

› **INTEGRATED PLANNING, DESIGN
AND OPERATION OF 4TH
GENERATION DISTRICT HEATING
AND COOLING NETWORKS**

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CONTEXT: BIG PICTURE

- › Heating/cooling accounts for 46% of all consumed energy in Europe, 85% is powered by fossil fuels.
- › Every day, > 1.0 G€ of fossil fuels are imported into Europe (from Russia, Middle East)
- › Every day, > 1.3 G€ of thermal energy is discarded as an unused by-product of electricity generation
- › Theoretically, there is plenty of waste- and natural heat for all heat demand.

- › District heating/cooling networks (DHCN) connects thermal production and consumption
- › Efficiently exploiting waste- and natural heat with 4th generation DHCN:
 - › Coordination of multiple, decentralized, possibly uncontrollable thermal sources (e.g. solar thermal)
 - › Integration of low temperature heat sources (e.g. waste heat)
 - › Efficient distribution
 - › Interaction with other energy infrastructures (e.g. electricity, gas), both direct (conversion technology) and indirect (coupled markets)

CONTEXT: MARKET

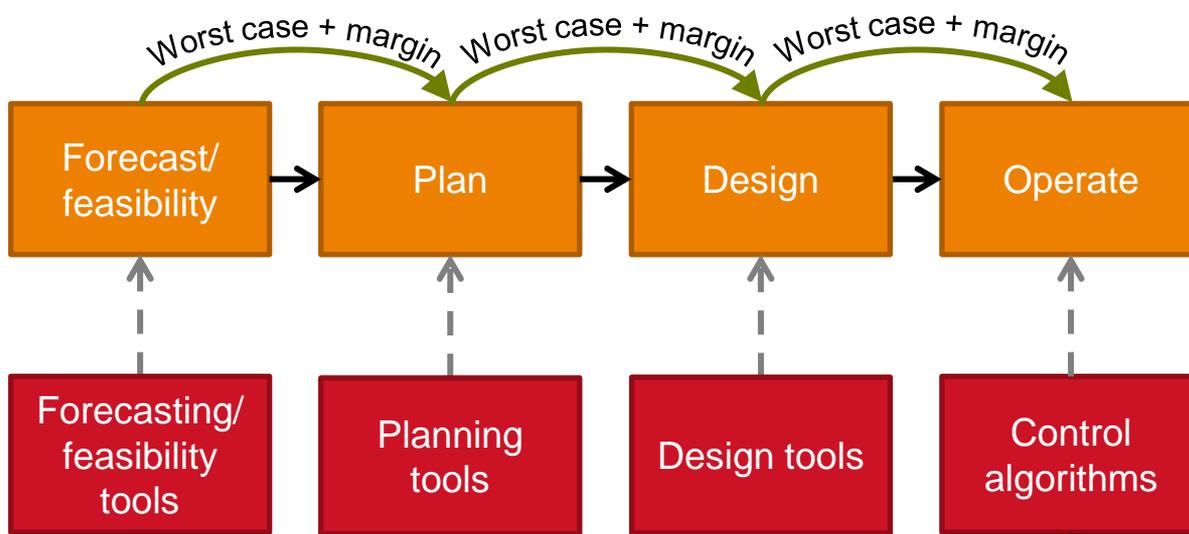
- › Profitability of conventional DHCN under pressure, future uncertain:
 - › DHCN requires large investments
 - › Volatile/rising prices of fossil fuels/CO₂ emissions
 - › Volatile/rising prices of biomass
 - › Volatile/falling revenues of CHP: thermal must-runs during times of low electricity prices
 - › Scarcity of high temperature waste heat industry that is willing to sign decade-long contracts
 - › Falling space heating demand due to building refurbishments

4th generation DHCN addresses most/all these points, however:

How to properly plan/design such a 4th generation network?

