progRESsHEAT

Comparing different district heating supply scenarios with energy savings and individual supply options in six European municipalities

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Outline

- progRESsHEAT project
- Least Cost Tool
- Case presentations and preliminary results
- Conclusions
- Key success factors

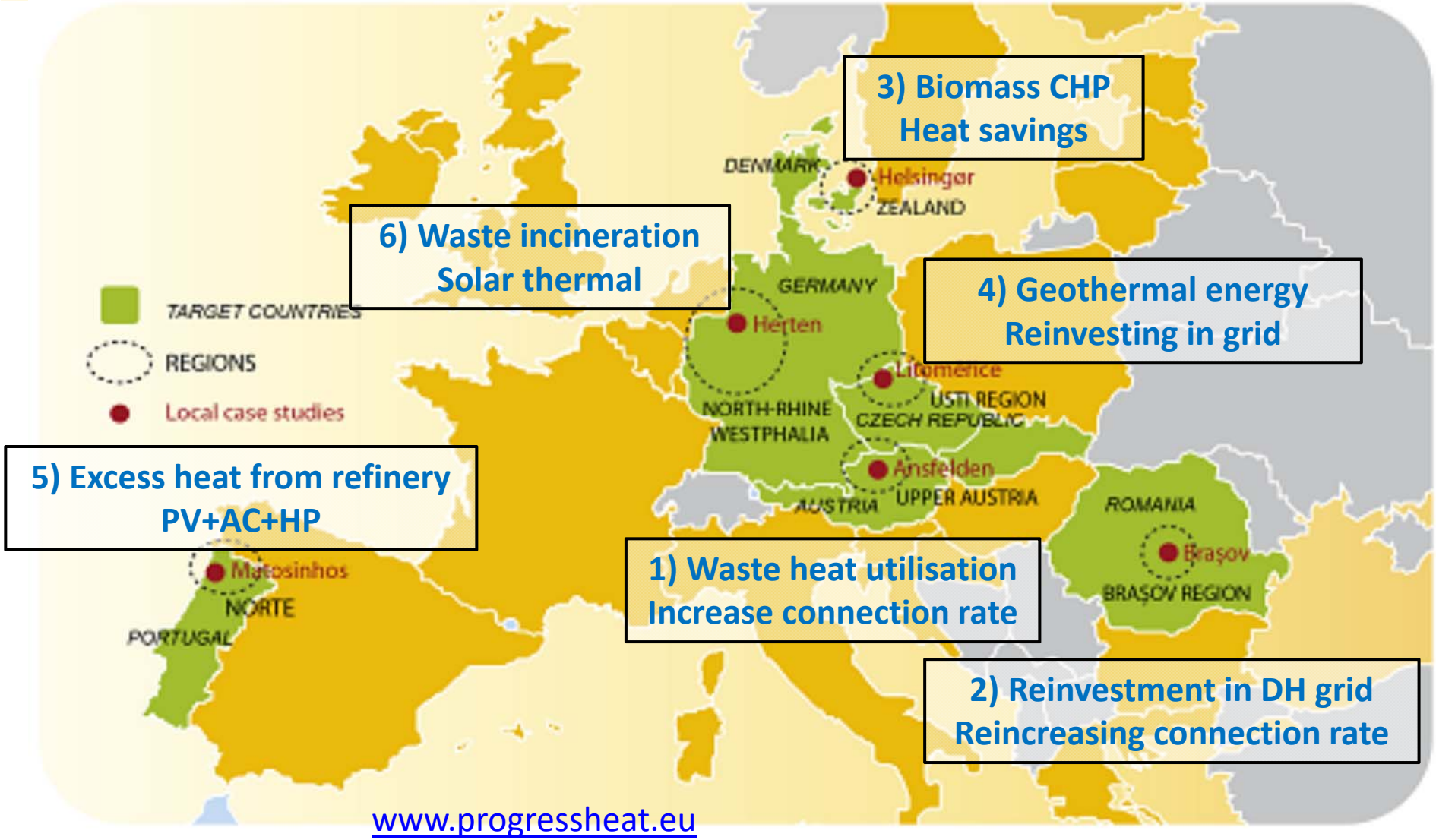
progRESsHEAT

Core objective

Support **policy makers** and **public authorities** at **local, regional and national level** in the development and implementation of **integrated strategies** and **policies** to enforce the use of **renewable and efficient heating and cooling solutions** in their regions

- **6 Countries:** Denmark, Germany, Czech Republic, Austria, Portugal and Romania
- **3 Geographical levels:** National, regional and municipal
- **Project duration**: March 2015 – October 2017
- **Project partners**: Scientific partners, Communication partners, Local partners

