TECHNISCHE UNIVERSITÄT WIEN

Method for Integrated Strategic Heating and Cooling Planning on Regional Level – The Case of Brasov

Richard Büchele

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Energy Economics Group

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

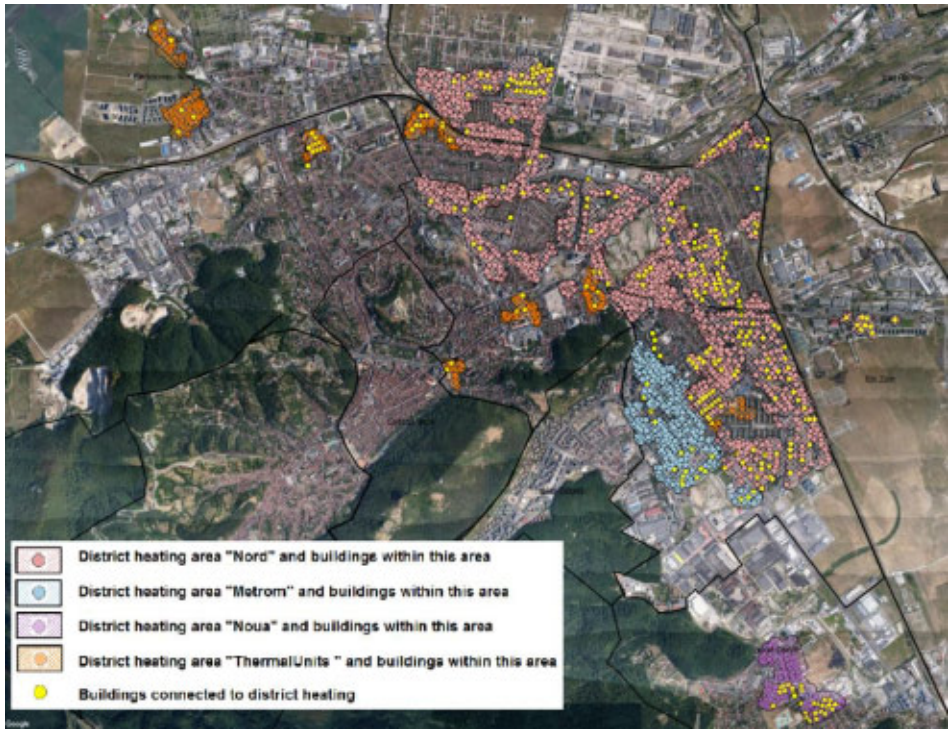
- Empirical analysis:
  - Interviews & surveys
  - Barriers and success factor
- Policy assistance process:
  - Policy Group Meetings
  - Policy Workshops
  - Capacity building workshops
- Quantitative analysis:
  - Analysis of current demand and supply + RES potentials
  - Development of modelling frameworks
  - 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 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)

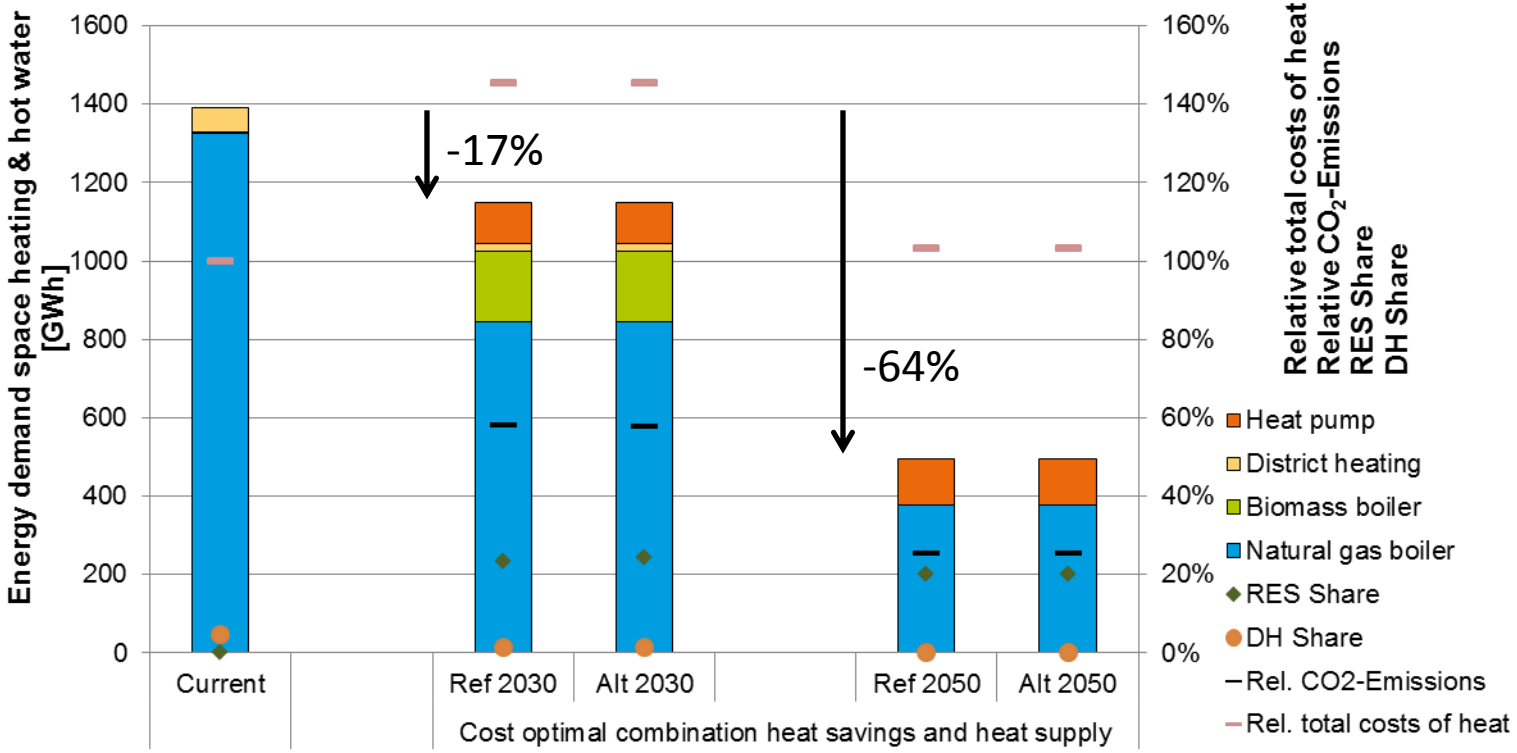
$$LCOH = \frac{(IC*cap*CRF+costs_{O\&M})}{Heat\ Demand} + \frac{costs_{fuel}}{efficieny}$$

