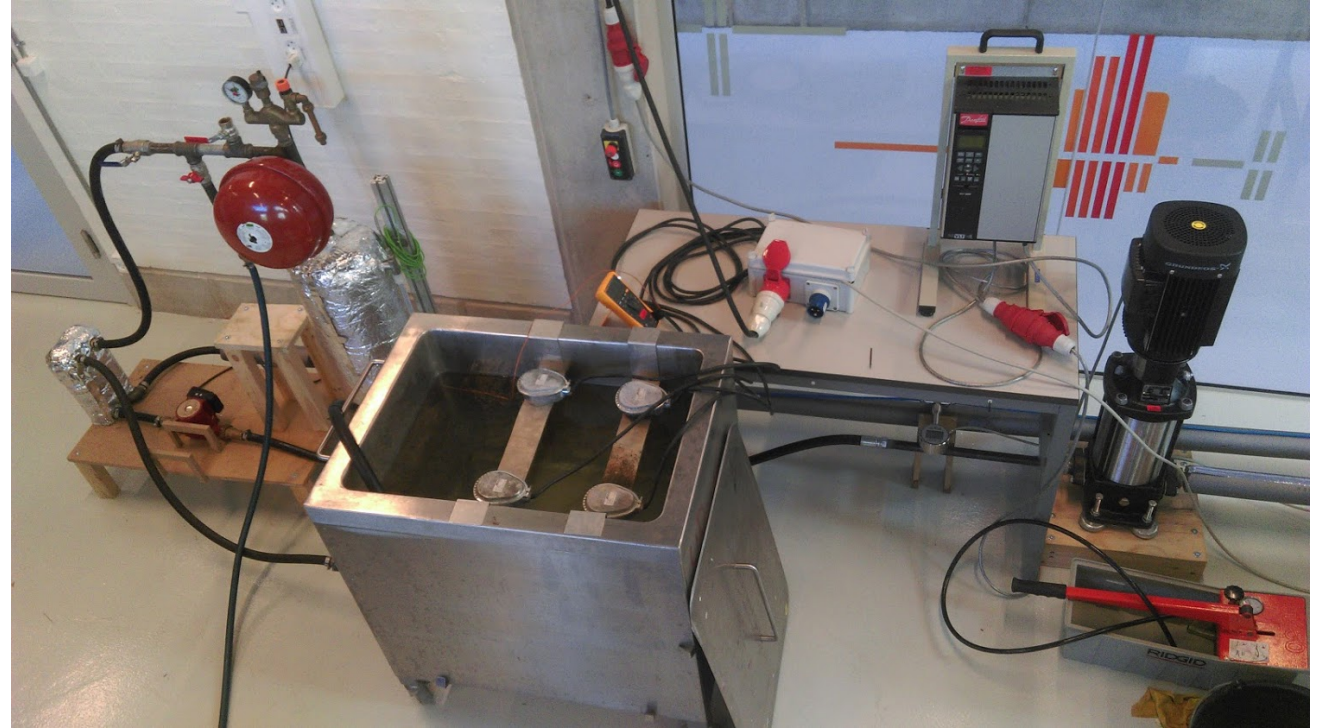
SPE 96300 1999



Test rig at AAU