Local cases



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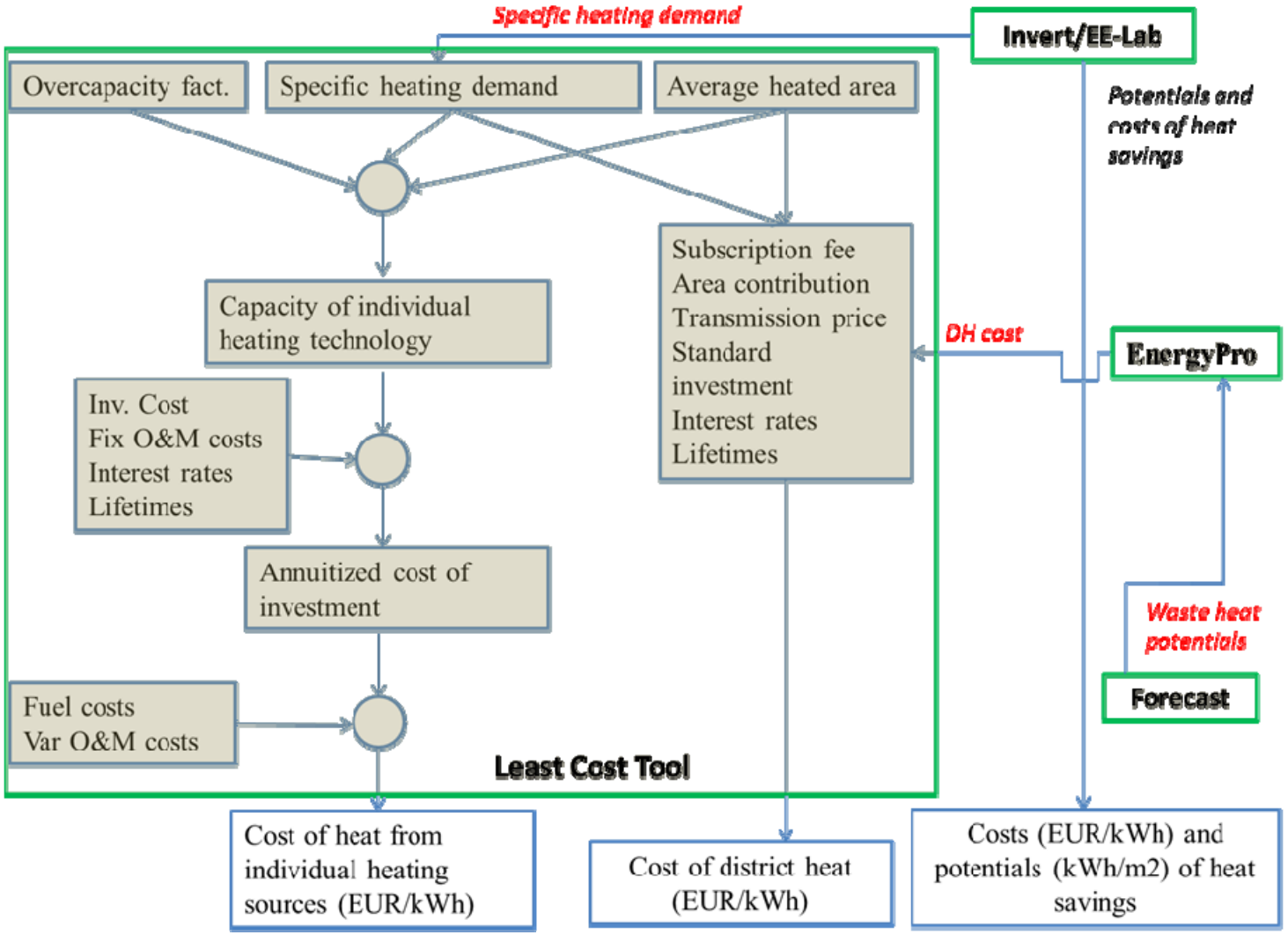
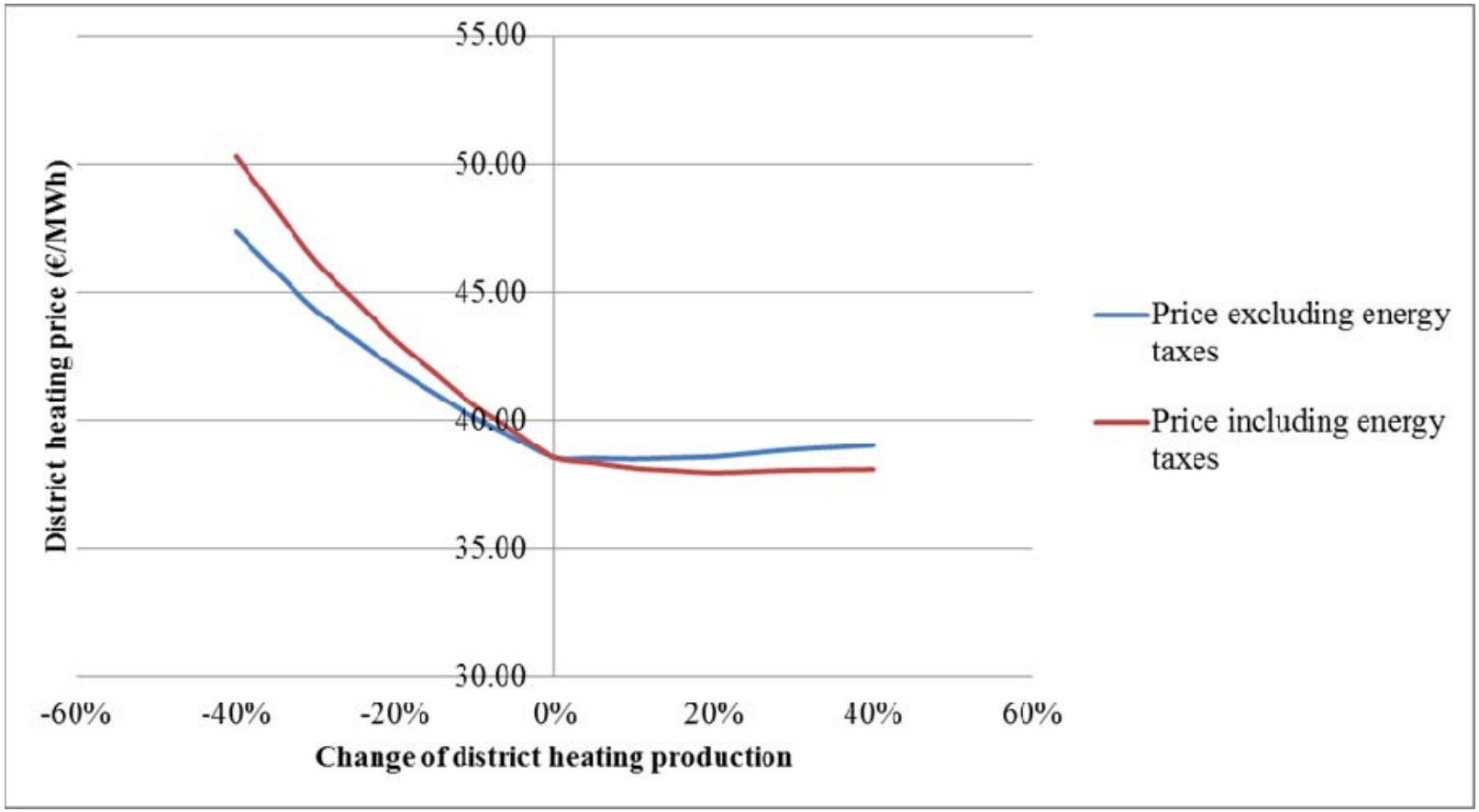
Least Cost Tool – part 1

