Selection of design scenarios for an industrial waste heat based micro-district heating network supplying low-energy buildings

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CITYOPT Project

• Holistic simulation and optimization of energy systems in Smart Cities.
• EU FP7 funded R&D project
• 7 partners
• Total budget 3,8 million €
• Feb 2014 – Feb 2017
Case study: possible micro-DHN in Vienna

- **Aim:** to integrate the existing thermal energy supply systems of the buildings and the waste heat of the cooling system of the RTA’s climatic wind tunnel in a thermal network:
  - use of the waste heat to cover the office buildings’ heating demand
  - Reduce the costs to cool the climatic wind tunnel
Case study: possible micro-DHN in Vienna

TechBase
Gas Boilers

EnergyBase
Heat pumps
Solar panels

FutureBase
Storage tank

Waste heat from cooling systems

Ground storage
Case study: Challenges

• Integration of:
  – Fluctuating heat sources, prosumers
  – Storages (long term & short term)
  – Different heat demand & profiles: low temperature & standard buildings
  – Different temperature levels

• Need of:
  – New system design
  – New control strategies
  – New business models

⇒ Case that can be scaled up or adapted to other cases of refurbishment/extensions (if waste heat is available)
Challenge: different supply profiles

RTA waste heat available, 2013 - 2014
Challenge: different supply profiles
Reference scenario: individual heating (current status)

Add. Building and FutureBase are low-Energy building with heat pump

RTA chiller

Vienna DHN
Scenario 1: micro DHN

FutureBase: No heat production system

RTA chiller

Short term Storage Tank

Additionnal Building

EnergyBase

FutureBase

TechBase

Vienna DHN
Scenario 2: extended micro DHN

Add. Building, FutureBase: No heat production system

RTA chiller

Short term Storage Tank

Additionnal Building

EnergyBase

FutureBase

TechBase

Vienna DHN
Assumptions/control strategy

- The control system tries to maintain the supply temperature of EnergyBase in the micro DH (same as add. building and FutureBase)
- TechBase boiler used to heat up the temperature for TechBase and as a back-up for the other buildings
- Priority order of heat sources used:
  1. Waste heat
  2. Vienna DH network
  3. Own production sources (Solar, HP, gas boiler)
Simulation methodology

Web browser
User interface

CITYOPT

Operational tool
Planning tool

Web server

APROS

Simulation tool

Optimization

Models, default values

Database
Preliminary results: Energy balance

Worst case scenario with 2014 waste heat data
Preliminary results

Total values

- **PE (MWh)**: REF SC > SC1 > SC2
- **CO2 (tons)**: REF SC = SC1 > SC2
- **Costs (k€)**: REF SC < SC1 < SC2

Operational
Conclusions

• Waste heat use:
  – More simulations are needed to evaluate the micro-dh over the years
  – Combination of several heat sources (fossil and renewable) can be more interesting than a major waste heat source

• Future work:
  – Ground storage integrated in the model
  – Hydraulic & controls optimization
  – Further economic evaluation (e.g. invest. costs)
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Smart Energy Systems and 4th Generation District Heating