4DH
4th Generation District Heati[ng]
Technologies and System[s]

MINIMIZATION OF LOSSES IN LOW TEMPERATURE DISTRICT HEATING

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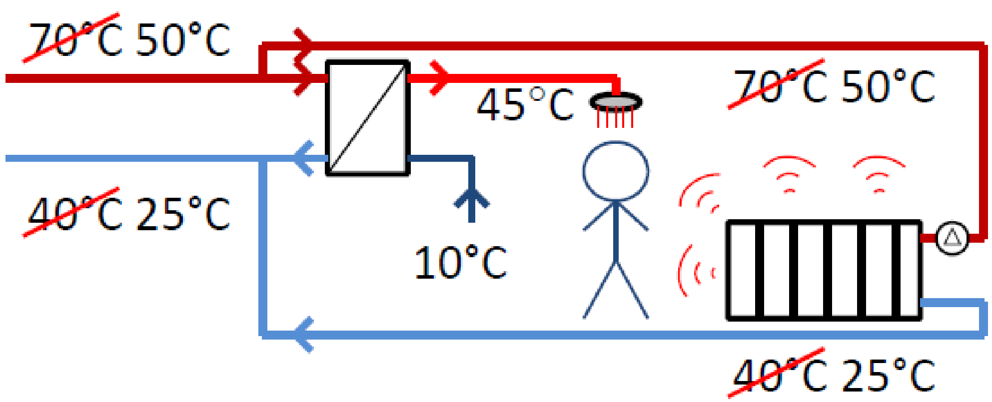
LTDH Concept

Supply temperature in DH has decreased. Categorised as:

- 1 st generation district heating STEAM
- 2 nd generation HIGH TEMPERATURE WATER 120°C
- 3 rd generation MEDIUM TEMPERATURE WATER 80°C
- 4 th generation LOW TEMPERATURE WATER 50 °C



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Objectives

- Development of measures for optimization of the heating system. E.g. drag reducing additives, pulse operation, local temp. boosting by heat pump, new materials of pipes and insulation.
- The creation of a mathematical model based on real case. Investigation of the actual thermal and hydraulic regimes of the heating system.
- Simulation and investigation of the system performance including suggested measures on the basis of created model
- Determination of the energy and economic benefits after the introduction of measures aimed to optimize heat supply system.

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Sub objectives

- Optimization of the operation of the DH supply;
- New materials with lower surface roughness, better insulation and flexibility;
- Local temperature boosting by heat pumps or electric boilers;
- Drag reducing additives which can reduce the pressure losses in the distribution system or alternatively used for increasing the flowrate in systems with low supply temperature for maintaining the same amount of heat.

