TECHNISCHE UNIVERSITÄT WIEN

Integrated Strategic Heating and Cooling Planning on regional level for the case of Brasov

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Content

- **Introduction:** Integrated Strategic Heating and Cooling Planning Process
- **Method:** quantitative analysis
- **Results:** quantitative analysis
- **Conclusion and Discussion**

Integrated Strategic Heating and Cooling Planning Process

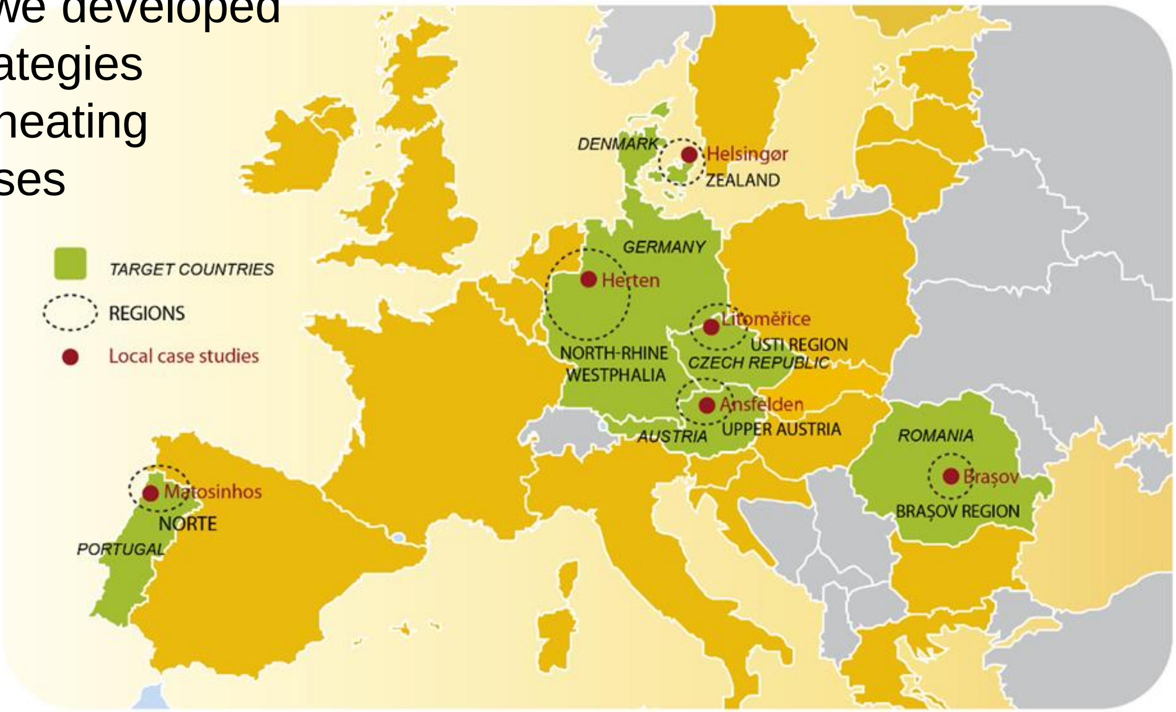
- Integrated:
  - Demand and supply are not seen as independent dimensions but are interlinked
  - Heating sector connected at least with the power sector

- Strategic:
  - Whole planning process should be guided by a “desired final state” (efficient, renewable and affordable low carbon system)
  - Includes framework conditions:
    (policies, economic assumptions etc. and their development play an important role in the strategic planning process)

- Planning Process:
  - All steps accompanied by intensive and target-group oriented information campaigns and involvement of all relevant stakeholders in order to ensure the achievement of the desired objectives

Project: progRESsHEAT (2015-2017)

- Aim: Assisting local, regional, national and EU political leaders in developing policies and strategies to ensure a strong and fast deployment of renewable and efficient heating and cooling systems
- 6 Local case studies where we developed local heating and cooling strategies through integrated strategic heating and cooling planning processes
- Case of Brasov
- www.progressheat.eu