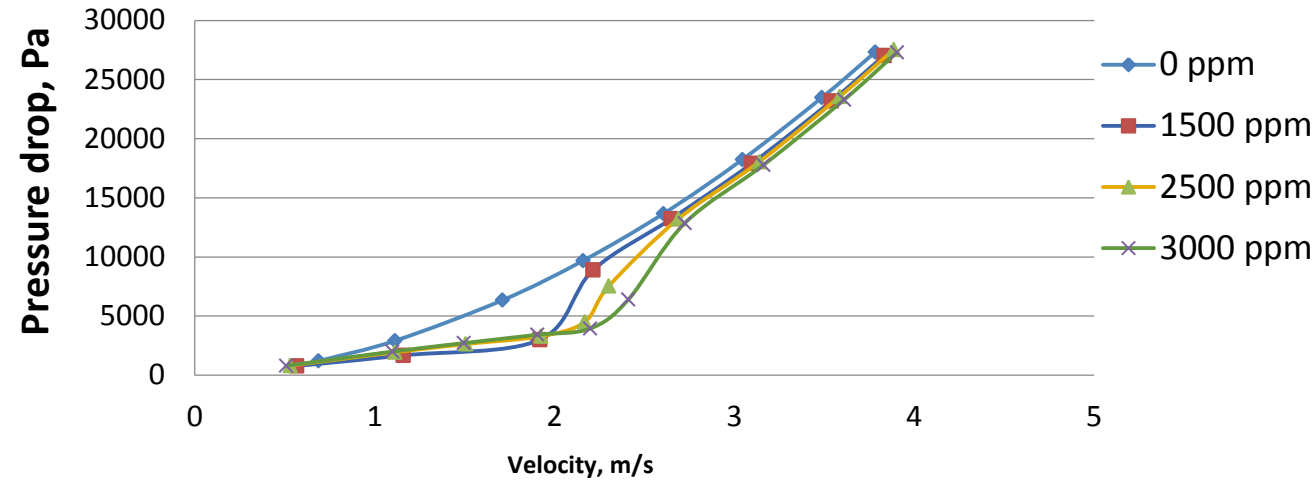


Test rig at AAU

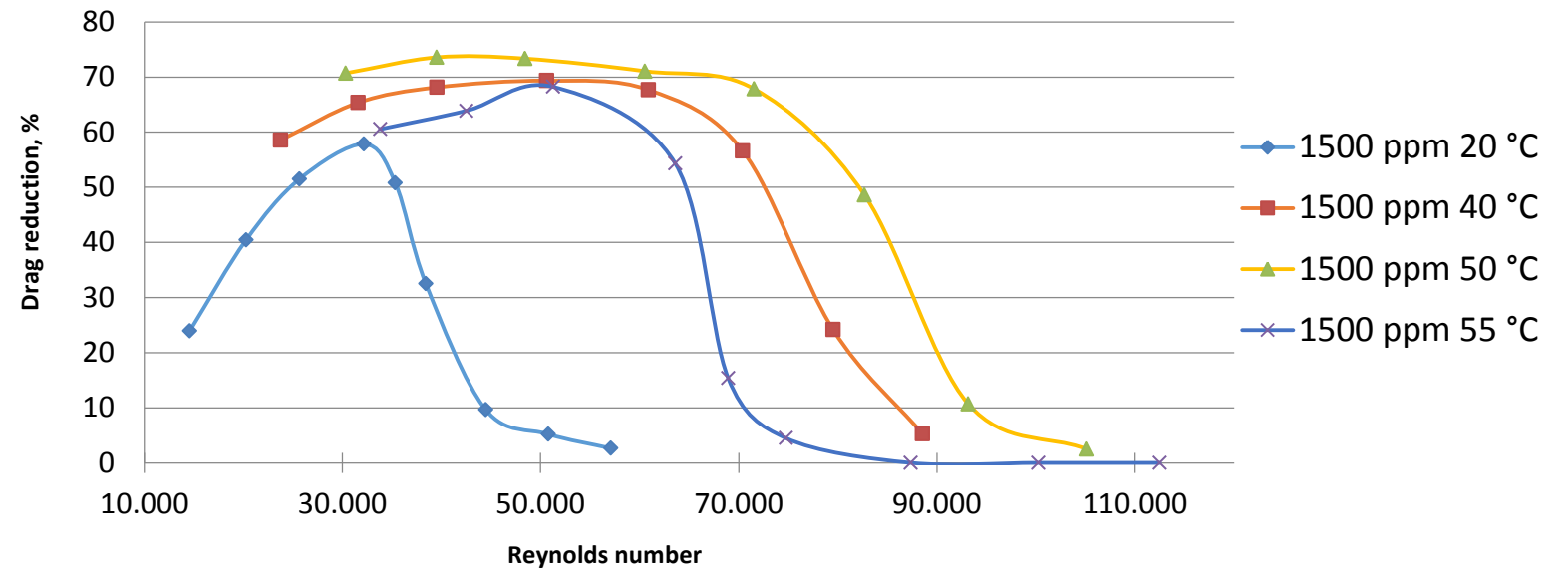


