2nd International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 27-28 September 2016

Comparison of two methods for finding Least Cost Solutions for Heat Saving and Heat Supply in Buildings

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27.09.2016

Contents

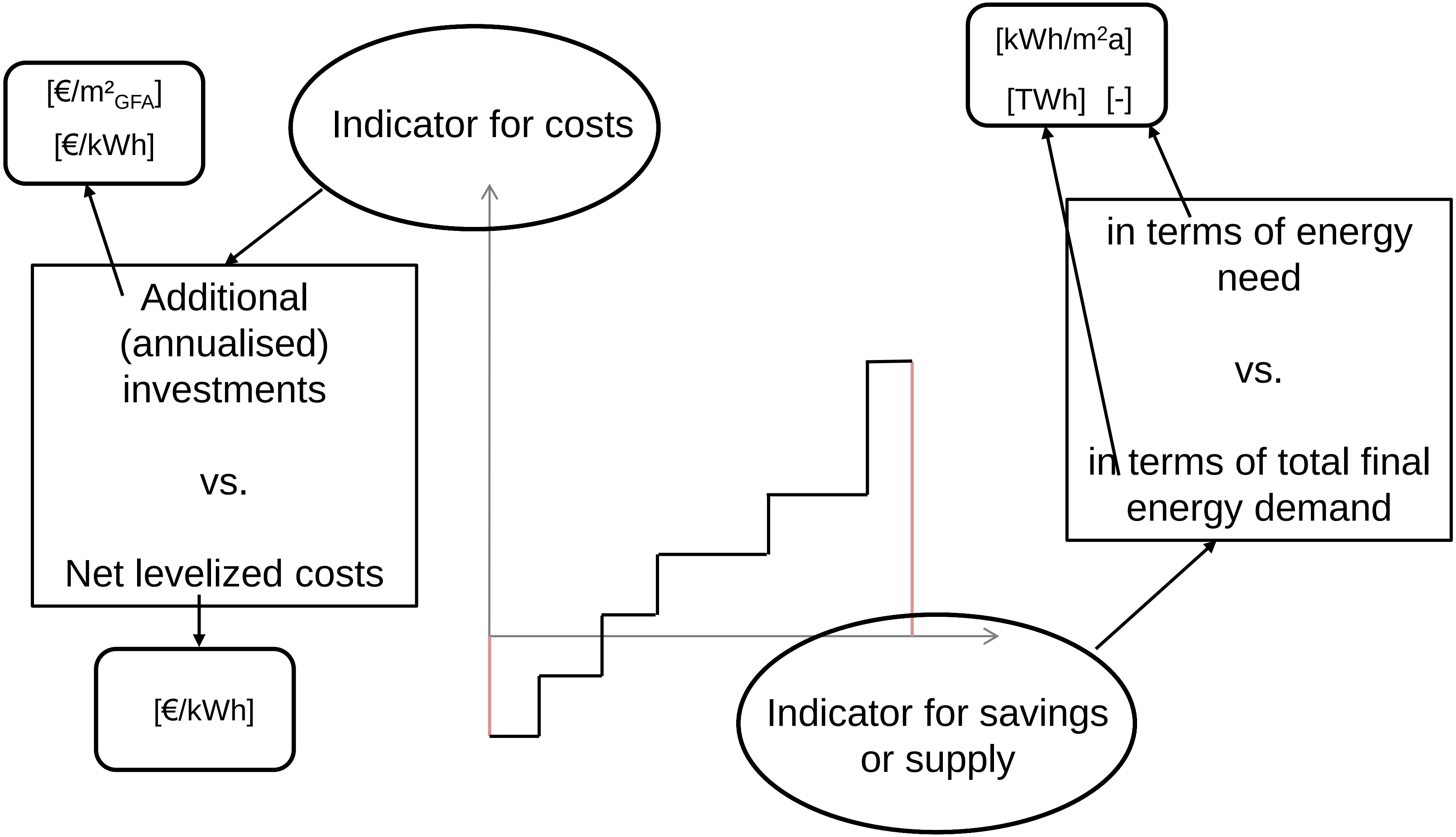
Motivation and aim of work

Motivation and Aim

- Emission reduction target of the EU
- Big potential for energy saving in the building stock in order to decrease CO_2 emissions
- Find cost optimal combinations of heat savings (renovation measures) and heat supply (DH or individual supply technologies) for space heating and preparation of hot water in the building stock
- Compare two different approaches which have the same objective

