H2020 STORM Project

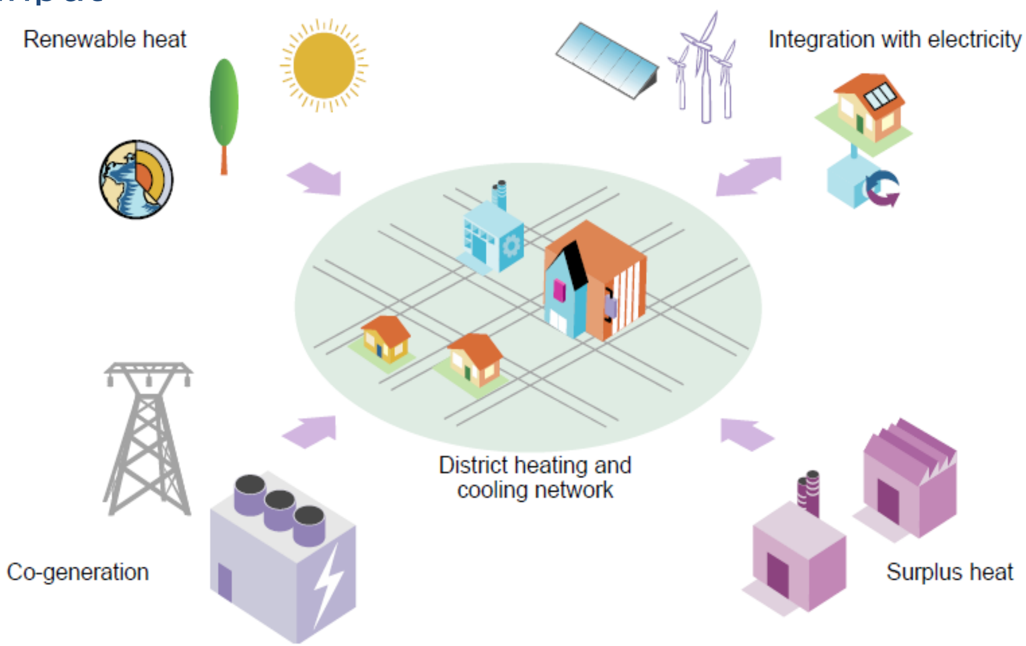
The context: 4th generation DHC

Decarbonising our energy system by making it more efficient & integrating more renewables

4th generation DHC vs. 3rd generation

- Uncontrollable production sources with fluctuating input

→ Need for flexible solutions



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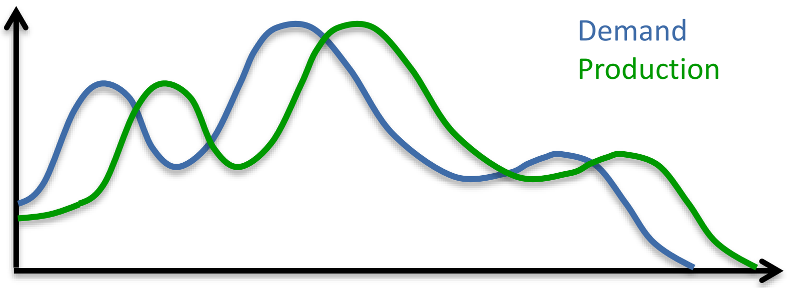
The challenge for 4th generation DHC

- DHC networks are demand driven, not production driven



How to make a network follow these fluctuating production profiles then?