Present experimental results

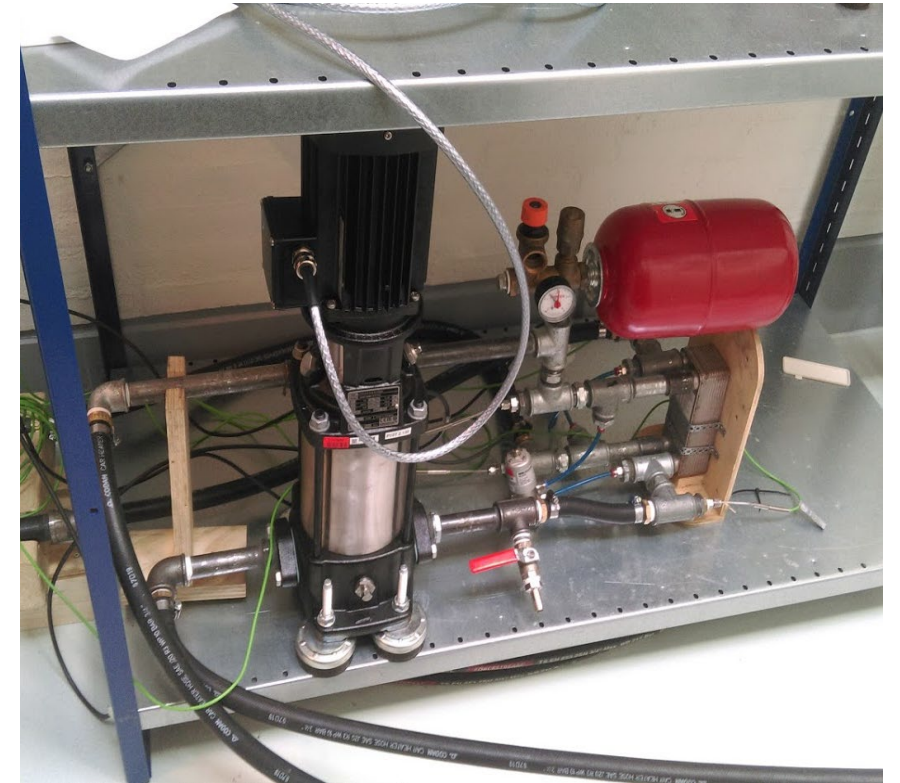