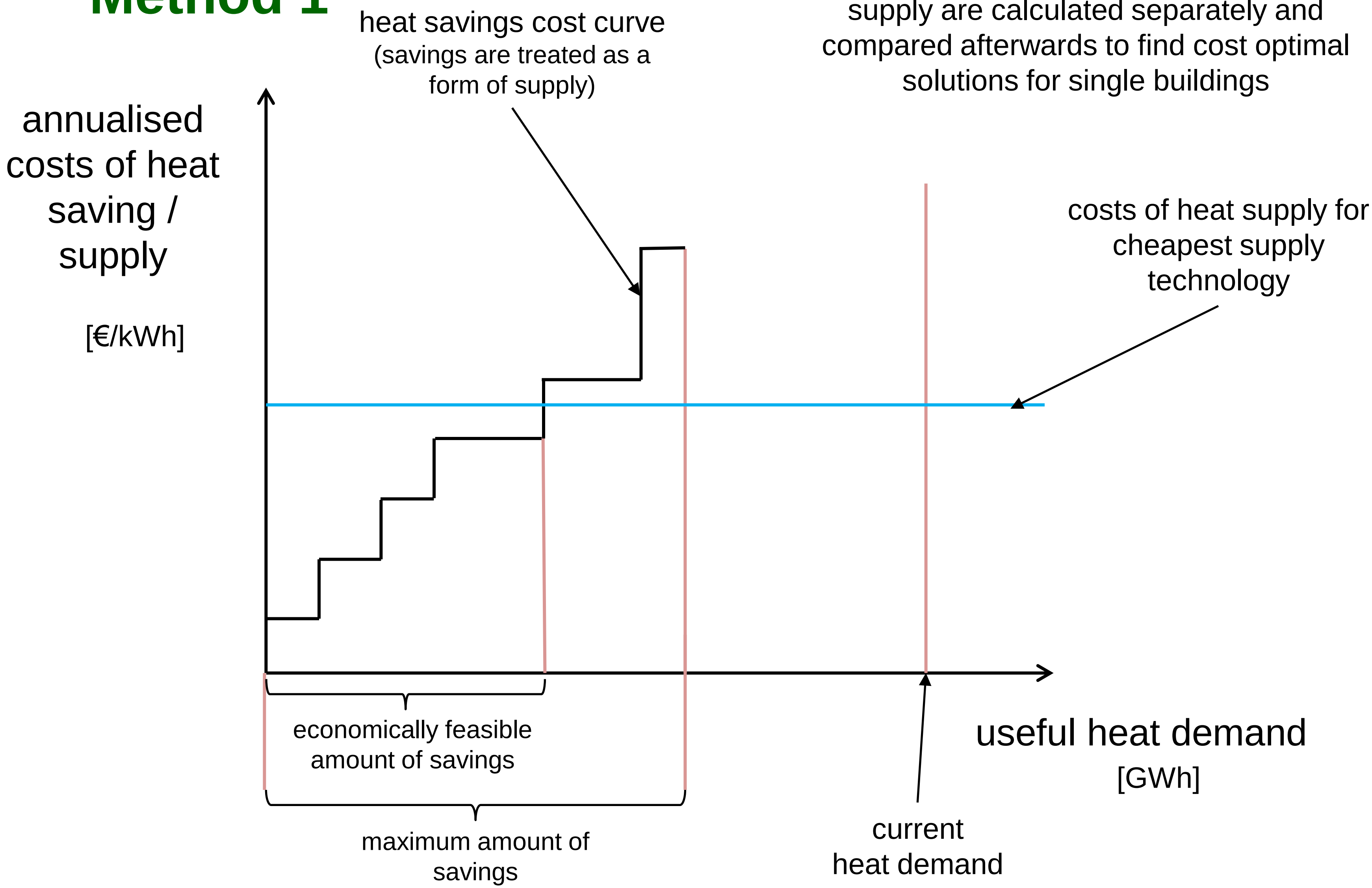
Technical description of the two methods