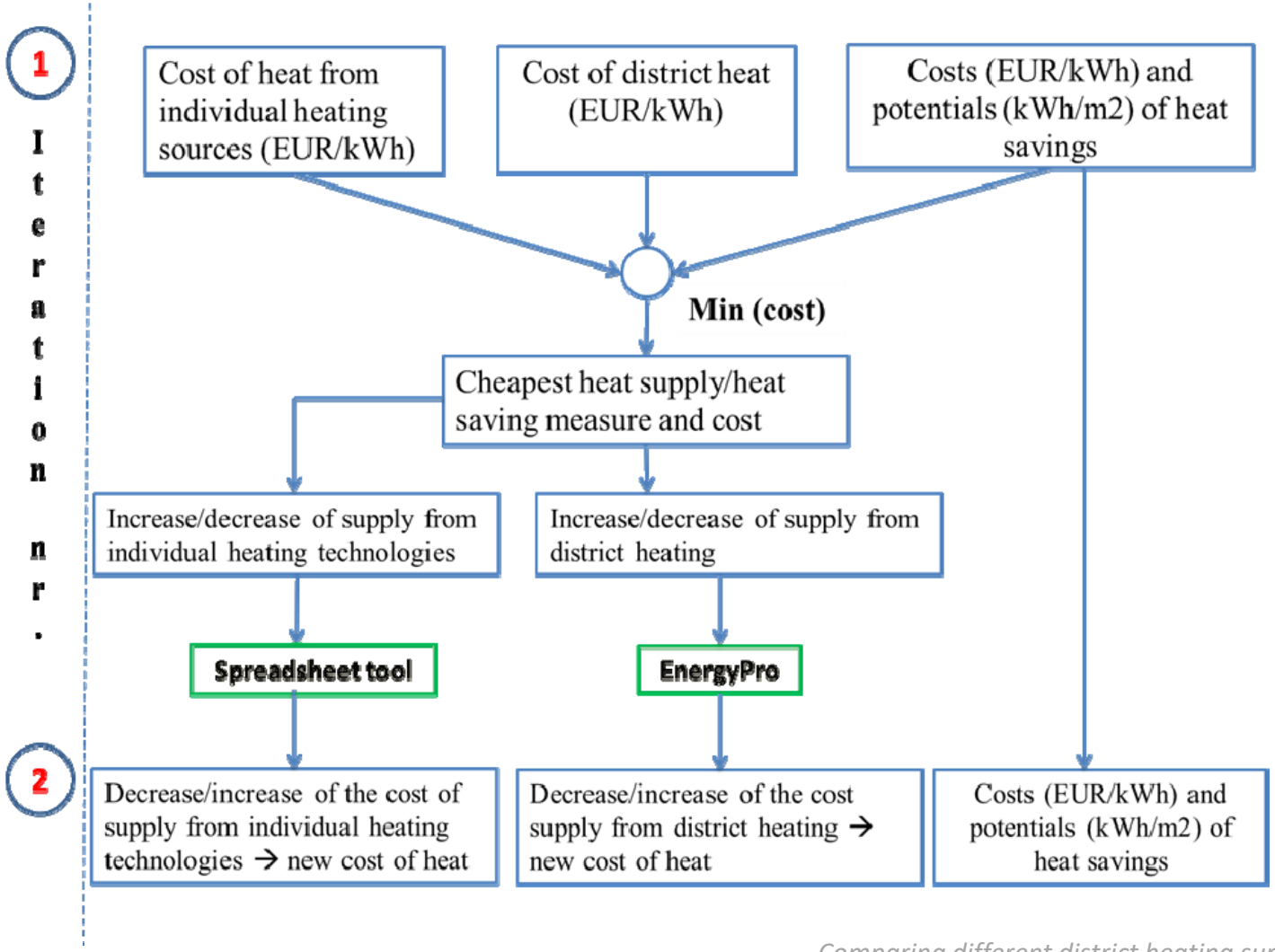


Least Cost Tool – input from EnergyPro



Comparing different district heating supply scenarios

Least Cost Tool – part 2

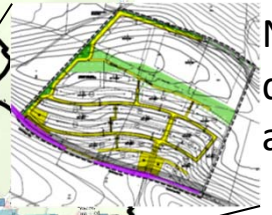


Comparing different district heating supply scenarios

Case Ansfelden

Current biomass district heating network

New development area



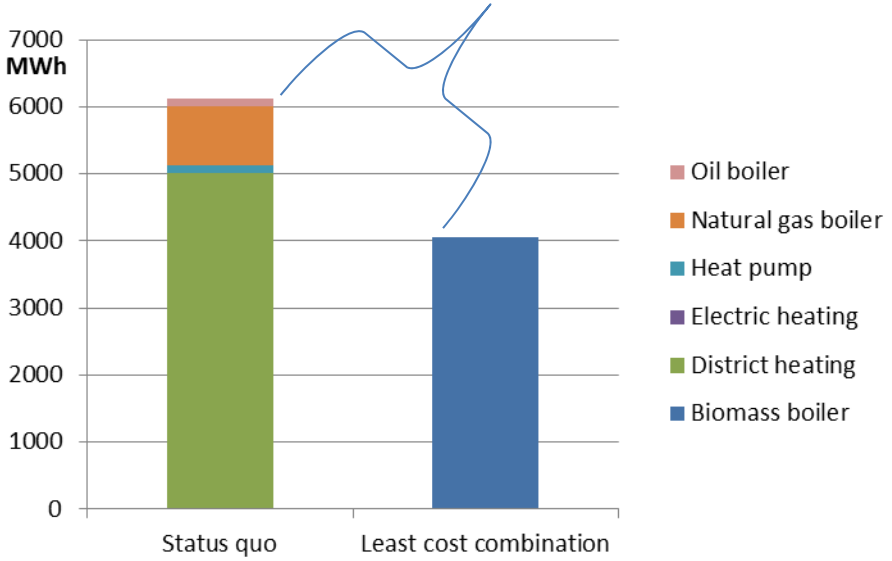
Industrial site with waste-heat potential

Case Ansfelden - Feasible initiatives

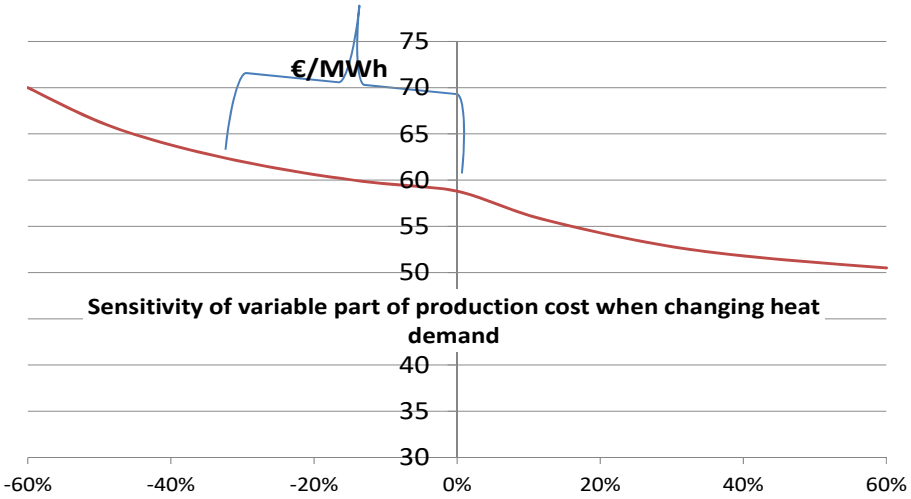
Decreasing heat demand may lead to increasing heat prices for DH:

- Example: old (1945-1980), small (around 500m²) multi-family-houses

1. Heat saving is cheapest option: -34% in demand



2. DH supply costs (variable and fixed costs) increase by 22%



3. Heat supply cost from individual biomass boilers stays constant

4. Cheapest combination: heat savings and individual biomass boilers

Additional analyses to be carried out including other heat generation options and settings