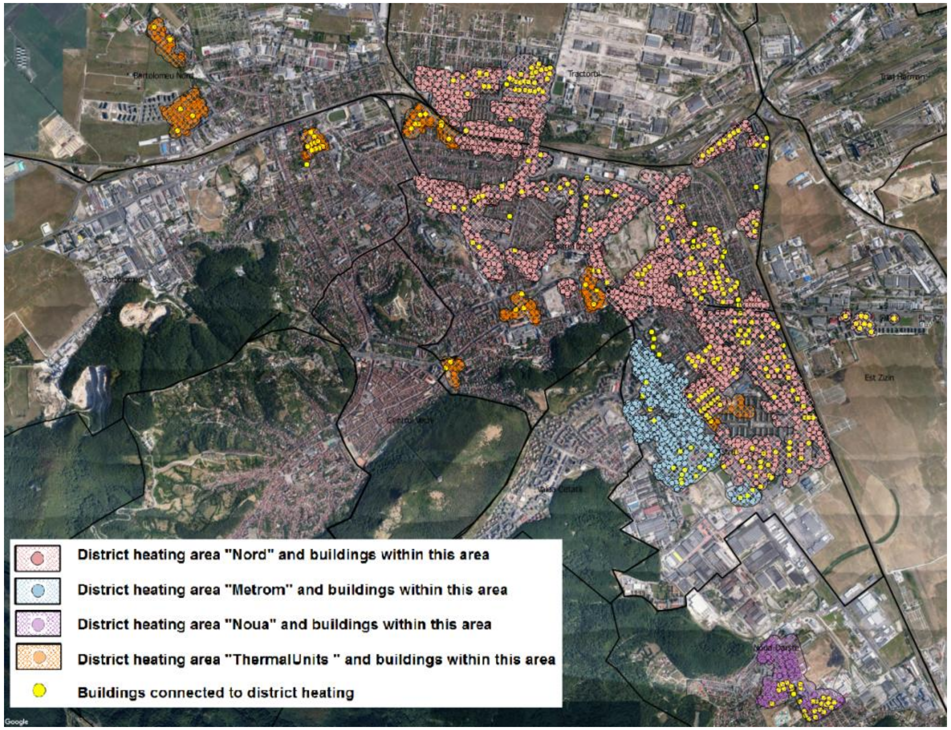


Implementation of Integrated Strategic Heating and Cooling Planning Process in progRESsHEAT

- Empirical analysis:
  - Interviews & surveys
  - Barriers and success factor
- Policy assistance process:
  - Policy Group Meetings
  - Policy Workshops
  - Capacity building workshops
- Quantitative analysis:
  - Analysis of current demand and supply + RES potentials
  - Development of modelling frameworks
  - Economic feasibility of technical solutions
  - Detection of business cases and need for policy

Brasov case study - Status quo

- Municipal area: 158 km²
- Inhabitants: 274 500 (2014)
- Altitude: 625 m
- Detailed building stock data:
  ~17 000 buildings
  (category, location, floor area, age)
  ~9.8 Mio m² floor area
- Demand for SH&DHW: ~1400 GWh
- District heating supply ~5% (~67 GWh)
  - Four DH areas
    - 36 km transport network (13 km renewed) + 70 km distribution network (16 km renewed) (owned by municipality)
    - Old & overdimensioned / very high network losses: >50%!! / unreliable→many disconnection
    - External supplier:
      11 (new) CHP gas engines (43 MW_{el} / 38 MW_{th}) + natural gas boiler (107 MW_{th})
- Remaining heat demand (~95%) supplied by natural gas boiler



Modelling Framework

Idea: Find cost optimal combination for consumer between…
…for different building classes located in different areas of the municipality

Heat savings

- Minimization of investments into building envelope (windows, roof, basement, walls) to achieve 10 different levels of heat savings relative to national building code (incl. maintenance)
- Levelized costs of heat savings (EUR/kWh_{saved}) derived for different building classes in Invert/EE-Lab[1)] (10 categories / 3 construction periods)

→ Choose heat saving level that is most economic with cheapest supply option per building

$$min(HS * LCOHS + (HD - HS) * LCOH)$$

→ Calculate new levelized costs of heat supply options after implemented heat savings