Introduction to cost curves

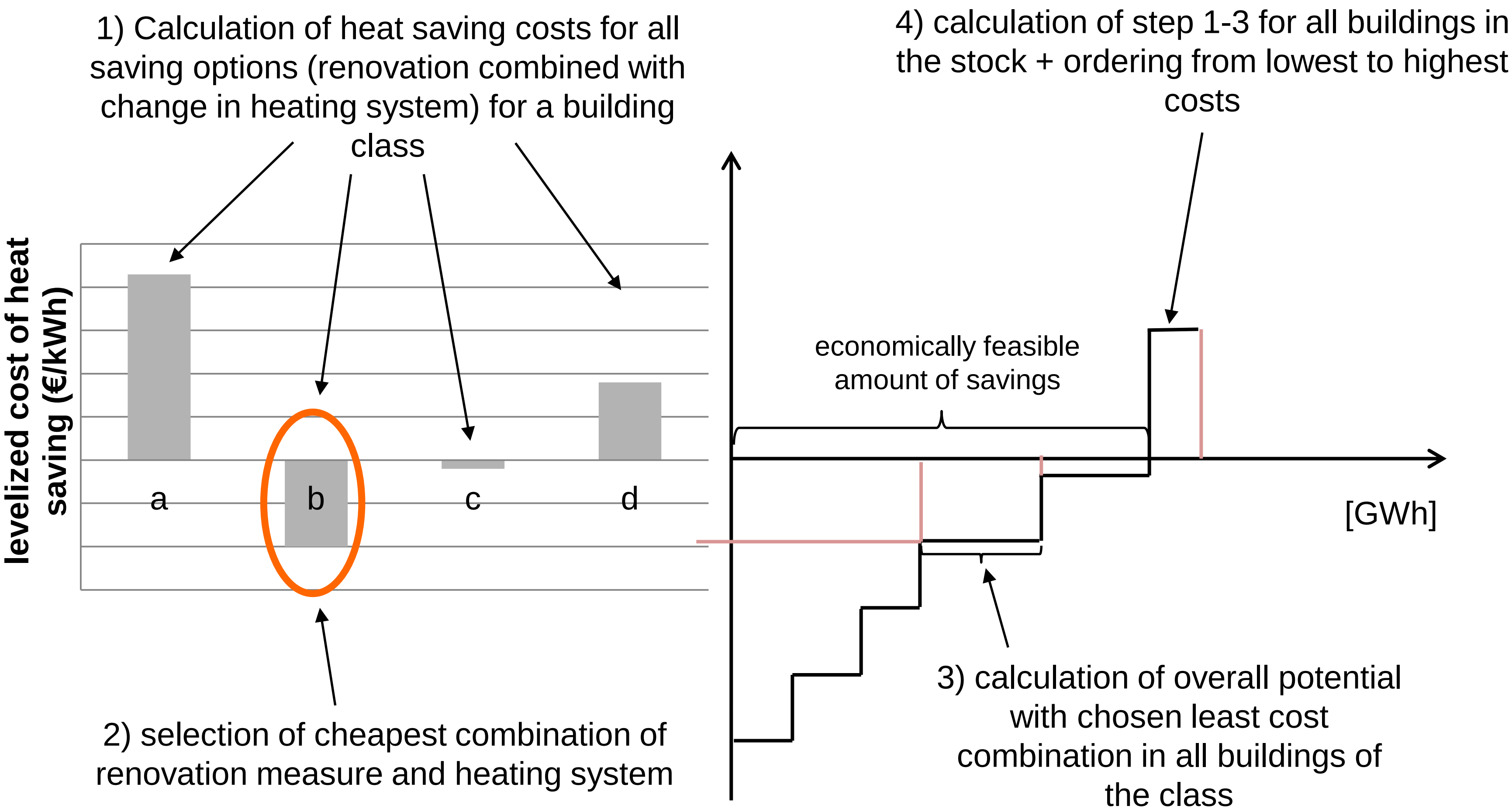


Method 1

Costs of heat savings and costs of heat supply are calculated separately and compared afterwards to find cost optimal solutions for single buildings