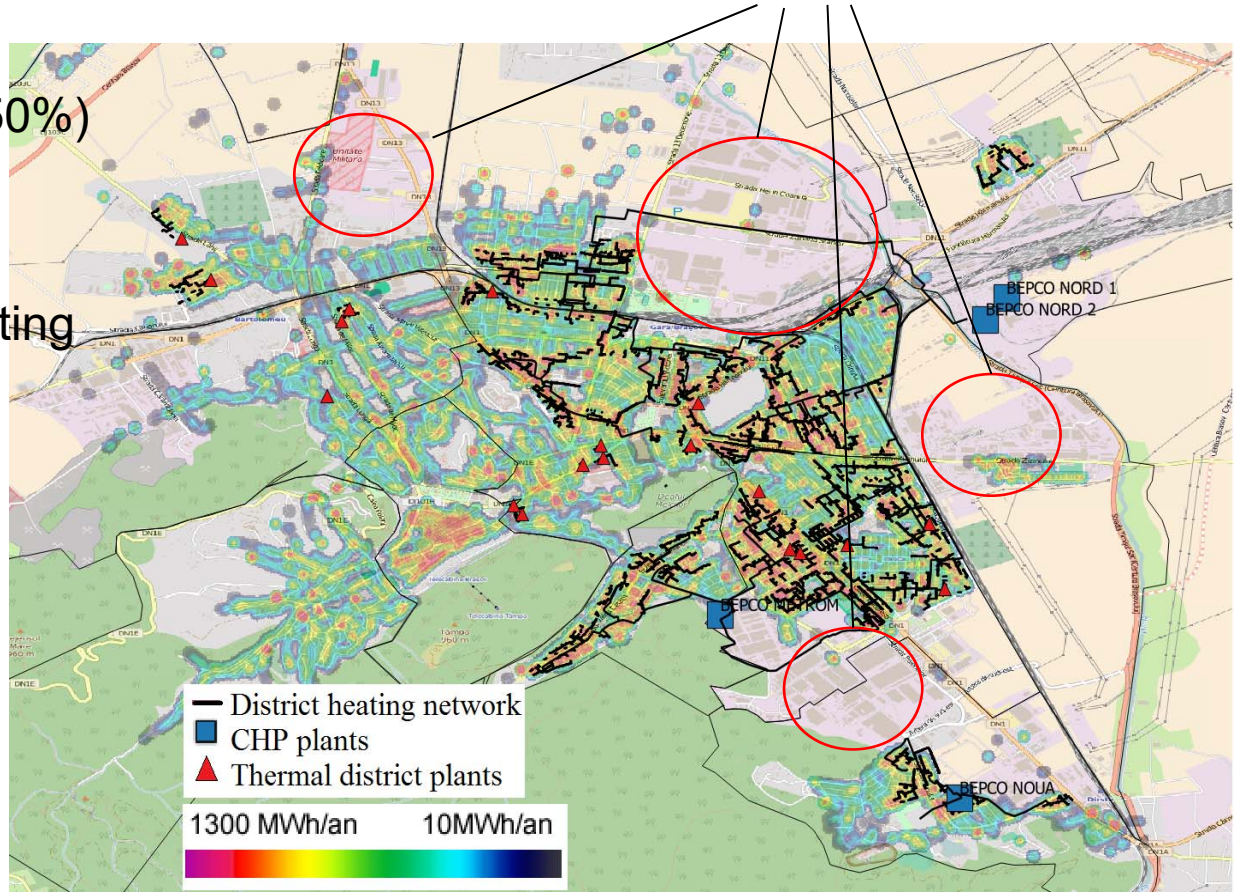
Case Ansfelden - Key success factor

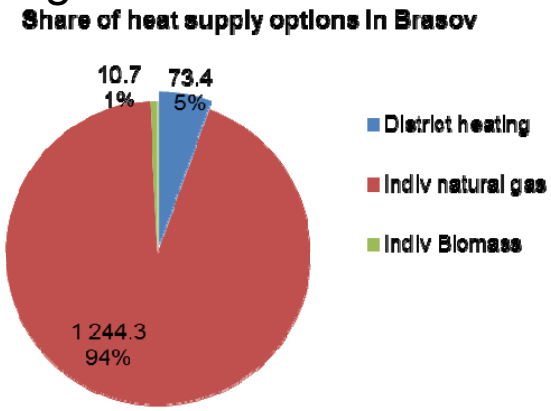
- Solution: waste heat utilisation?
  - Interest from paper industry?
  - Owner/ risk taker?
- Increase connection rate
  - Subsidies for biomass DH
  - And for connecting to DH?
- Climate goal for new local settlement

Case Brasov - Setting the scene

- Old district heating system formerly supplying industry and households
- Industry closed down 1990
- Now overdimensioned and unrelyable
- Big losses in network (>50%)
- Split ownership of grid and heat generation
- Bad image of district heating
- Change to individual gas boiler

Former industrial sites
Changing to commerce or settlement area





Case Brasov - Feasible initiatives

Scenario of renewing the network until 2030

- Estimated additional investments of 55 Mio €
- Drop of losses from >50% to 10%
- Assumption that saved heat can be sold to additional costumers

→ increase of DH price of only +12%

Scenario of renewing the network until 2030 and use whole capacity of supply units to connect additional costumers

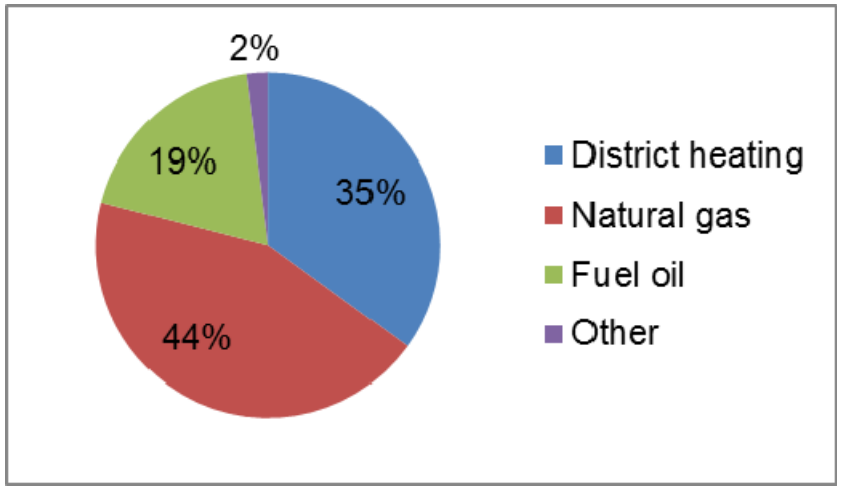
→ decrease of DH price by -22%

Case Brasov - Key success factor

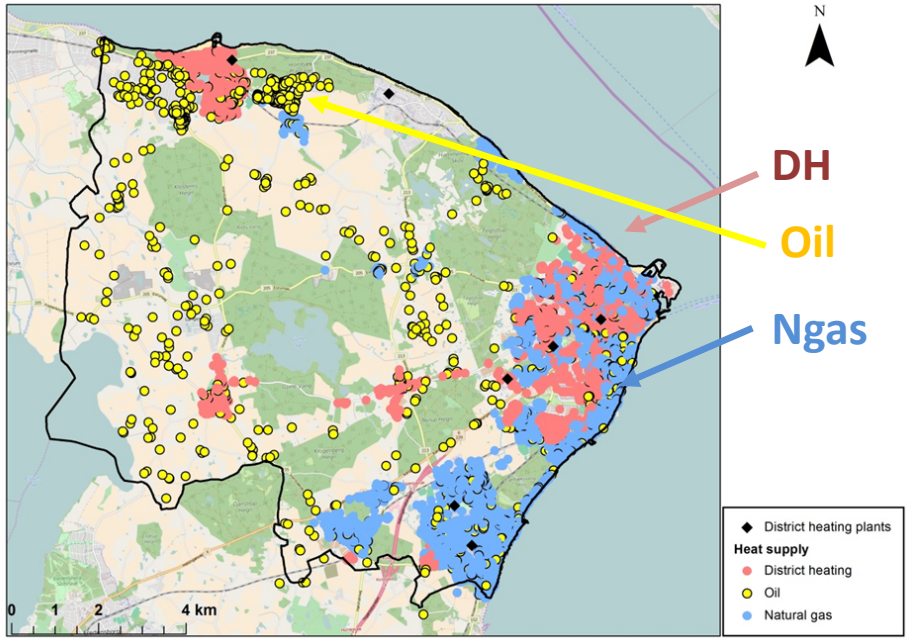
- New settlement with mandatory connection to DH
- Municipal ownership of DH grid?
  - Long-term investment horizon of a strategic investor is required (e.g. the municipality)
- Clear and stable contracts with heat suppliers (if different from grid owner)
- New image for DH

Municipality of Helsingør

- Northeastern part of the Zealand island, Denmark
- 122 km2
- 62.000 inhabitants in 2013
- Total CO2 emissions: 5.6 tCO2 eq. per cap.