- 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/

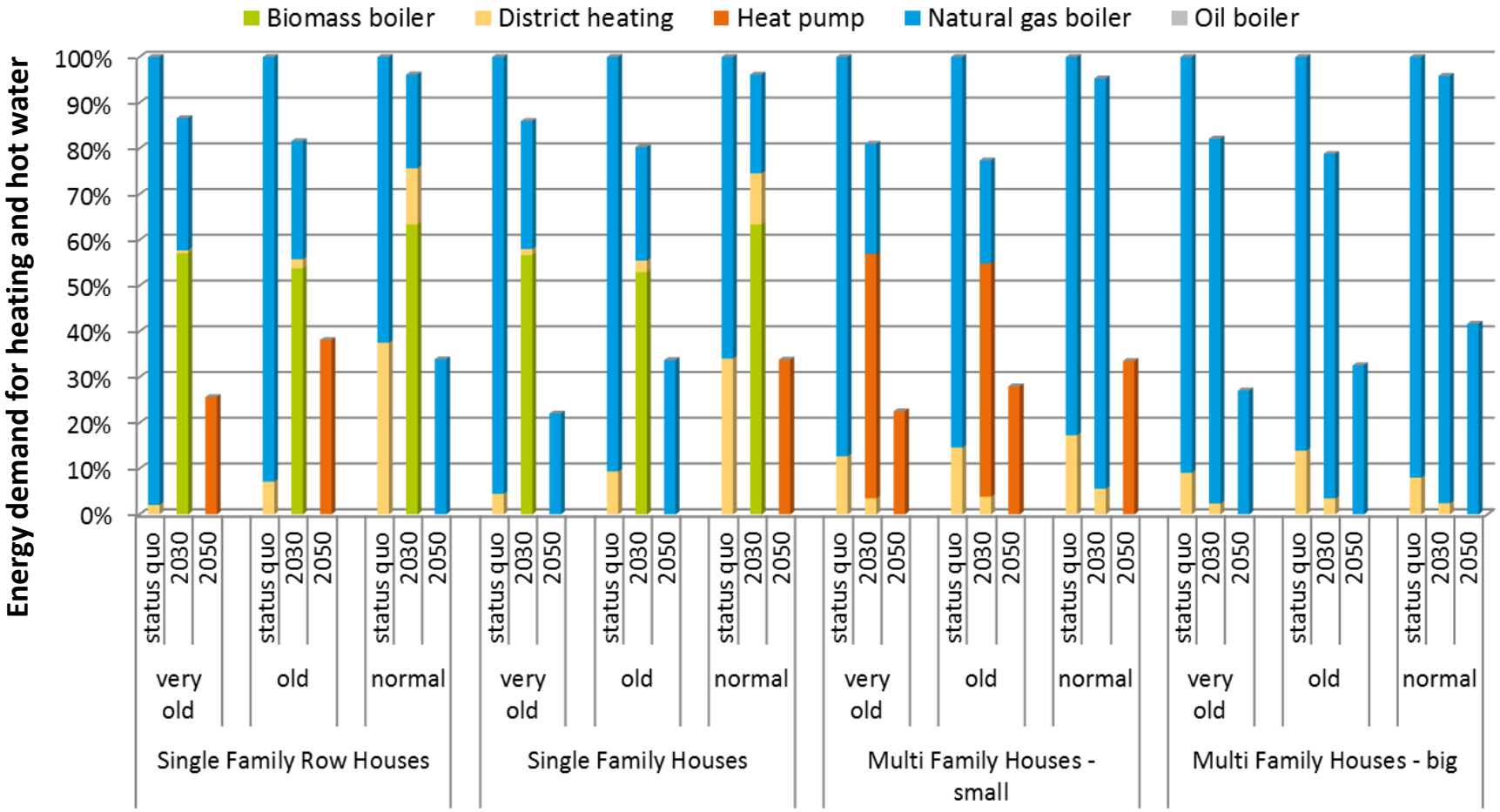
[2)] http://www.emd.dk/energypro/

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

- 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

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, ….

Thank you for your attention!

Richard Büchele

buechele@eeg.tuwien.ac.at

Orig. Photo: Patrick Stargardt