Method 2


1) Calculation of heat saving costs for all saving options (renovation combined with change in heating system) for a building class
4) calculation of step 1-3 for all buildings in the stock + ordering from lowest to highest costs
levelized cost of heat saving (€/kWh)
a
b
c
d
economically feasible amount of savings
[GWh]
2) selection of cheapest combination of renovation measure and heating system
3) calculation of overall potential with chosen least cost combination in all buildings of the class

Overview of differences between the methods

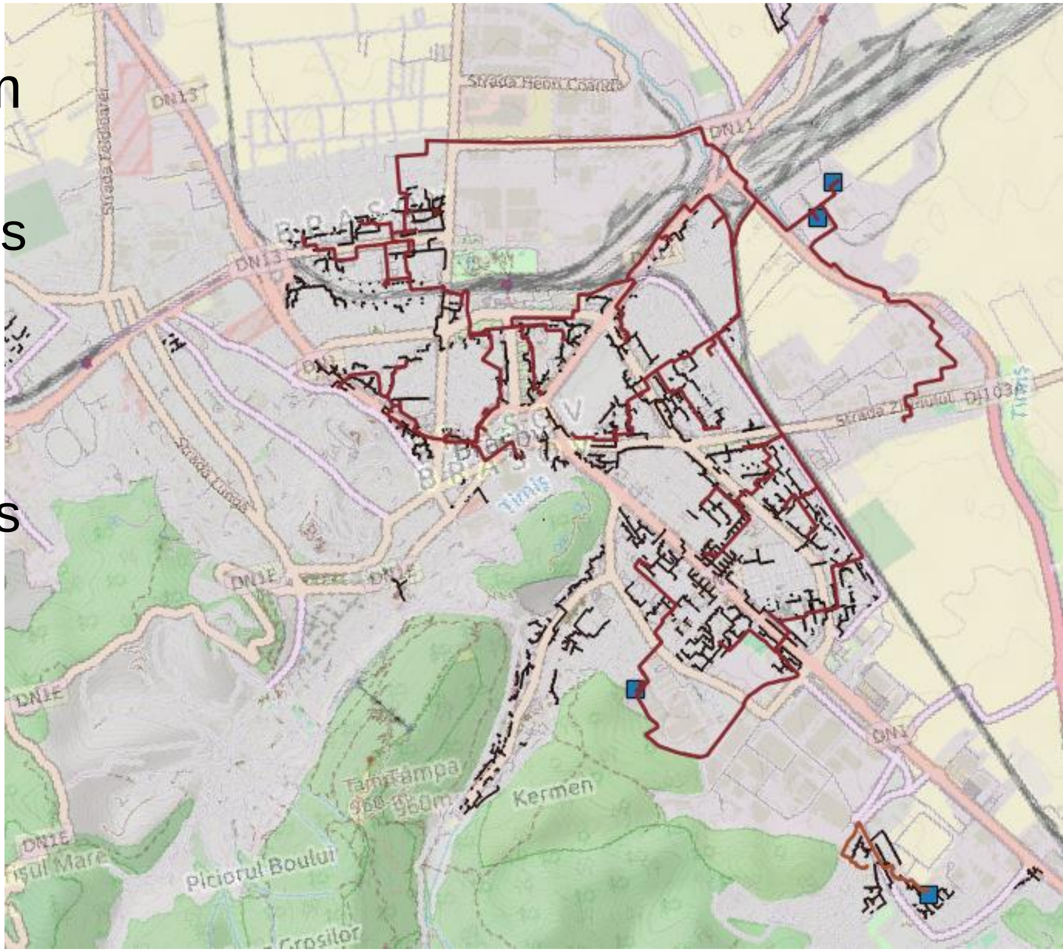
	Method 1	Method 2
Methodological differences		
Energy indicator	Useful energy demand	Final energy demand
Cost indicator	Separate calculation for saving and supply	Costs for combination of saving measure and supply technology
Differences in implementation		
District heating	Distinction between district heating areas, next to district heating areas and individual areas	Distinction between district heating areas and no district heating areas
Representation of building stock	10 building categories, 3 building classes, 5 supply technologies	10 building categories, X building classes, Y supply technologies
…		