- DH based on natural gas CHP and waste incineration



Heat supply types in 2013

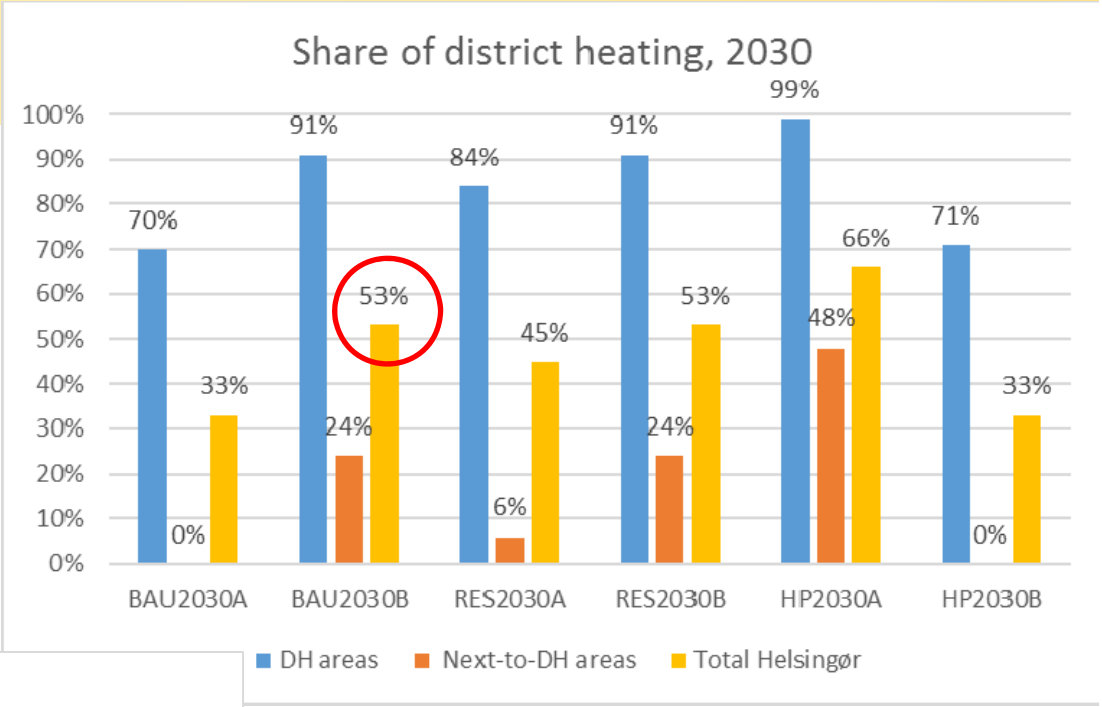
Helsingør - Feasible initiatives

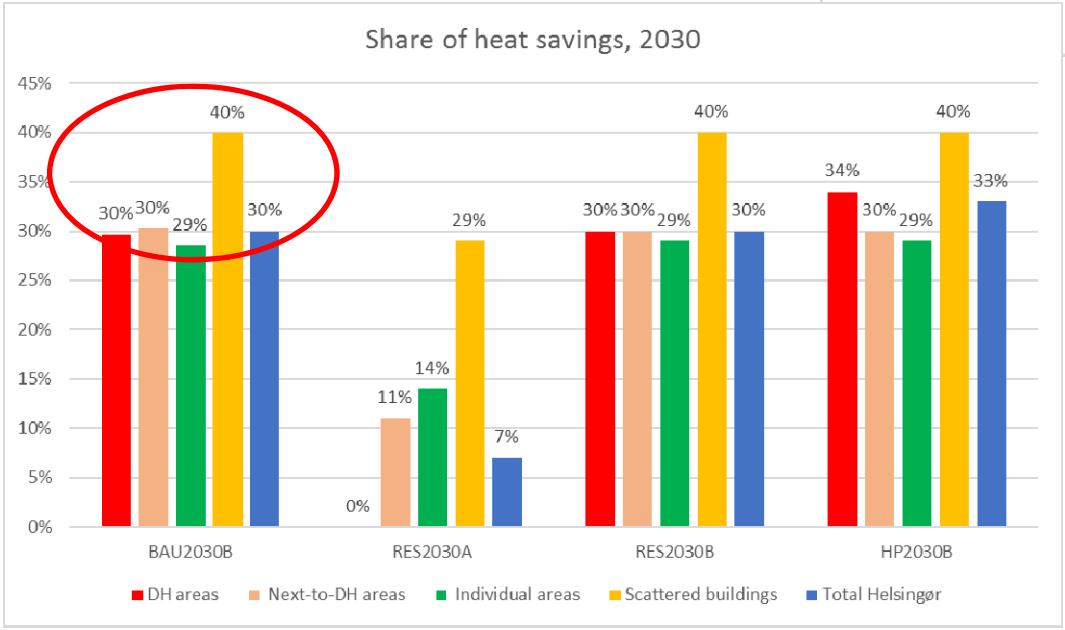
Scenarios

- BAU: biomass CHP being built
- RES (no fuel oil or ngas boilers)
- HP (heatpumps and heat storage)

Perspectives

- A - Simple socio-economic
- B - Private economic (incl tax)





Biomass CHP + DH expansion is private economically feasible (from 35 to 53%) (no tax on biomass)

30-40% heat savings are private economically feasible; mainly

- in old buildings
- outside DH areas

Comparing different district heating supply scenarios

Helsingør
Key success factors

- Zero tax on biomass - and subsidy for CHPs that generate electricity using biomass
- Heat supply zoning - and proving that DH is more socio-economically feasible
- Loans with 1.5% interest rate guaranteed by the municipality
- Non-profit rule for DH companies
- Thermal renovations happen together with other renovations

Municipality of Litoměřice

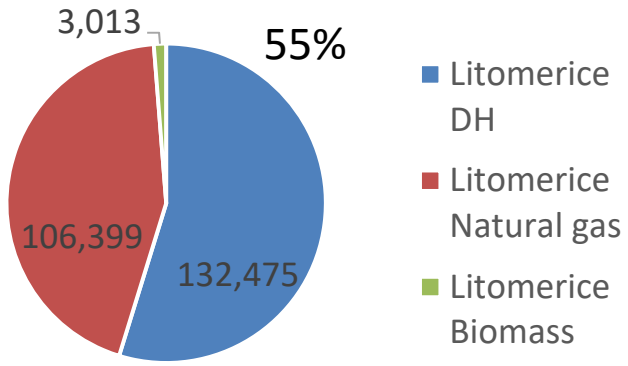
Location Northern part of the Czech Republic

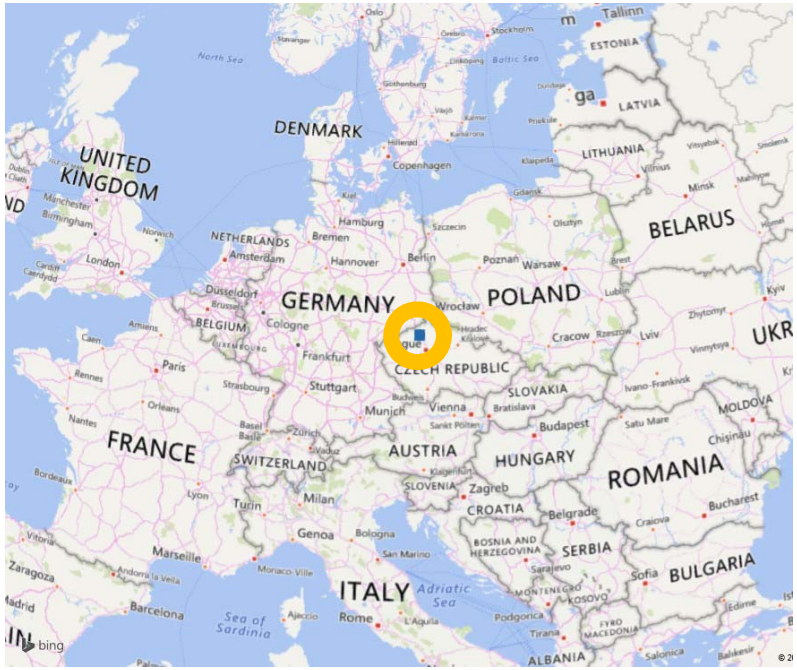
Area 1 340 km2

Inhabitants 24.000 in 2013

CO2 136 ktCO2 eq. (2013). 5.7 tCO2 eq. per cap.