Conventional DHCN development (static)

From big picture to operational details based on peak load



- › Design based on worst case peak loads, with additional margins
- › Different software tools (and parties) per phase
- › Tools aimed at conventional DHCN

Over-dimensioning increases CAPEX and OPEX

The key of 4th generation DHCN:
Smart controllers

Game changer

P•WERMATCHER
smartgrid technology

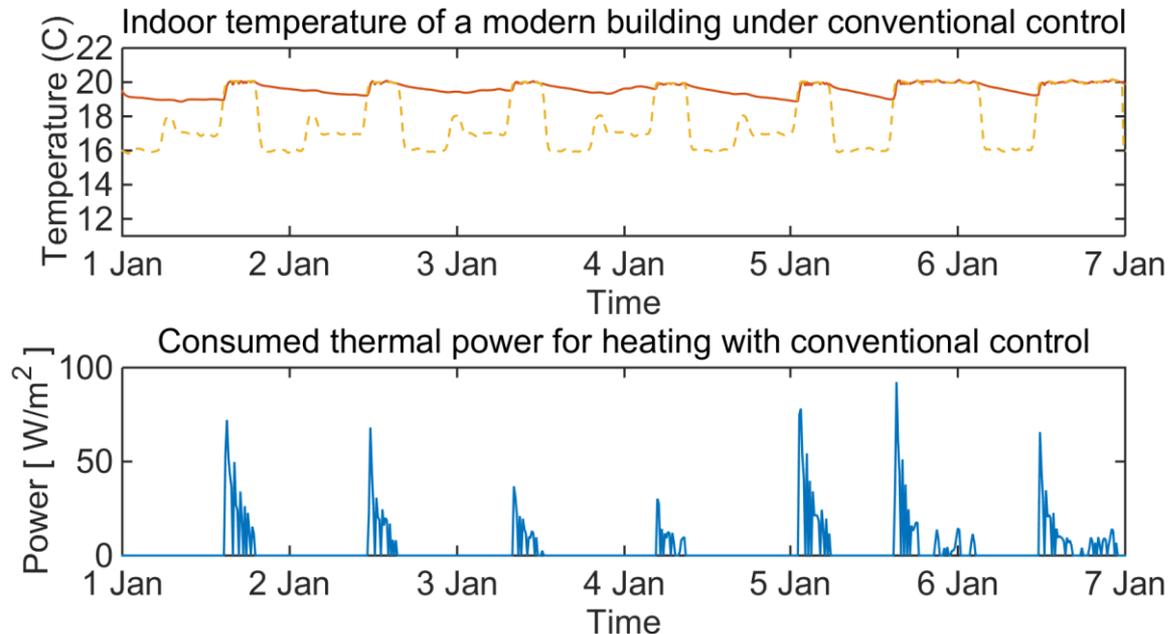
MULTI
COMMODITY MATCHER

HeatMatcher

Smart control with cascading benefits: game changer

System-wide optimization (smart control): coordination of sources, storage and consumers

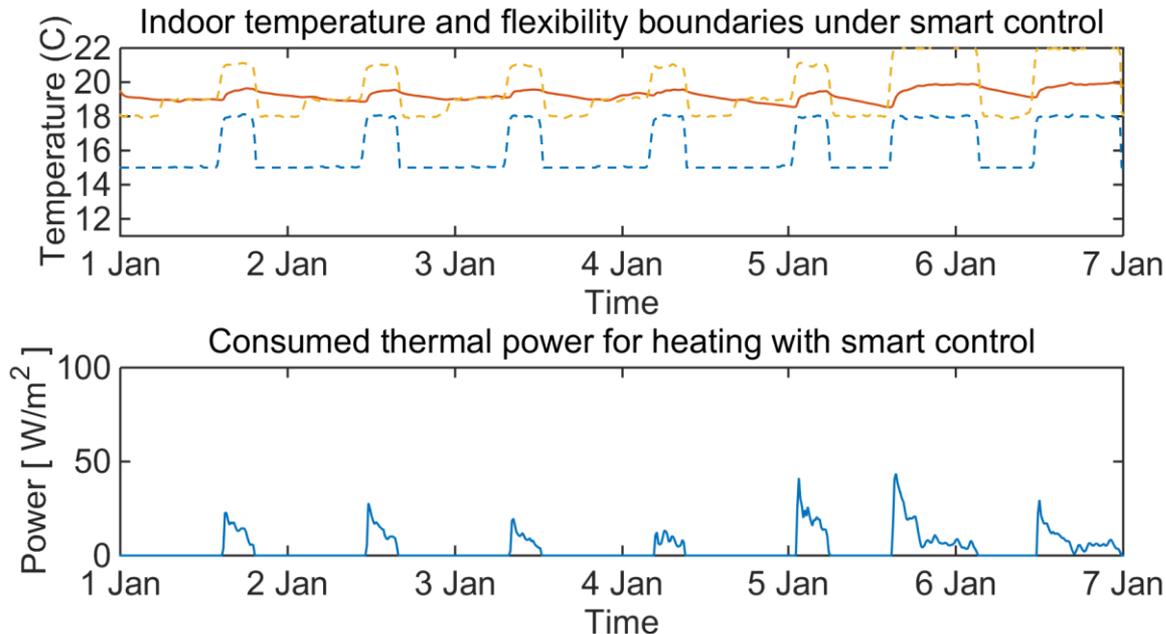
- › Example: peak shaving by demand management in a new district with modern houses