Case study for the city of Brasov

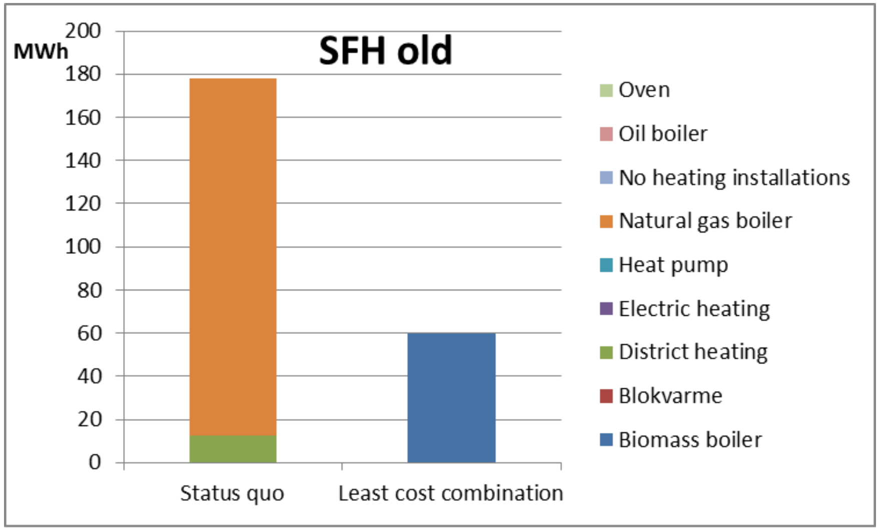
Short introduction to city of Brasov (Romania)

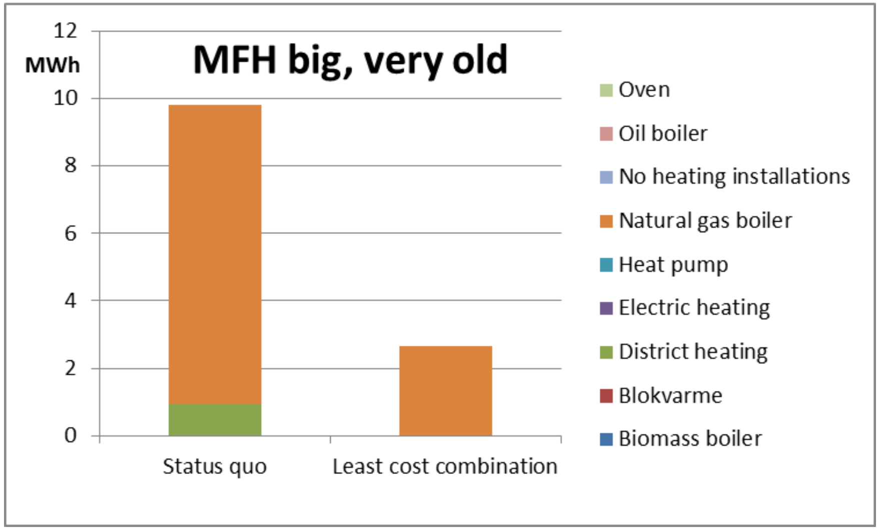
- Old district heating system
  - Old coal CHP replaced by new CHP gas engines (2010-2012)
  - A lot of costumers disconnected from DH
  - Very high network losses (>50%)

  →high reinvestment costs
- Currently
  94% individual gas boiler,
  5% DH,
  1% individual biomass