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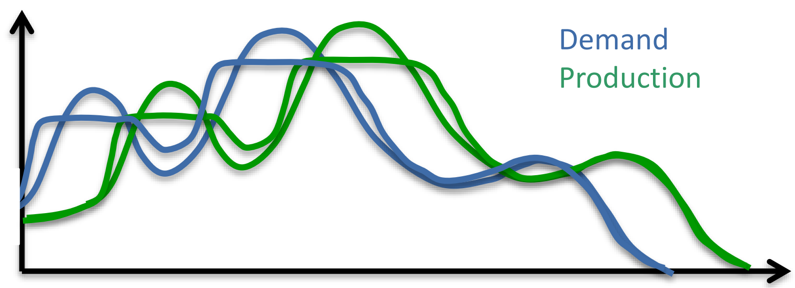
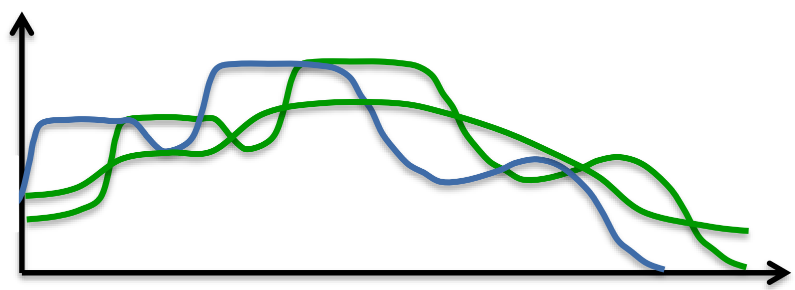
The solution to 4th generation DHC

Solution 1: Influence the demand. Then, production will follow.



Solution 2: Decouple demand and production.



Both solutions can be achieved by a **smart controller** that makes optimal use of the flexibility in the network.

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The solution to 4th generation DHC

'Natural' flexibility in DHC networks

1. Thermal mass of buildings

2. Water in network pipes

'Artificial' flexibility in DHC networks

3. Physical thermal storage buffers

➔ The flexibility is there!

➔ A intelligent network controller can 'activate' this flexibility

➔ the STORM project

The STORM project

STORM = ‘**S**elf-organising **T**hermal **O**perational **R**esource **M**anagement’

- Aim: Develop & demonstrate a generic intelligent DHC network controller based on self-learning optimization techniques

- Start date: 1st of March 2015, 42 months

What are the objectives of the project ?

- To **develop** a **generic** controller for district heating and cooling (DHC) networks
- To **demonstrate** the developed generic controller in two existing DHC networks.

… and to

- quantify the benefits,
- develop innovative business models,
- increase the awareness and
- ensure market-uptake

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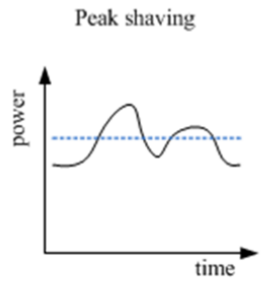
The generic features

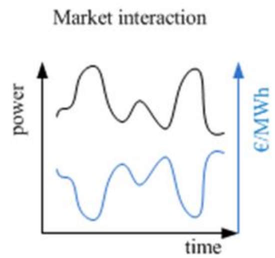
- Generic = able to deal with a wide range of networks

- Guaranteed by a number of features:
  1. Add-on to existing network controllers and SCADA-systems
  2. Open-source communication protocols
  3. Self-learning algorithms to prevent model tuning
  4. Multiple thermal storage concepts
  5. Multiple control strategies
  6. 3rd and 4th generation demonstration sites

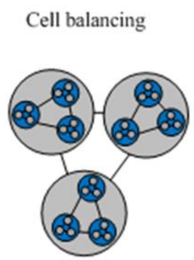
Multiple control strategies



For typical networks with a smaller sustainable energy source (biomass boiler, heat pump) and a larger fossil backup ➔ Elimination of fossil fuel.



For networks coupled to the electric grid by heat pumps/CHPs ➔ Switching the devices at interesting power price.



For more sophisticated networks: balance supply and demand of heat/cold in a cluster ➔ increased efficiency.