Smart control with cascading benefits: game changer

System-wide optimization (smart control): coordination of sources, storage and consumers

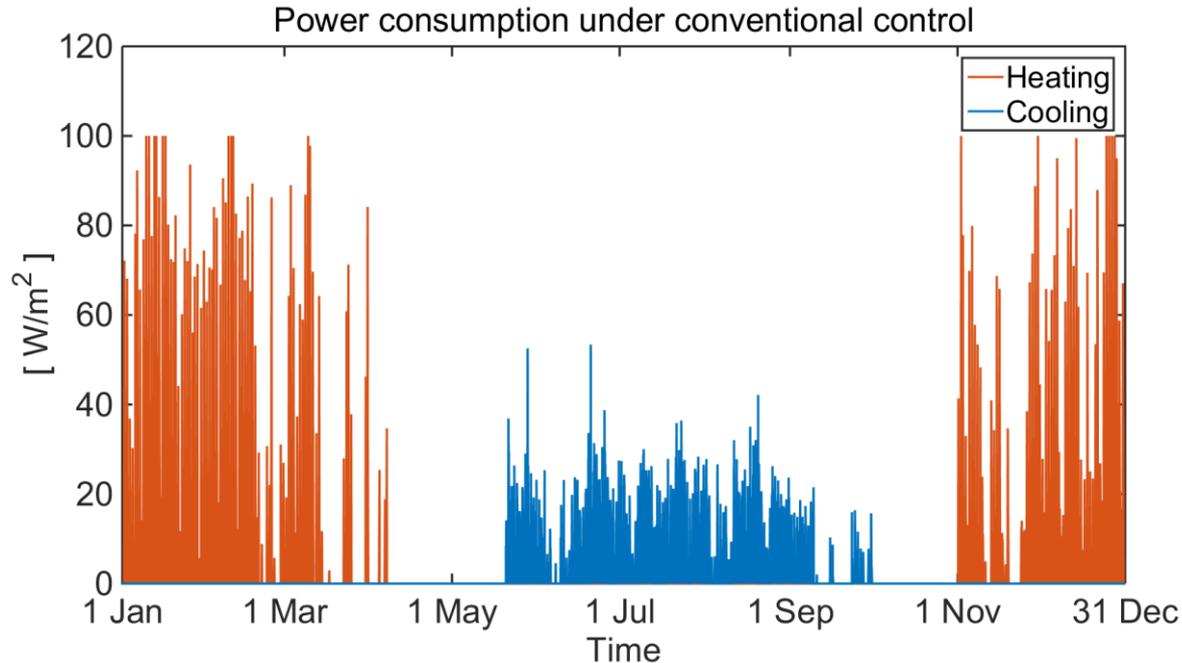
- › Example: peak shaving by demand management in a new district with modern houses



Smart control with cascading benefits: game changer

System-wide optimization (smart control): coordination of sources, storage and consumers