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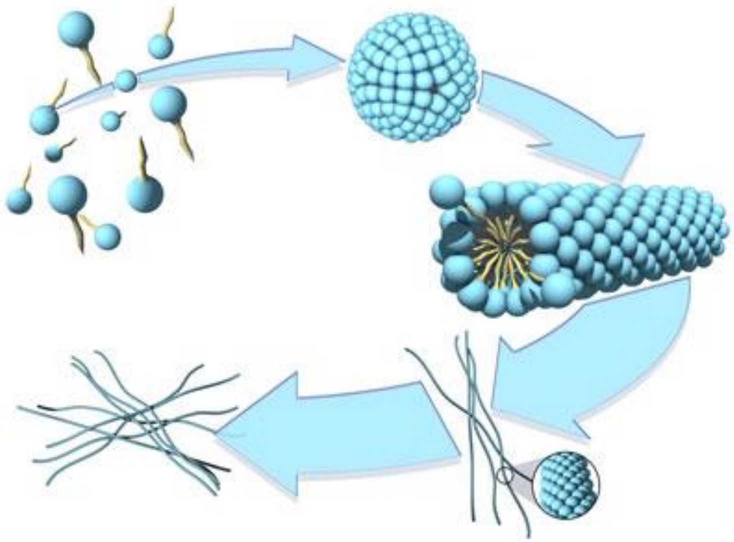
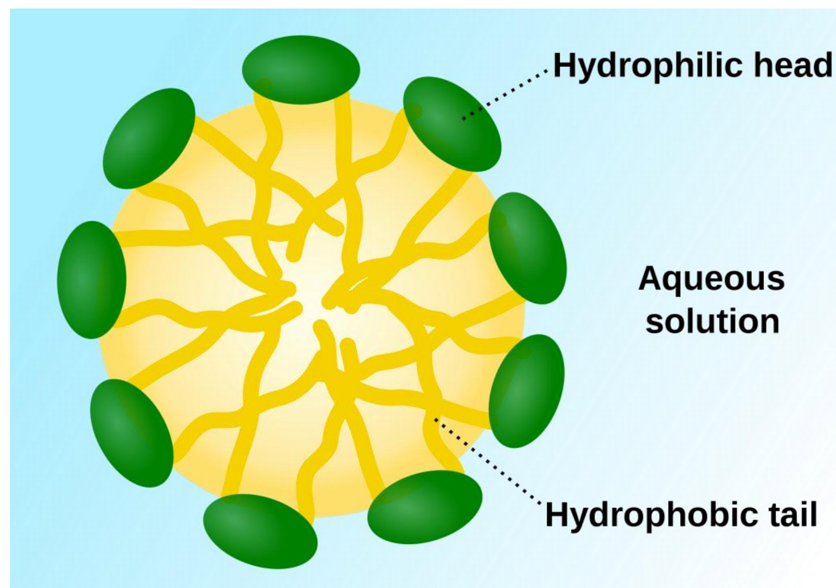
Drag Reducing Additives



Surfactant molecules dispersed in a liquid are called micelles.

- Wormlike micelles
- Spherical micelles



After break can reform in comparison with usual polymers

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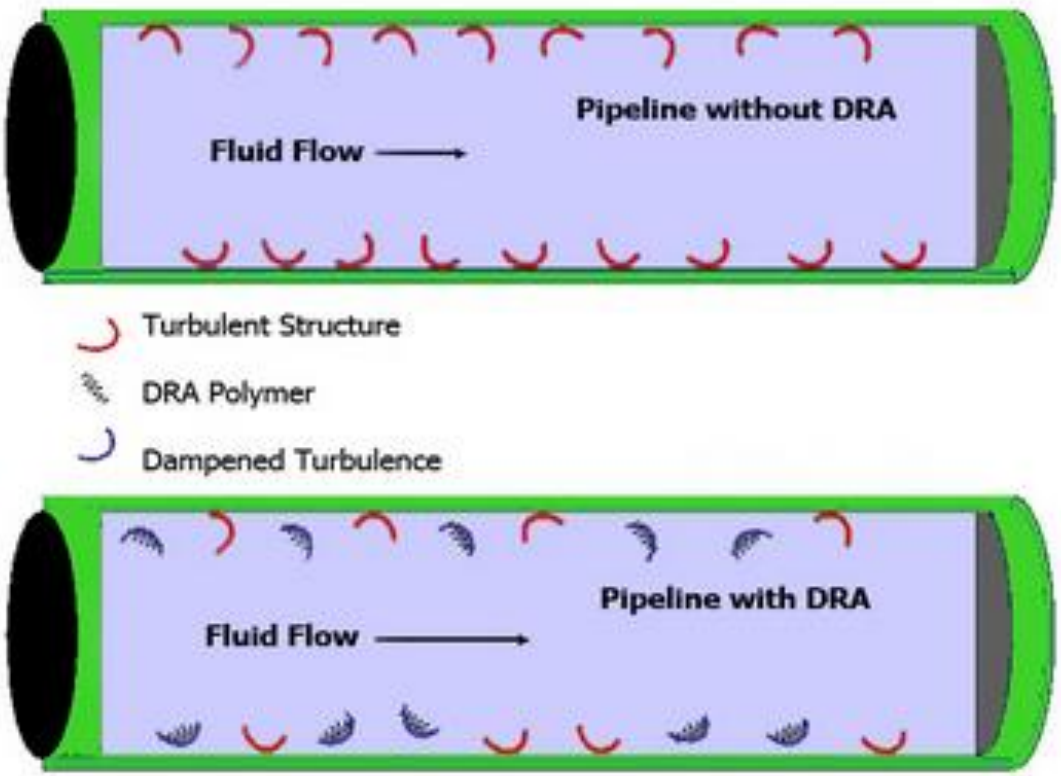
How does DRA work?