Heat demand used in model

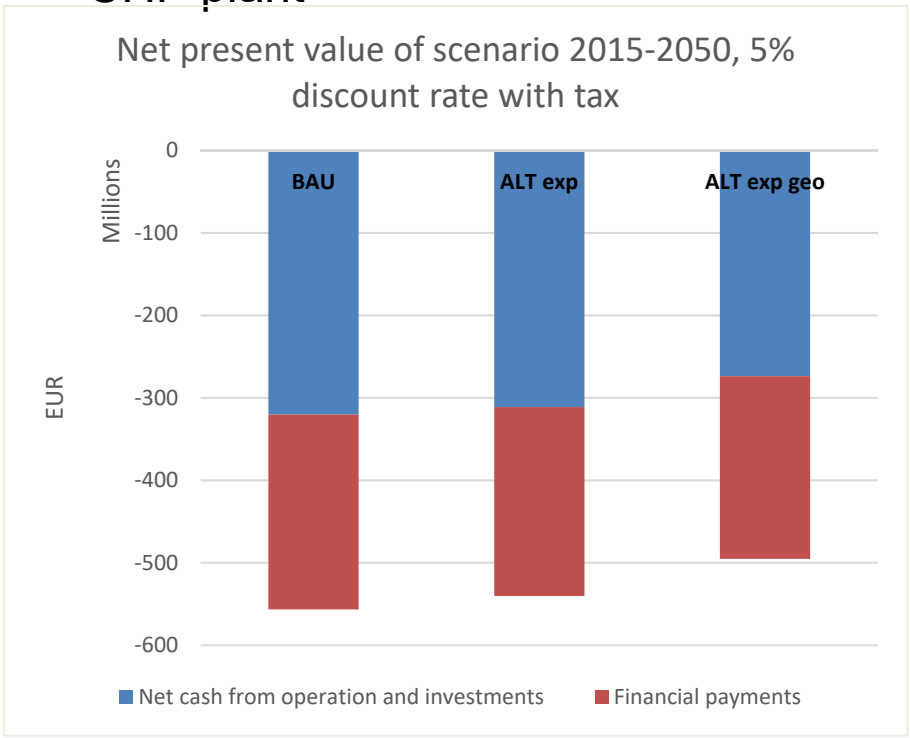


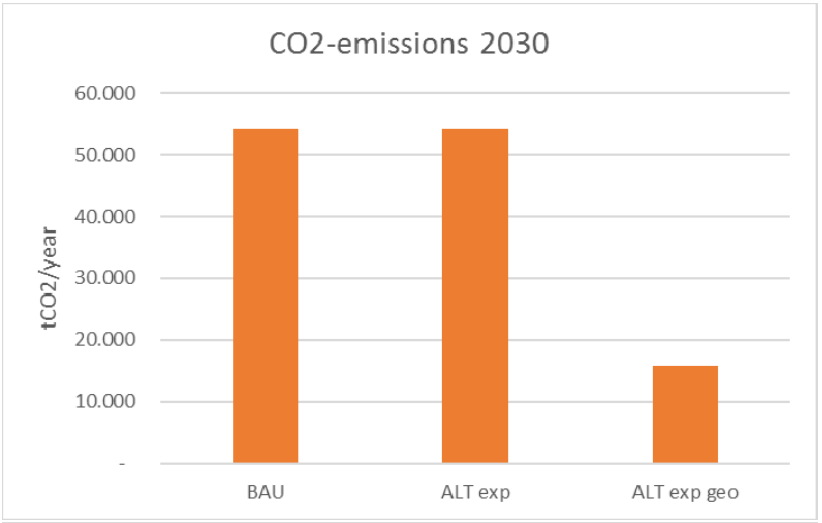


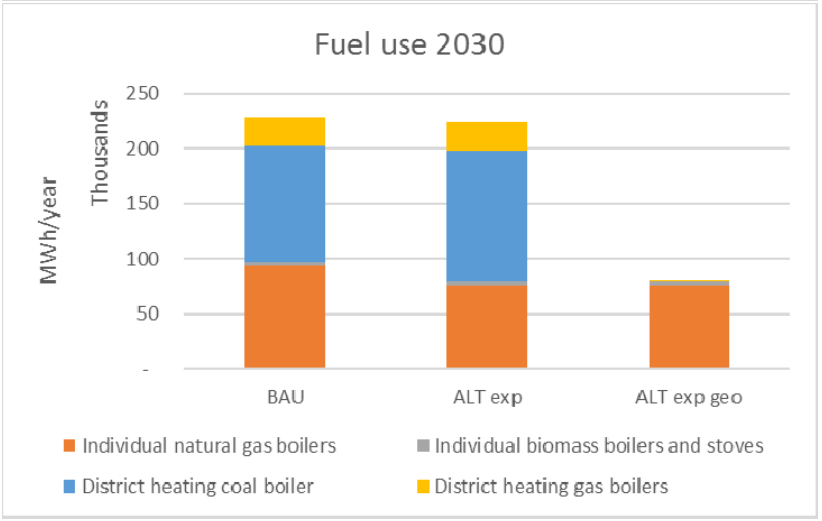
Litoměřice
Feasible initiatives

Scenarios

- BAU
- Exp - DH expansion
- Exp Geo - DH expansion and geothermal CHP plant





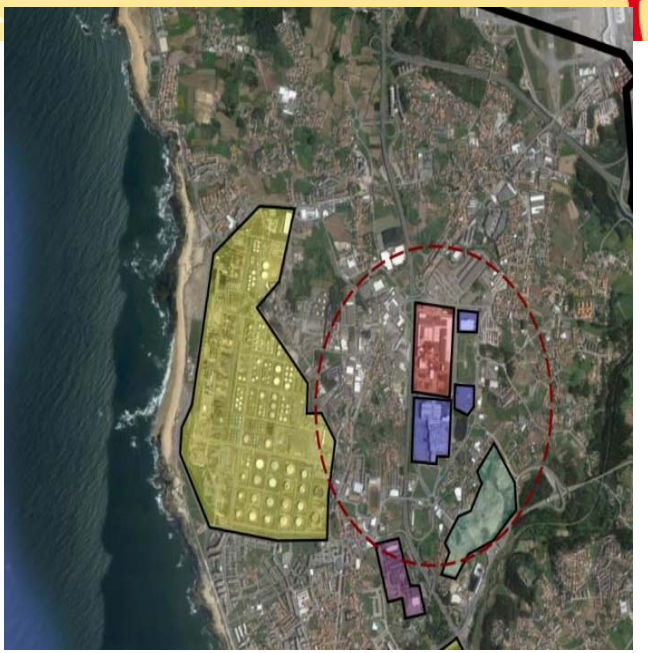


Comparing different district heating supply scenarios

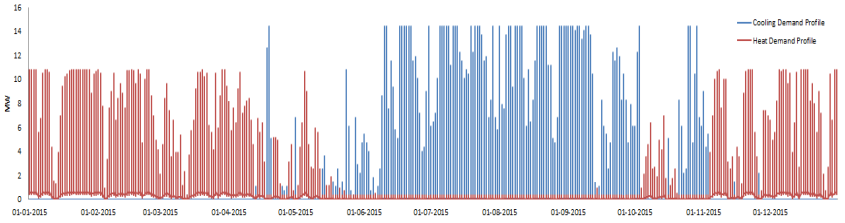
Litoměřice
Key success factors

- Ownership of DH plant - or clear terms of access to the DH grid
- New image of DH: Consumers need to see key numbers on cost and other relevant inputs (such as CO2/MWh or jobs/year)
- Cost savings possible through conversion to DH with construction of geothermal plant.
- Risk management related to exploring geothermal energy