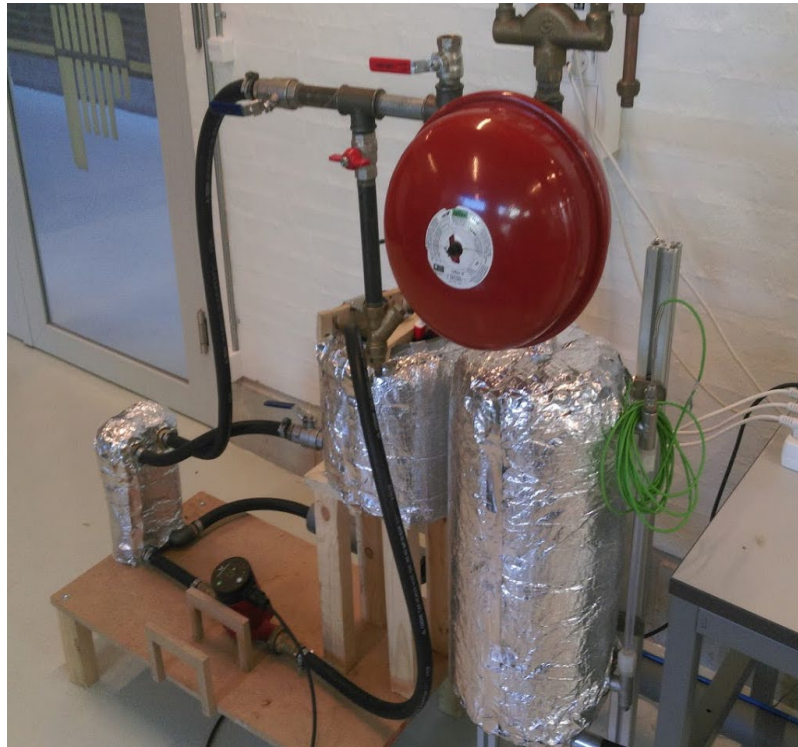
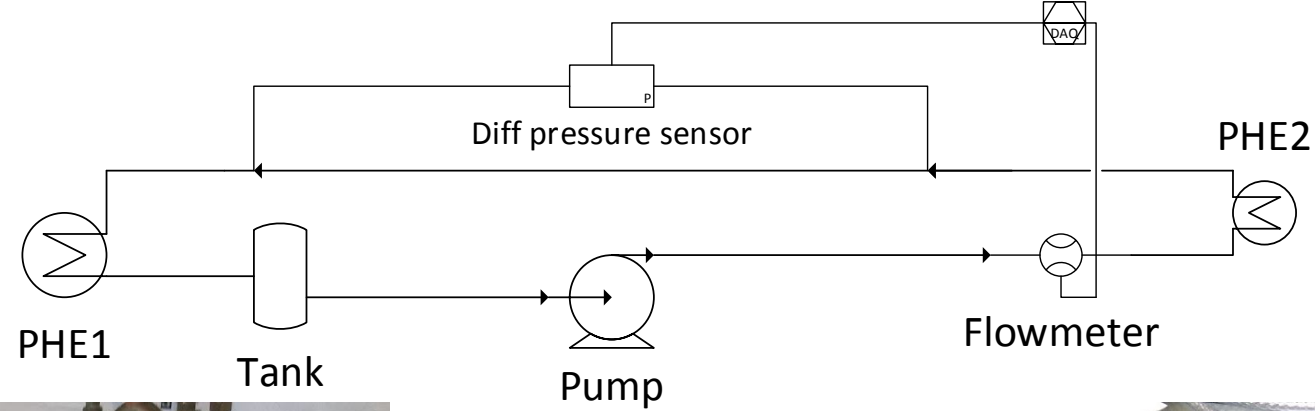
Beraid solution at 20 °C