Heat supply options

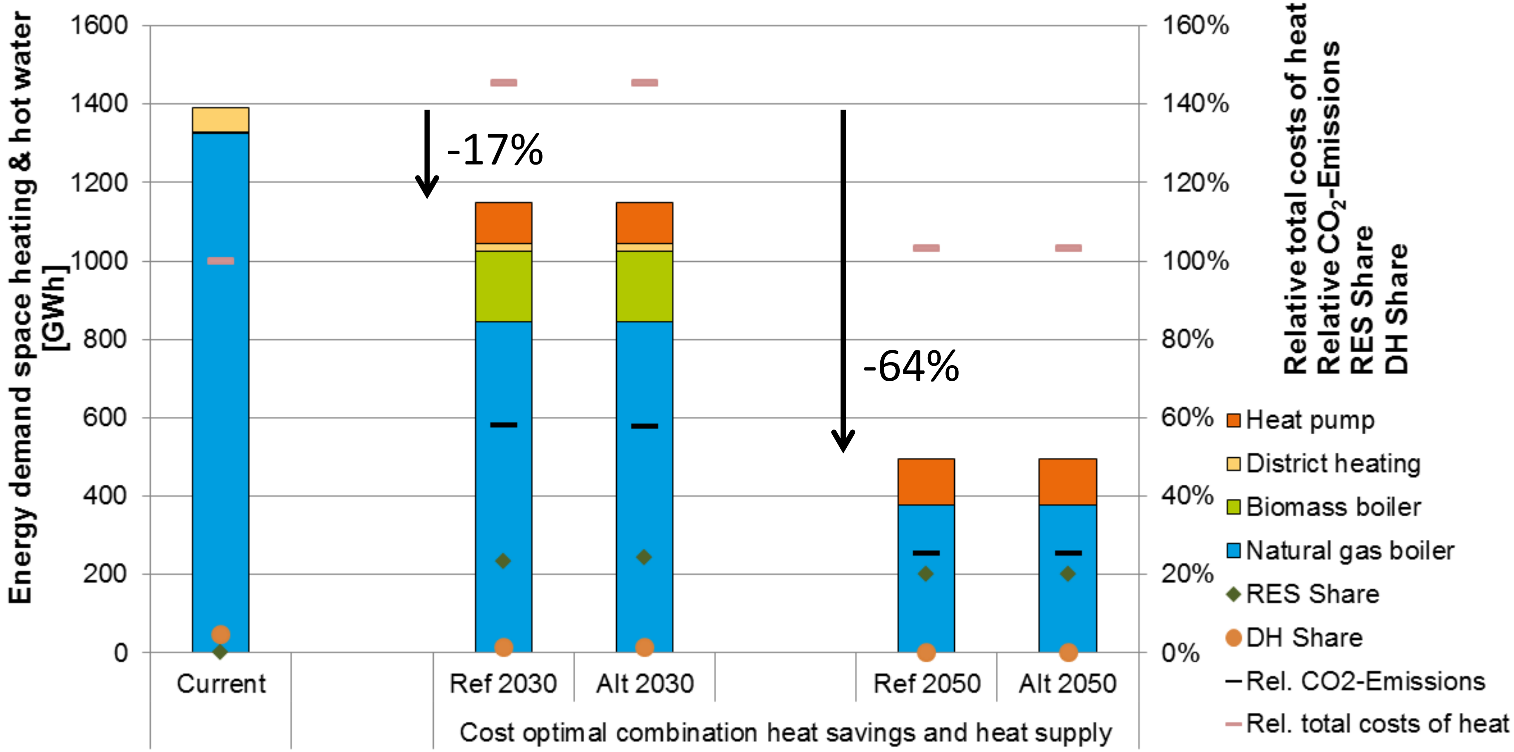
- LCOH of individual technologies (biomass-, oil- & gas boiler, HPs)

$$LCOH = \frac{(IC * cap * CRF + costs_{O\&M})}{Heat\ Demand} + \frac{costs_{fuel}}{efficieny}$$

- LCODH District heating
  - Sensitivity of LCODH depending on additional/ less heat demand (Dispatch optimisation model in energyPRO[2)] for a reference and alternative DH supply scenario)
  - GIS based analysis:
    Four different types of areas
    - District heating areas
    - Next-to-DH areas
    - Individual areas
    - Scattered Buildings/ Individual buildings