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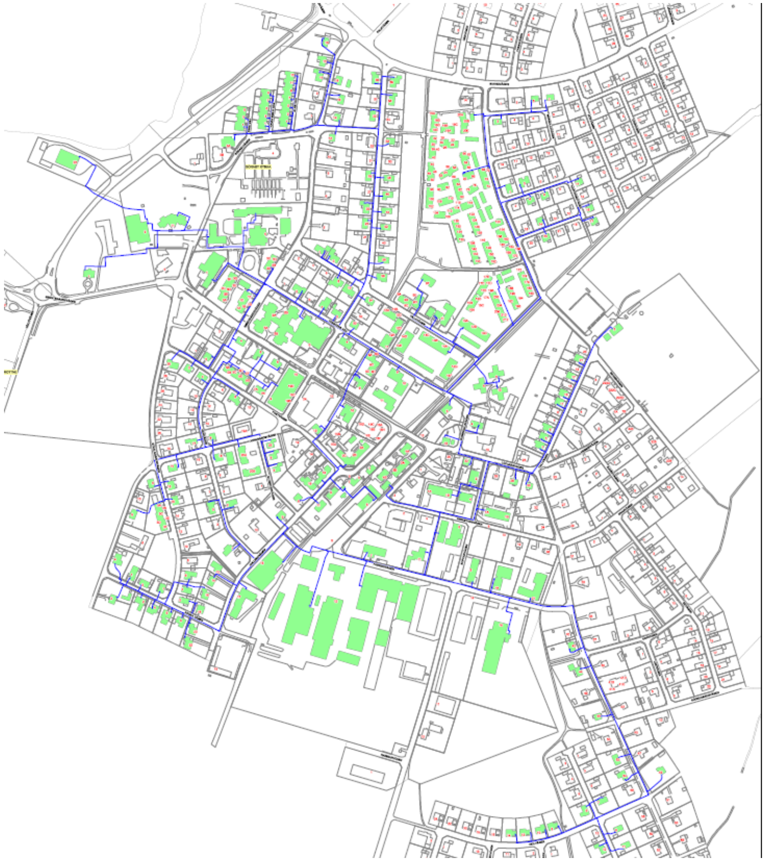
The demonstration sites