This interaction is complex; the long chain molecules dampen turbulent bursts near the pipe wall



Hence due to different obstacles, long chains can be destroyed and DRA will not work so well.

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Reference cases

Object	Operating hours per year	Benefit
Home for the aged (5.5 kW , 2*1.5 kW)	8760	39%
Hotel1 (15 kW)	8000	49%
Hotel2 (11 kW, 7,5 kW)	2000	48%

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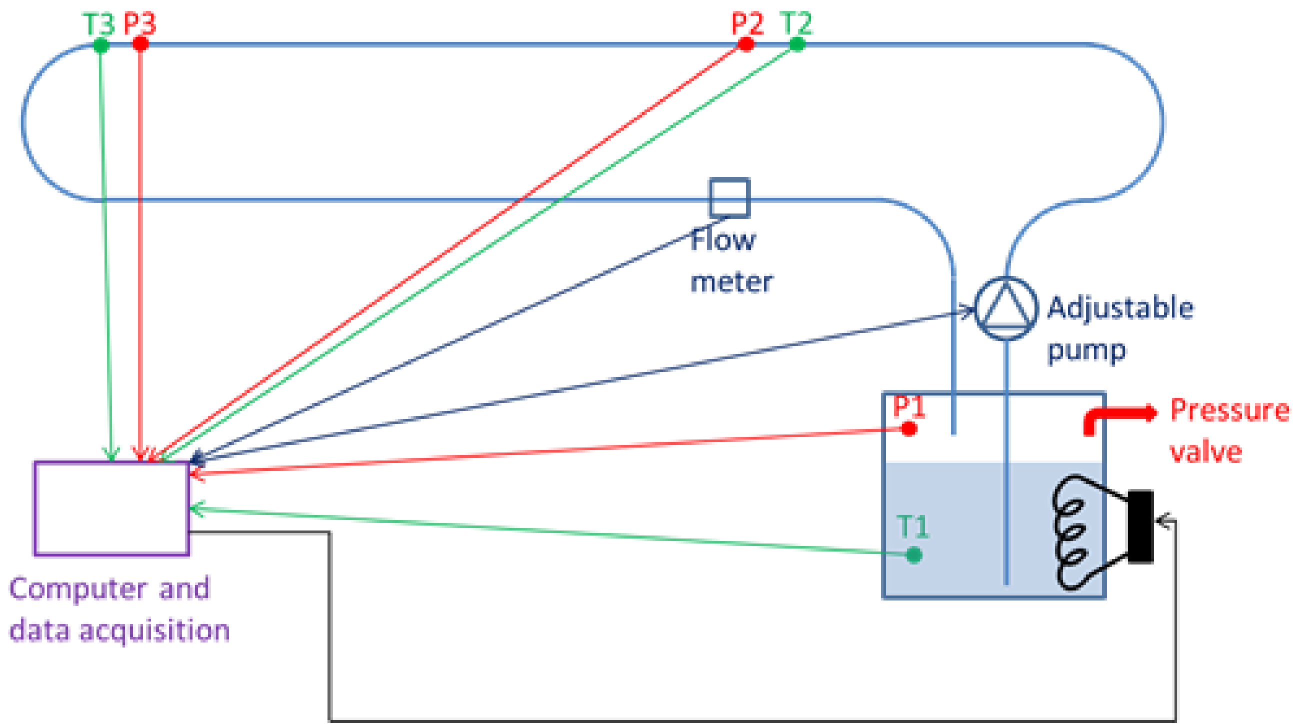
Test rig