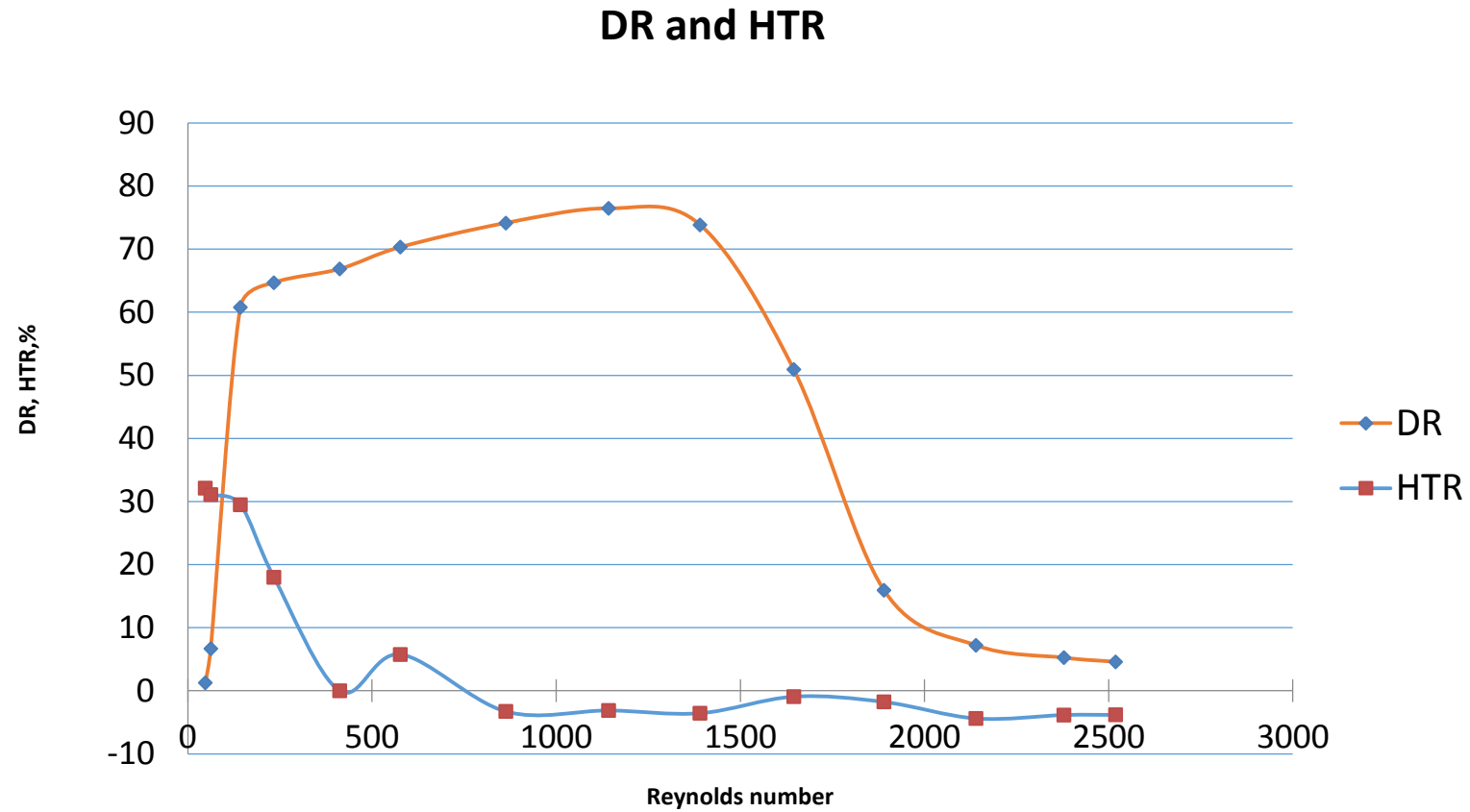
Beraid solution at 1500 ppm



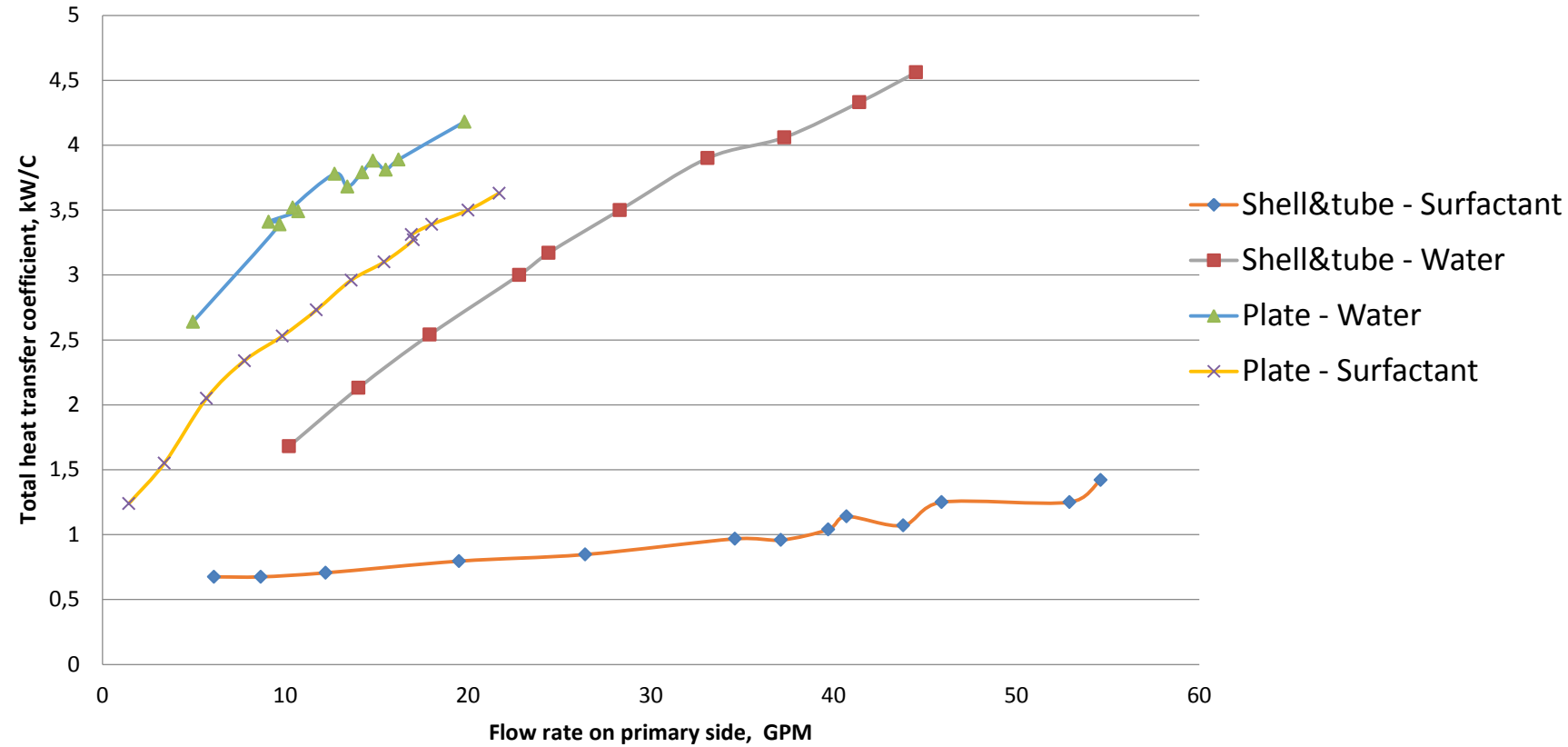
Heat transfer reduction in PHE



Heat transfer reduction in PHE



Previous experimental results of HTR in Herning



Opportunities

So what are the potential benefits?

- Reduce the required pumping power in the existing DH grid
- Extend the district heating range to existing or new build areas without changing the transmission pipes
- Supply urban areas with increasing population density with heat without changing the changing the grid.

Challenges and concerns

- *Reduction in the convective heat transfer in heat exchangers*
- *Long time stability of the additive*
- *Environmental concerns*
- *Increased water hammering effect at higher flow velocities*
- *Availabillity of additives*

Going forward

- Inventions made by researchers at Aarhus University gave rebirth to the concept and a new project group was formed
- Due to change of priorities and other circumstances the Engagement from Aarhus University was put on hold
- The experimental work was continued at Aalborg University as a part of the 4DH project.
- We now consider the experimental work on lab scale to be completed

Going forward

We are looking for district heating companies and others, who finds the concept interesting and might want to join the project group.

The objective of the project group will be to evaluate the before mentioned concerns and bring the concept from the present level and to a full scale test and demonstration stage

The project team consist of:

- *Jesper Breuning, ProVectas*
- *Flemming Hammer*
- *Maksym Kotenko*
- *Carsten Bojesen*

We will be available during the conference.

If you interested in this subject then please contact me by mail cbo@et.aau.dk

Going forward

Thank you for your attention!

Questions?

