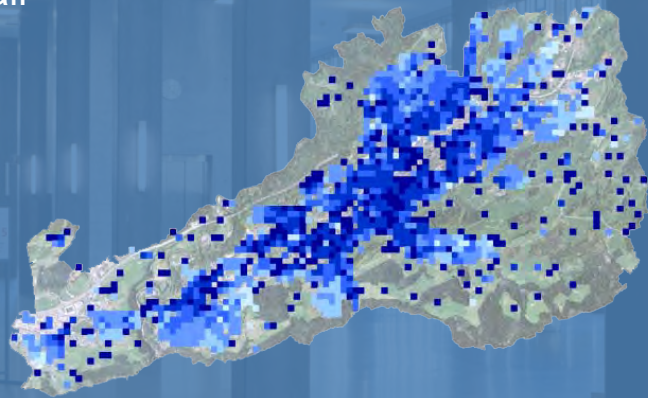


IBU - Institute for Civil and Environmental Engineering

MODELLING THE TRANSFORMATION OF HEAT SUPPLY AND DEMAND

A case study for the residential building stock of the city of
St. Gall



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Rapperswil, 26th September 2013

Introduction

- **University of applied Science Rapperswil**



- **IBU - Institute for Civil and Environmental Engineering**



- **IFM – Insitute of Facility Management**

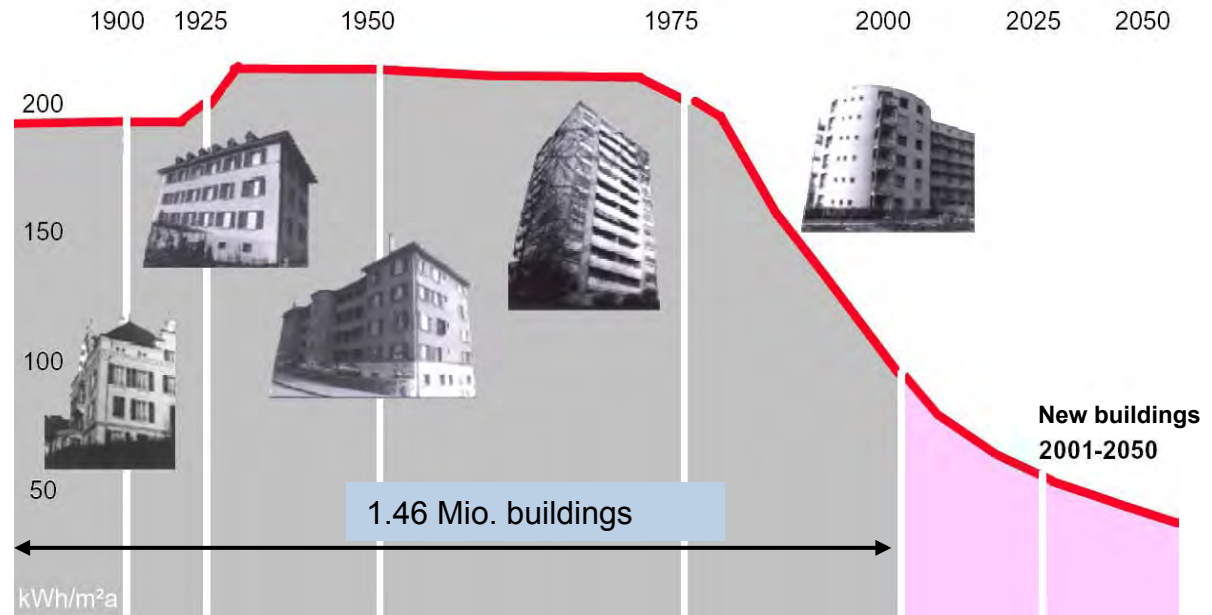
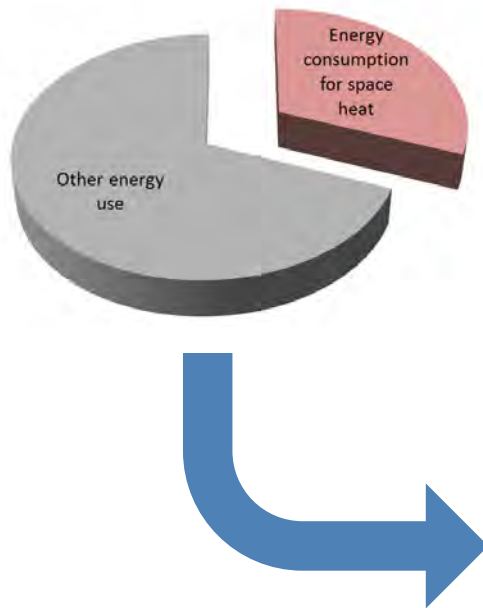


- **BAER- a cooperative research project**

- Sub-project: Energy- and material efficiency of the building stock



Swiss building stock



Source: Richner, P., Energieeffizienter Gebäudepark: Der SIA weist den Weg. (http://www.webtv1.ch/images/content/Tag_der_Technik_Richner_Empa.pdf)

- Energy demand for space heat after actual and future refurbishments
- CO₂-Emissions after the refurbishments and change of energy carrier

→ Can the energy goals be reached?