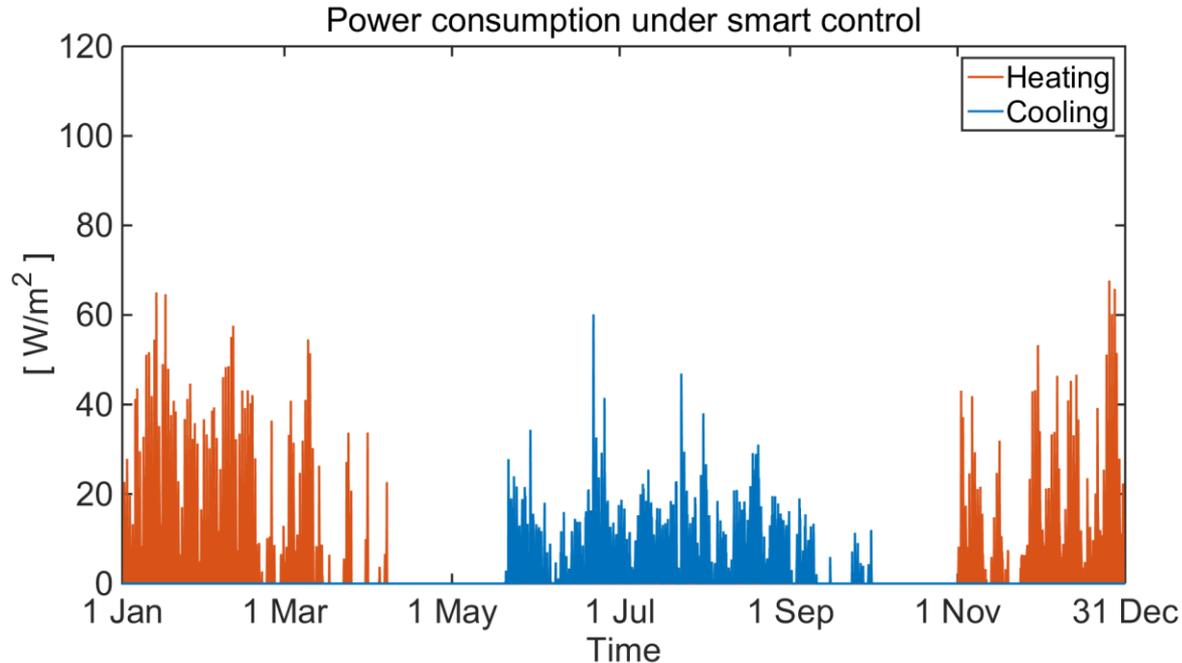
- › Example: peak shaving by demand management in a new district with modern houses



Smart control with cascading benefits: game changer

System-wide optimization (smart control): coordination of sources, storage and consumers

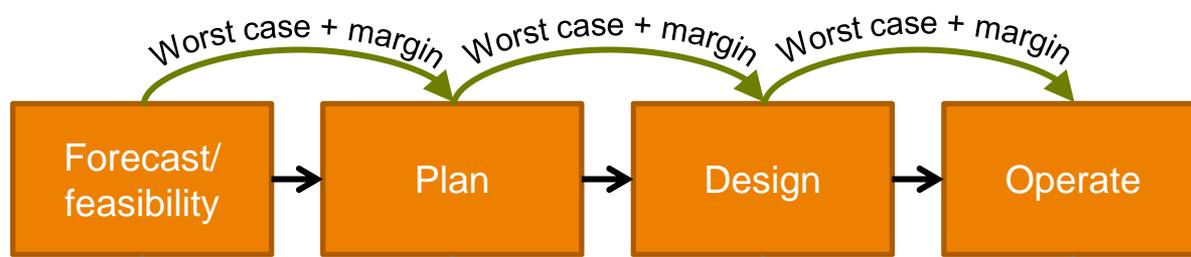
- › Example: peak shaving by demand management in a new district with modern houses



33% peak shaving

Conventional DHCN development (static)

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Over-dimensioning increases CAPEX and OPEX



4th Generation DHCN development (dynamic)

Smart thermal operation influences forecasting, planning and design

- › Smart control enables system-wide optimization, which is leveraged into efficient design
- › Holistic approach over all network time scales, from minutes (operation) to decades (investment)