Schematic illustration of the test facility at Aarhus University



Partners and schedule of DRA testing

Person	Company
Mogens Hinge	Aarhus University
Kate Wick-Hansen	Dansk Fjernvarme
Flemming Hammer	COWI
Jesper Breuning	Provectas

Duration	Tasks
1^{st}-2^{nd} week	Final setup of the test rig
3^{rd}-11^{th} week	First tests of clean water with diff. temperature and flowrates
12^{th}-24^{th} week	Broad DRA testing
24^{th} week	Status seminar and report
25^{th} week-..	Narrowing down DRA candidates

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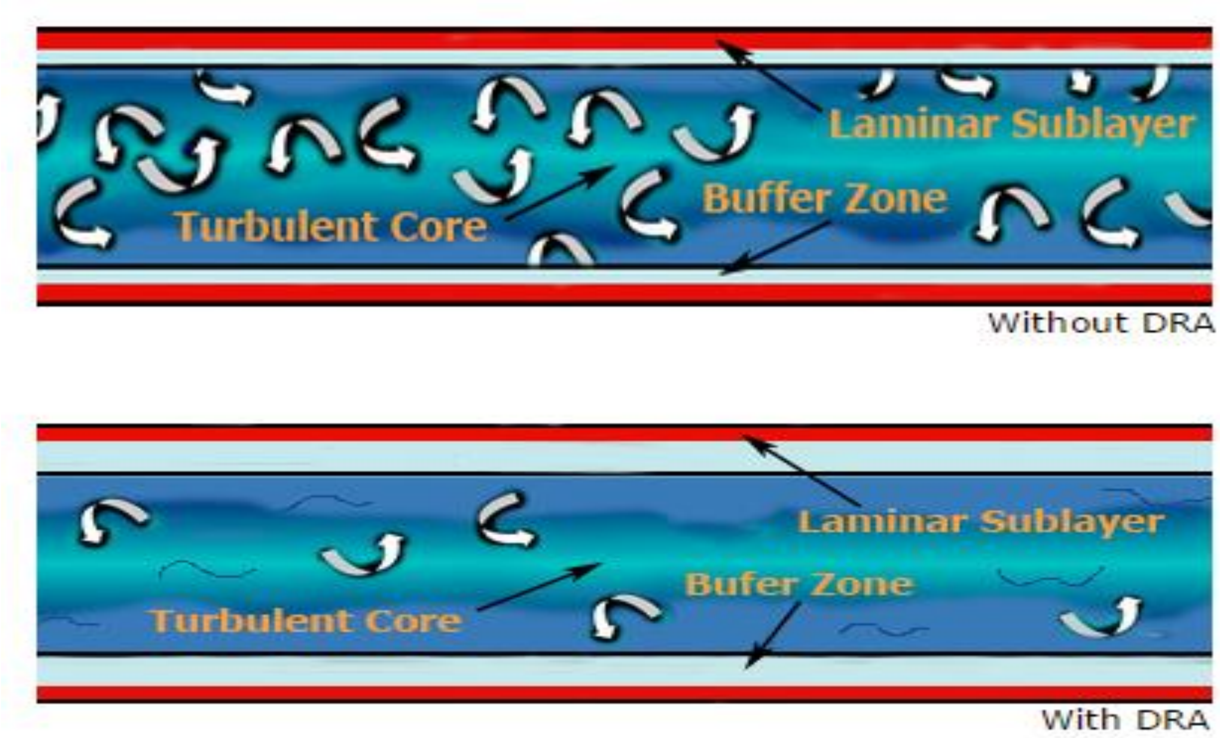
Desirable outcomes of DRA testing

- Up to 80% reduction in pump energy consumption
- Low DRA efficiency reduction in heat exchanger
- Increased flowrate using the same pump energy consumption
- Less turbulent flow will cause less heat losses



Conclusions

- Make 4th gen district heating more easily accessible and financially attractive
- Decrease energy consumption and reduce heat losses of distribution systems from approximately 20% to 10% of the produced heat
- Development of algorithm and procedure for evaluation of energy saving measures.

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