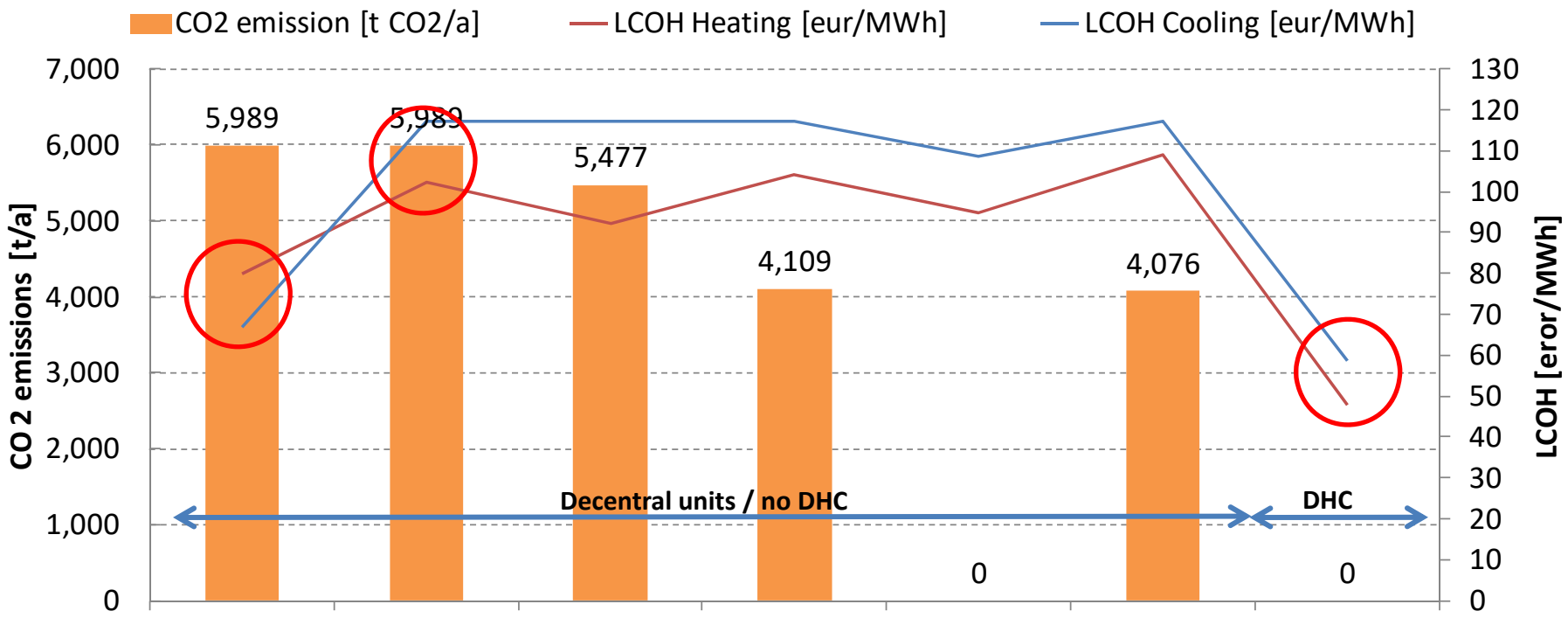
Matosinhos



- **Focus area**:
  - Shopping mall and large stores
    - Individual gas boilers + compression chillers
    - Demand for cooling three times higher than heating
  - Residential area under construction
  - Refinery as potential excess heat source
  - No DHC infrastructure in the city and surroundings
- **Energy demand in focus area**:
  - Cooling: 28 GWh/a (at right bottom in blue)
  - Heating: 15 GWh/a
- **Scenario analysis focuses on**:
  - Role of solar thermal, PV and HP
  - Economic viability of DHC
  - Connection of refinery for excess heat use
- **Simple socio-economic perspective**:
  - 1.5% discount rate, no taxes, no externalities



Matosinhos - Feasible initiatives: Results for LCOH and CO2



Comparing different district heating supply scenarios

Matosinhos
Key success factors

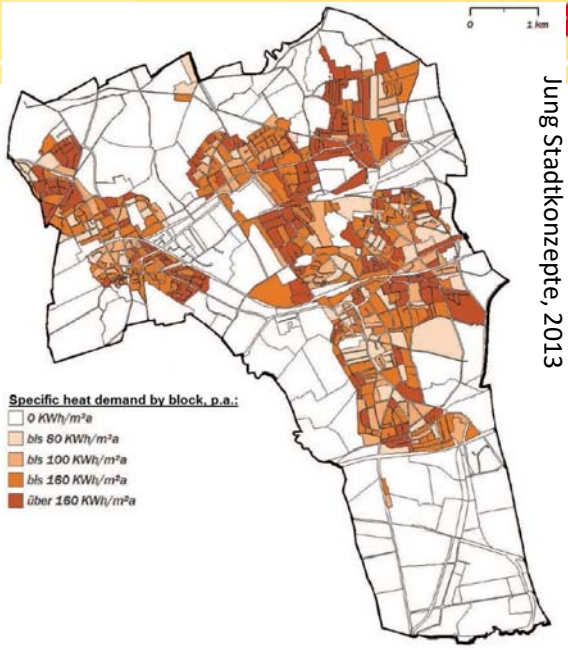
- Using **excess heat from refinery** seems very promising
  - close to city and not yet used
  - Estimated sufficient to supply focus area
  - Can be an opportunity to establish DH grid („door opener“)
  - However:
    - No tradition/ experience with DH in Portugal (only one network in Lisbon)
    - Uncertainty about future perspective of refinery

- **Photovoltaic** can be an option to decarbonize heating & cooling based on decentral **heat pumps** and **compression chillers**
  - High share of cooling -> el demand equally distributed across year
  - Building roofs (plus parking roofs) provide enough space
  - Current estimates with annual net metering (-> explore real time self consumption)
  - Attractive tariffs for HP and PV crucial

Herten

- 2 divided DH grids:
  - North: fed by coal CHP from transmission grid
  - South: fed by waste incineration
- Several distribution networks individually connected to DH transmission line

- Simple socio-economic perspective:
  - 1.5% discount rate, no taxes, no externalities



Jung Stadtkonzepte, 2013

2 DH scenarios:

1. Constant connection
2. Extending connection so that total heat demand remains relatively constant (see right)

Scenario 2: DH share by building type

Building type	2014	2030	2050
Detached house	14%	14%	14%
Terraced house	25%	25%	91%
Apartment building	40%	59%	100%
Large apartment building	55%	100%	100%