Rottne, Växjö, Sweden

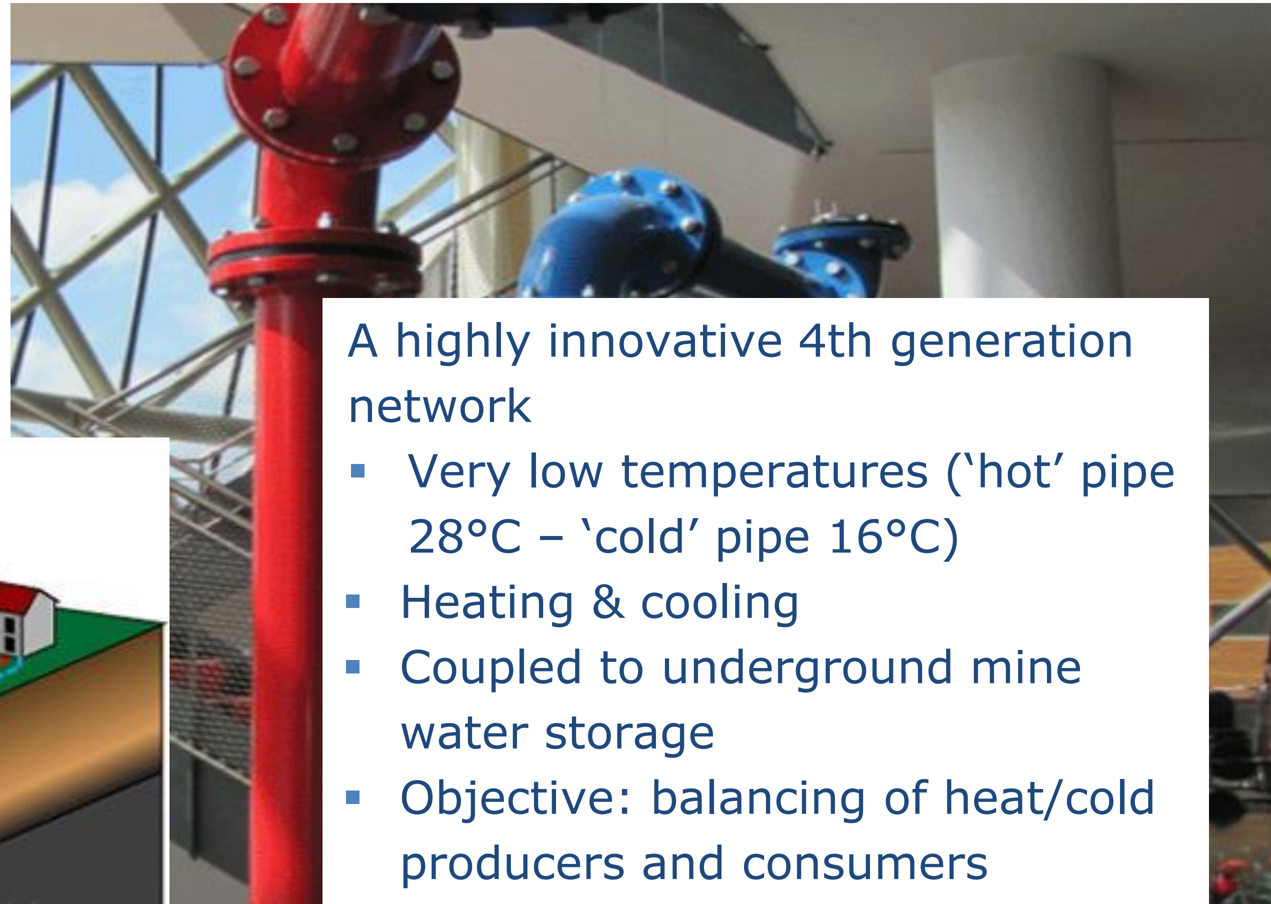


A very typical 3rd generation network

- 175 consumers
- 2 wood chips boiler (1.5 MW + 1.2 MW) + bio fuel boiler (3MW) (backup)
- Design temperature 90-60°C
- Objective: eliminate the operation of the expensive peak fuel boiler

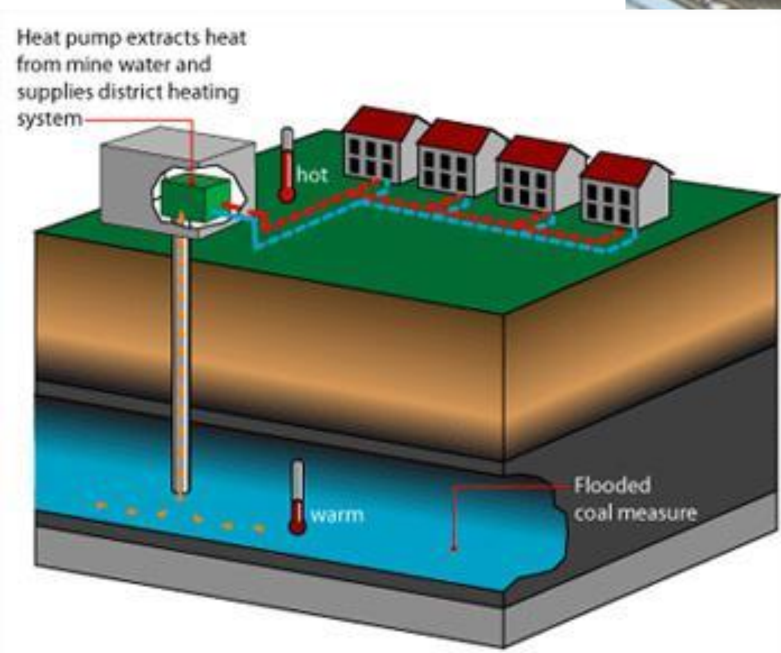
The demonstration sites

Heerlen,
the Netherlands



A highly innovative 4th generation network

- Very low temperatures (‘hot’ pipe 28°C – ‘cold’ pipe 16°C)
- Heating & cooling
- Coupled to underground mine water storage
- Objective: balancing of heat/cold producers and consumers