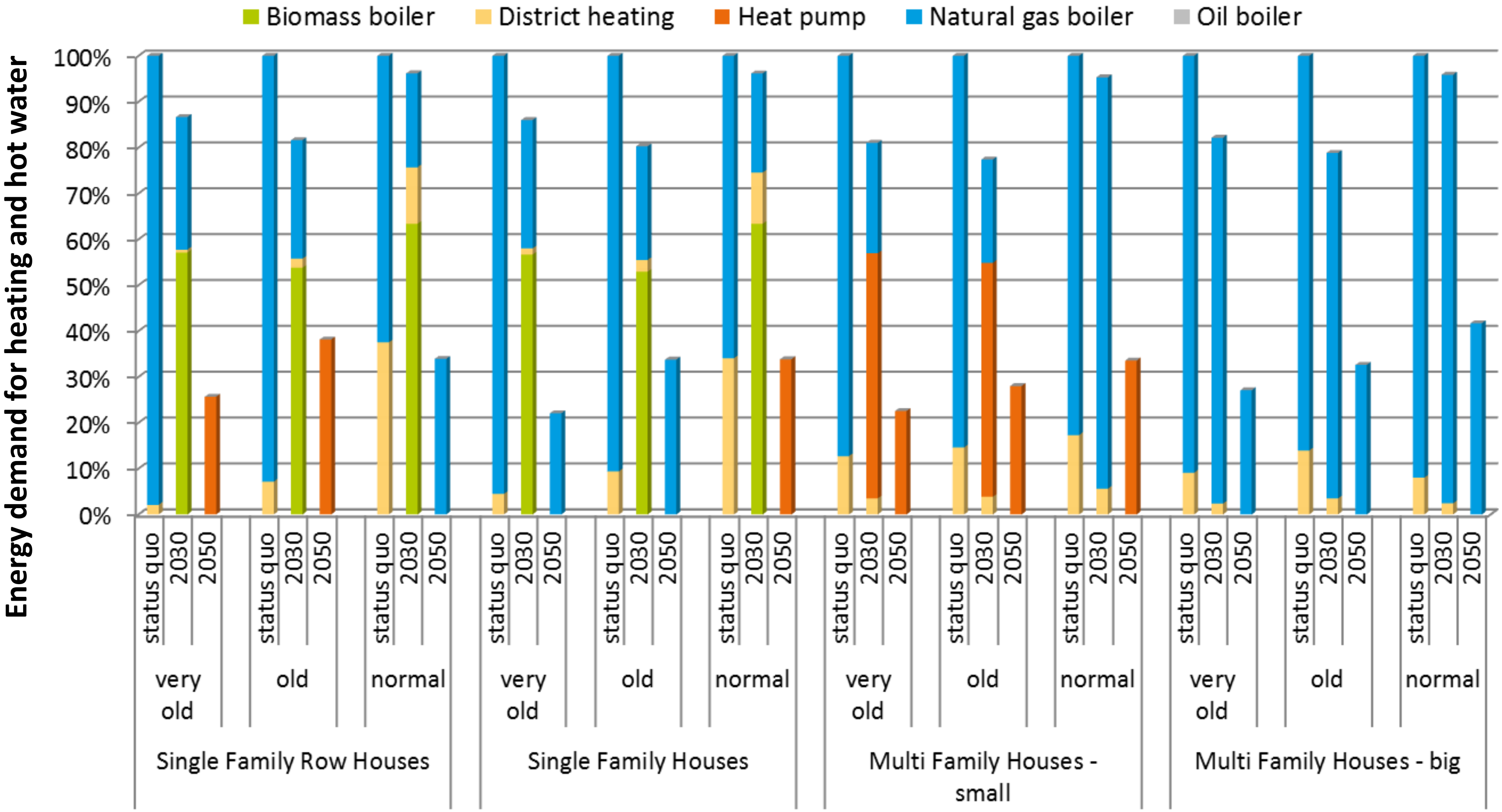
[1)] http://www.invert.at/
[2)] http://www.emd.dk/energypro/

Cost optimal combination of savings and supply for whole building stock in Brasov in Ref. and Alt. scenarios 2030/2050



- Almost no difference in reference and alternative scenario because DH is not economical
  - Ref and Alt scenario refer to two scenarios for the DH supply portfolio
- Heat savings until 2030 limited by renovation rate (~18-30% depending on building category) + limited replacement of heating system (~60%)
- Until 2050 full saving potential

Cost optimal combination of savings and supply in different residential building types in different scenarios



- Heat savings until 2030 limited by renovation rate (~18-30% depending on building category) + limited replacement of heating system (~60%) → only these buildings switch heating system
- Until 2050 full saving potential → all buildings switch to cheapest combination

Conclusions and discussion

- "Most economic" solution is not necessarily "best" or "desired" solution

Limitations: optimal vs. real behaviour, only per building class, rough GIS analysis (same costs within area), detail of modelling, data availability, economic assumptions, renewable potentials, ….

- Importance of integrated strategic heating and cooling planning
  - We need a target ("desired final state") and develop a strategy to get there
  - We need to include framework conditions
  - We need to integrate relevant stakeholders and get public acceptance
  - We need to include effects of heat savings vs. economy of (DH) supply

- Change in framework conditions/ policies is needed to reach "desired final state"

  → Policy assessment performed for Brasov based on the presented method

  → Paper: Impact of policy framework on the future of district heating in Brasov
  https://doi.org/10.1016/j.esr.2017.12.003

Thank you for your attention!

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Orig. Photo: Patrick Stargardt