Lean, dynamic networks with lower CAPEX and OPEX

TNO CHESS

› Controlled Hybrid Energy Systems Simulator (CHESS), based on FP7 E-Hub project



H2020 PROPOSAL **SODA4HEAT** (*PENDING*)

Smart **O**ptimization and **D**esign **plA**tform for **4th** generation district **h**eating and cooling networks

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VISION BUSINESS
CONSULTANTS



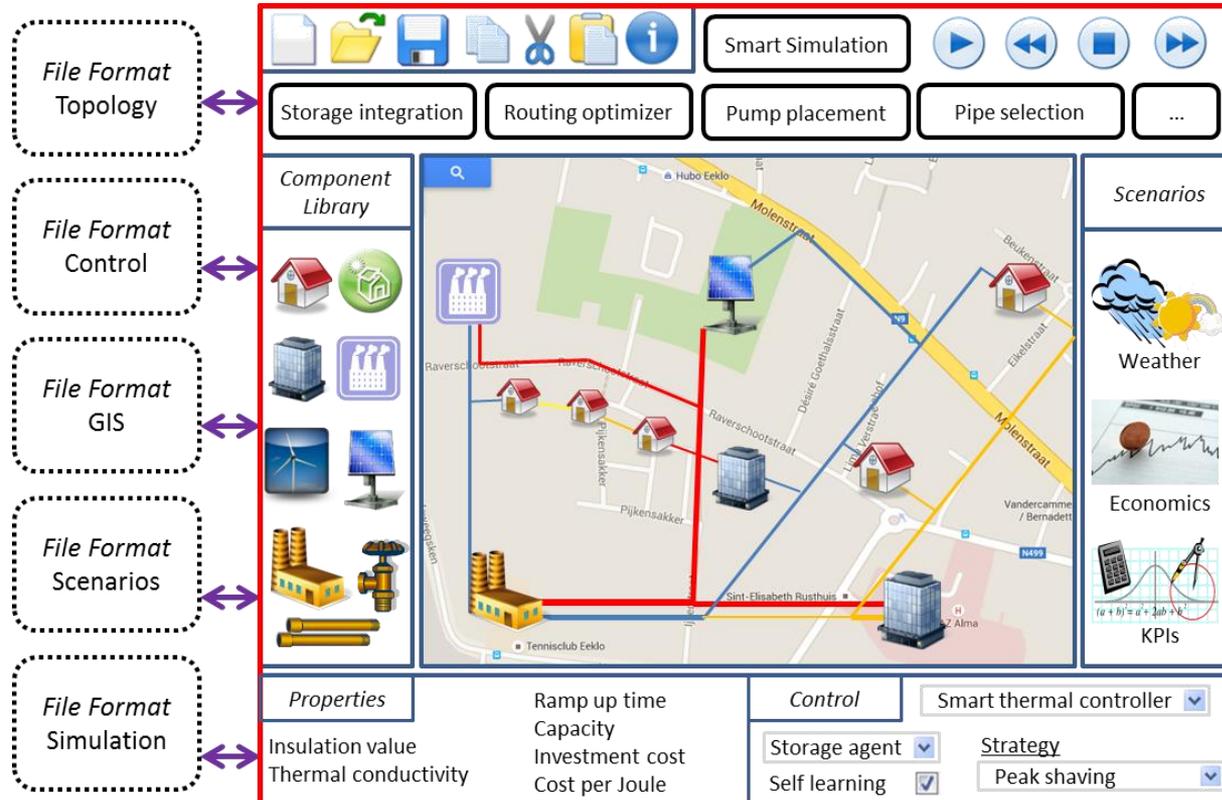
Refurbishment of
Warsaw's 2nd
generation network

Extension of Gamlitz-
Ehrenhausen-Retznei
3rd generation network



Greenfield design
of 4th generation
network in Eeklo

H2020 PROPOSAL SODA4HEAT (PENDING)



Results

1. Software platform
Open source
2. Smart simulation module
Compiled free
3. Design optimization modules
Compiled licensed

Join us!

- Stakeholders group (advisory role, software demo's, etc.)
- Open source community
- Cooperation

› **THANK YOU FOR YOUR
ATTENTION**

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