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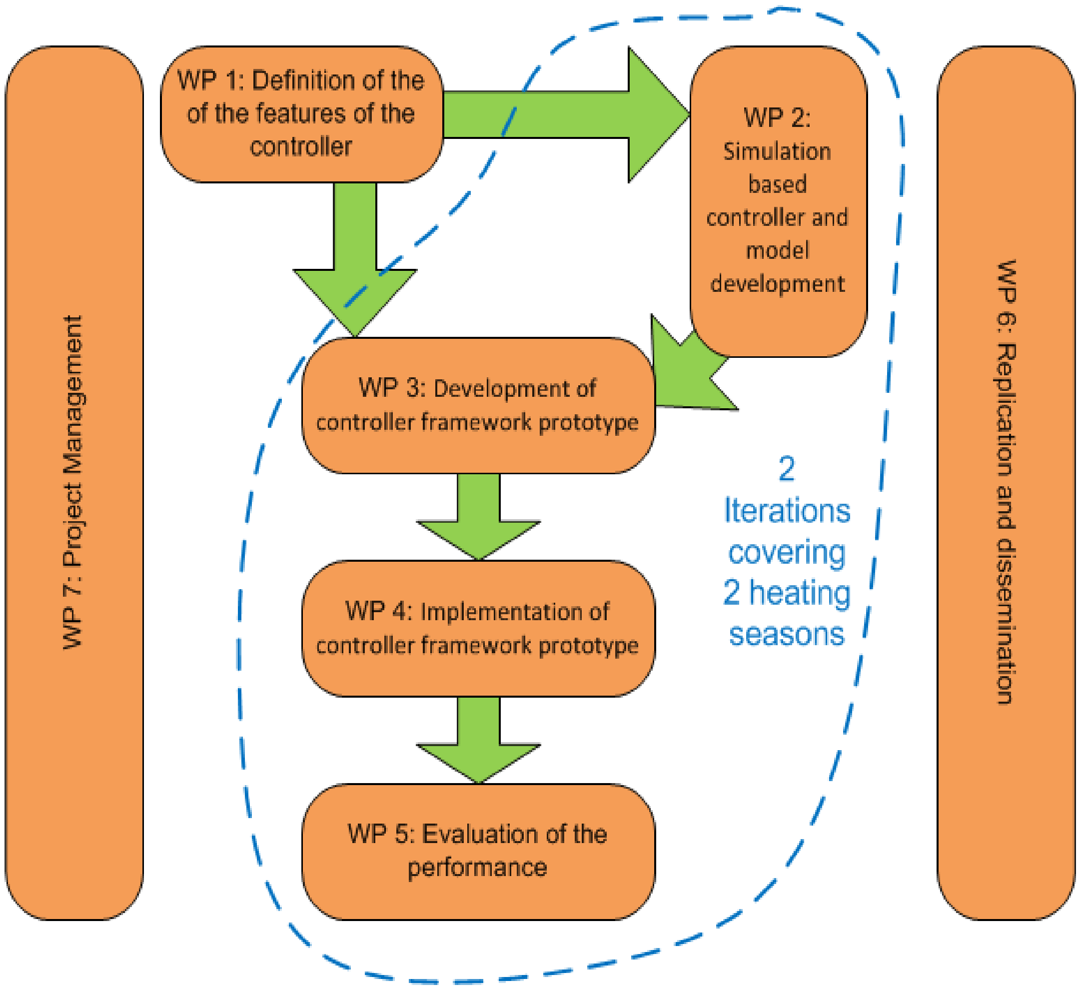
Work packages



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Implementation of the controller algorithm

3 modules

Forecaster

“What will be the energy consumption of the network for the next 24h?” – i.e. reference consumption

Planner

“Given the control objectives (peak shaving/elec. market interaction/cell balancing), which optimal cluster consumption profile can be achieved, taking into account this forecast?”

Dispatcher-Tracker

“Which individual control signals are necessary to follow/track the optimal consumption profile?”

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Status

Almost halfway!