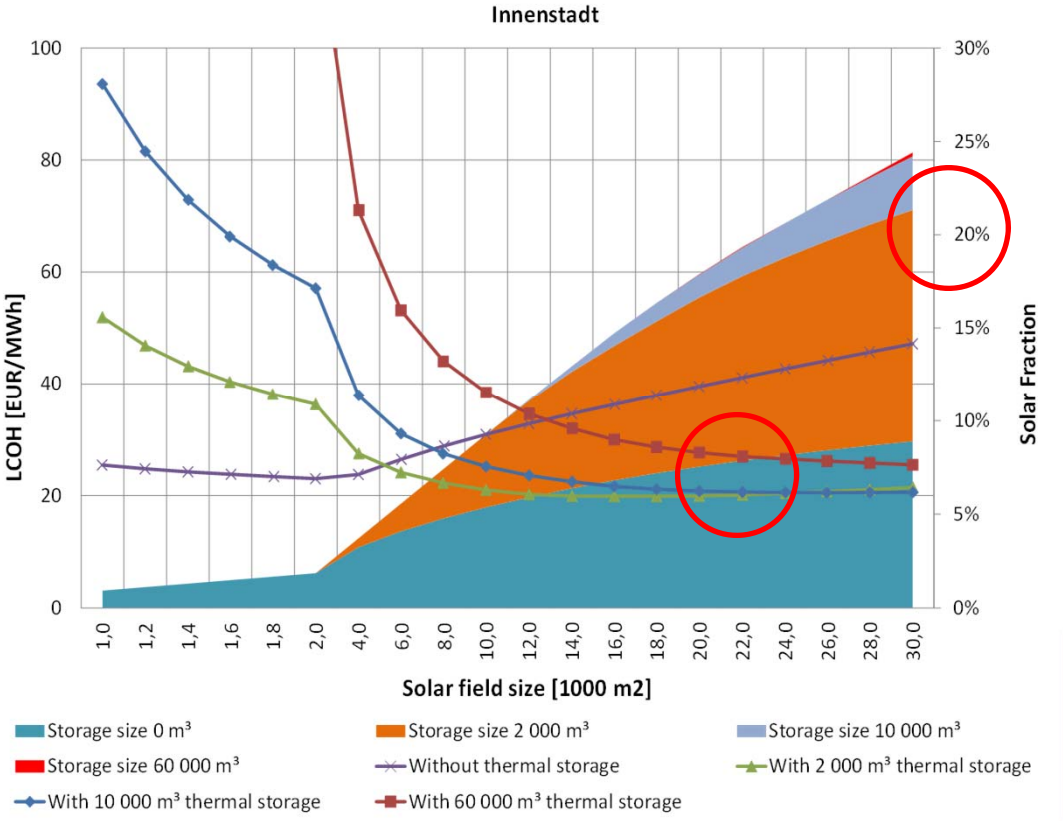
Herten - Feasible solutions: Solar thermal DH

Cost assumptions

	Costs
Land	5,30 EUR/m²
Collector field	200 to 400 EUR/m²
Pit Storage	50 to 200 EUR/m³

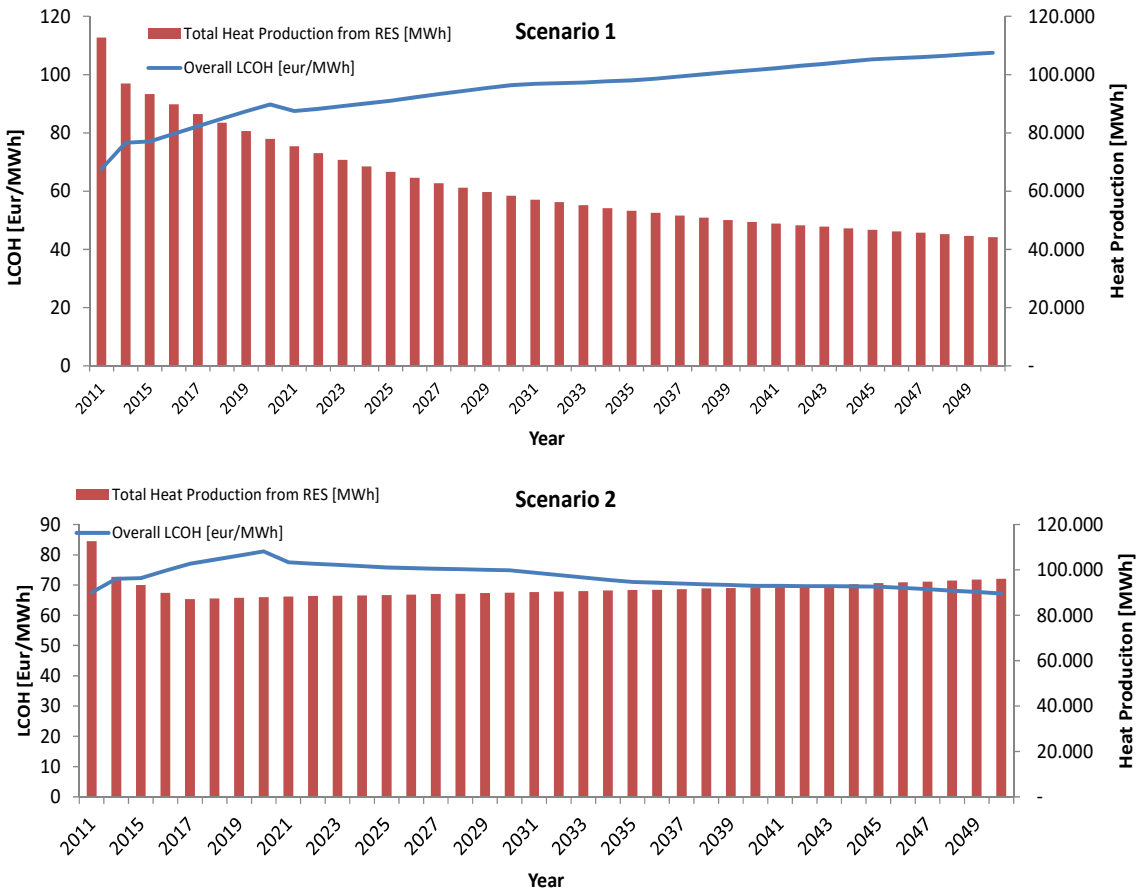
Example sub-system „Innenstadt“ (right)

- Across all sizes: LCOH range from 20-30 euros/MWh
- Solar fraction of ~20% can be achieved at ~20 euros/MWh LCOH
- < 4,000 m²: systems without thermal storage have lowest LCOH
- 4 – 25,000 m²: systems with 2,000 m³ thermal storage have lowest LCOH
- Sufficient agricultural land is available



Herten - Key success factors: extension of DH

- LCOH increase with falling heat demand (top)
- LCOH slightly fall with constant heat demand (bottom)
- Connecting new buildings can keep heat demand on constant level up until 2050 at least
- Assumptions
  - No reinvestment
  - Increasing prices



Comparing different district heating supply scenarios

Conclusions

Energy efficient heating and cooling consists of:

- Energy savings
- Individual and central green energy
- Efficient district energy

Efficient green district energy solutions are cheapest for society - when ensuring high connection rate

- should also be cheapest for individuals

Interesting DH supply options are:

- Excess heat
- Waste-to-Energy
- Solar heat
- Heat pumps
- Sustainable biomass

Energy savings and individual green energy should be made easily available for the rest

Conclusion: Key success factors (I)

Strategic local and regional heat/cool planning

- Long term environmental political targets (both at local and national level)
- Info campaigns and cooperation to smoothen transition
- Better geographic data availability (buildings, waste heat potentials, cooling demands and local RE resources)
- Availability, time and competences to use DH/C planning tools at local level (part of progRESsHEAT)

Conclusion: Key success factors (II)

Regulation

- Zoning to avoid double infrastructure (of respectively DH and natural gas) (mandatory connection in DH priority areas?)
- Ownership structures (including equal access to grids)
- Mandatory improvements of energy efficiency in buildings and industry? Including:
  1. energy savings
  2. efficiency improvements in DHC grids
  3. individual or DHC RE use
  4. DHC expansion

Conclusion: Key success factors (III)

Economy

– Access to cheap long term financing or subsidies (also for upgrading existing grids or investing in new)

– Risk taking - in particular in relation to industries

– Increased heat savings in DH areas must be matched by increased DH connection rate (or DH prices will increase)

– Non profit DH/C? (as in Denmark)

– Aligned taxes, tariffs and subsidies (CO2, fuels, electricity for HP and use of waste heat)

Thank you for your attention!

Questions and more info:

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