Exemplary results method 1 – private economic calculation





depreciation time:
15 y for supply technologies
20 y for renovation measures

Results

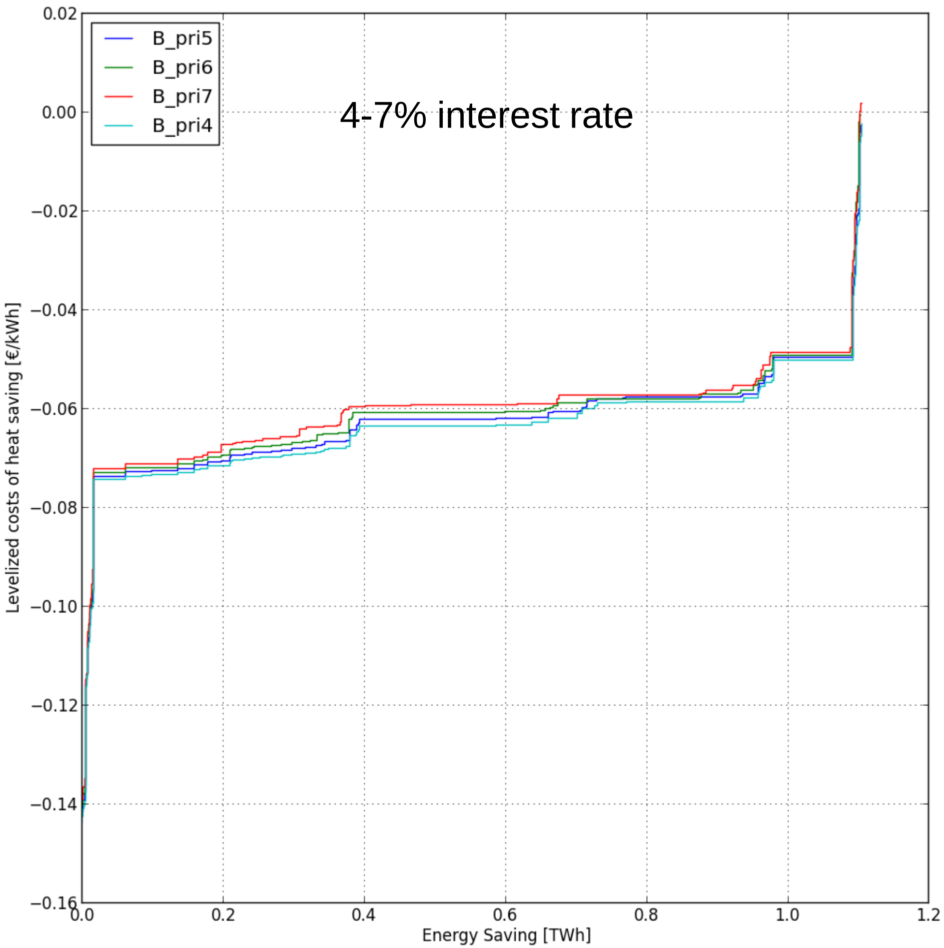
Around 60% savings of energy demand for all buildings

DH is not competititve
- High reinvestments
- Low gas price for privates

Smaller individual buildings change to biomass boilers, bigger buildings to gas boilers

Heat pumps depend on electricity price assumptions and COP

Preliminary Results method 2 – private economic calculation



depreciation time:
15 y for supply technologies
20 y for renovation measures

Results

saving of 40 – 80% of useful energy demand for all buildings

change to heat pumps (a/a and w/w) as well as to gas boilers

unrenovated old buildings lead to the cheapest savings

a higher interest rate leads to less ambitious saving as cost minimal solution

Conclusions and Discussion

Conclusions

- Important influencing factors on the resulting technology and savings combinations:
  - price sensitivity of district heat to the supplied heat demand (and the technologies used for supply of district heat)
  - rebound effect in the buildings after renovation
    - Overestimation of heat savings
    - Assumptions on building stock
  - socio- vs. private-economic conditions (interest rates, depreciation times, taxes, subsidies)
- Both methods provide important insights
  - Method 1: better suited for visualisation of combinations in single buildings
  - Method 2: better suited for visualisation of overall savings potential and resulting costs

Discussion / open issues

Open Issues:

- Show more results of each implementation:
  - CO_2 emissions (reduction)
  - Compare results per building class
- Verification of input data
- Sensitivity analysis still to be conducted for both methods to get more reliable results
- …