January to March 2016: Algorithms developed, implemented & tested in Rottne

This month, October 2016: start implementation in Heerlen network

THANK YOU!

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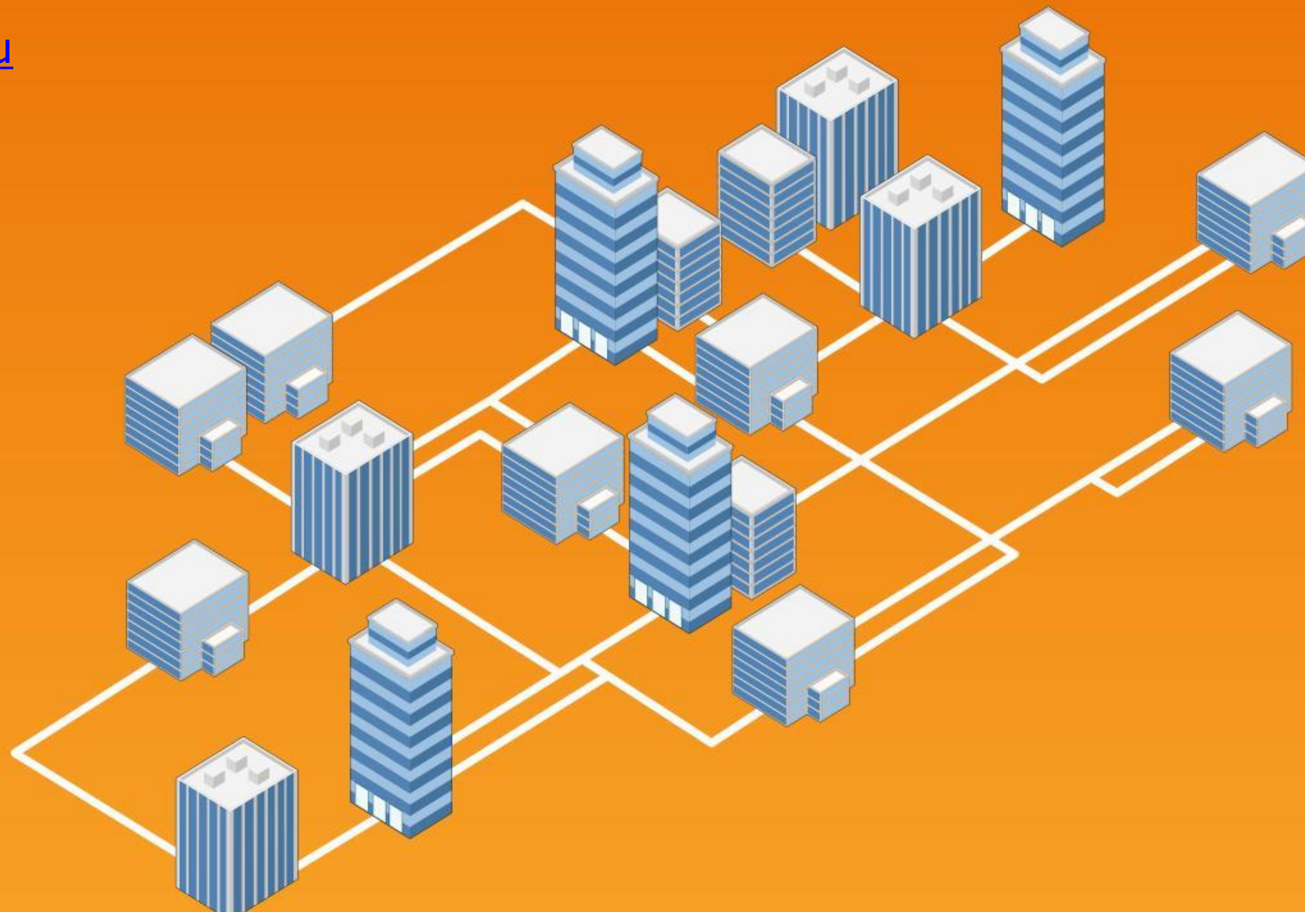

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