The case study: City of St. Gall

- **Energy goal 2050:**

- Reducing the demand of fossil fuel for heating by two-thirds

- **Planned geothermal power station**

- Should provide 40% of the building stock's heat demand



→ **Combination of new energy system with construction activities to increase energy efficiency**

Used data

Main data source: National register of buildings and dwellings (GWR)

- Living space (spatial explicit for each building)
- Main energy carrier
- Construction period
- Building type

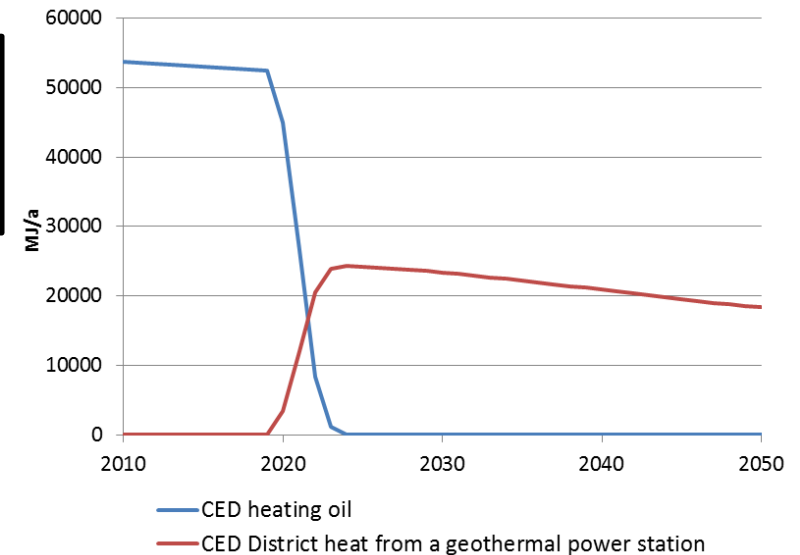
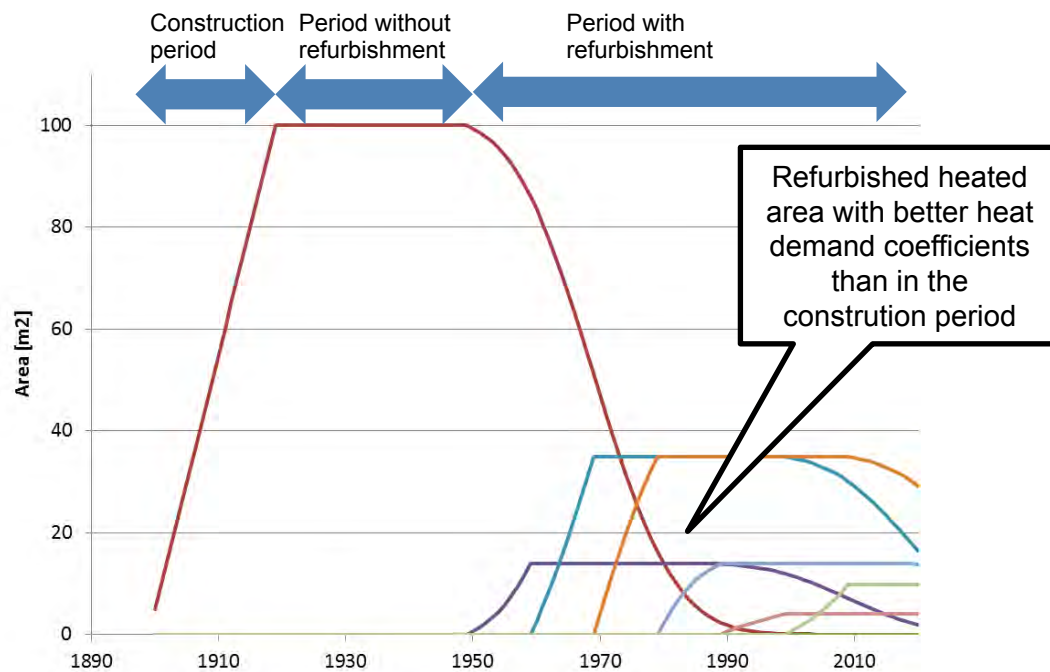
Added with characteristic values:

- Area proportions (Living space to heated area)
- Heat demand coefficient (MJ/m²a)
 - Source: Own analyses of 52 buildings of the city St. Gall
- Coefficients for CO₂-Equivalents and Cumulative Energy Demand (CED) for the energy supply
- Communal energy plan

Development of the refurbishment activities

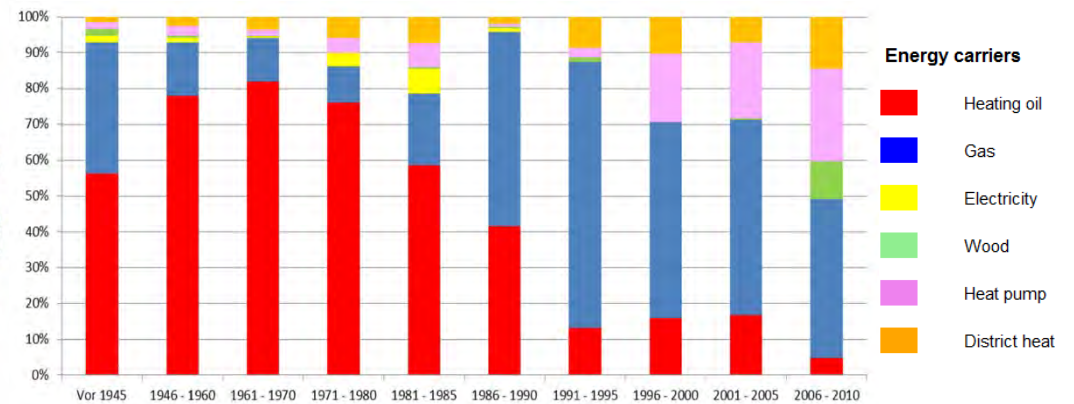
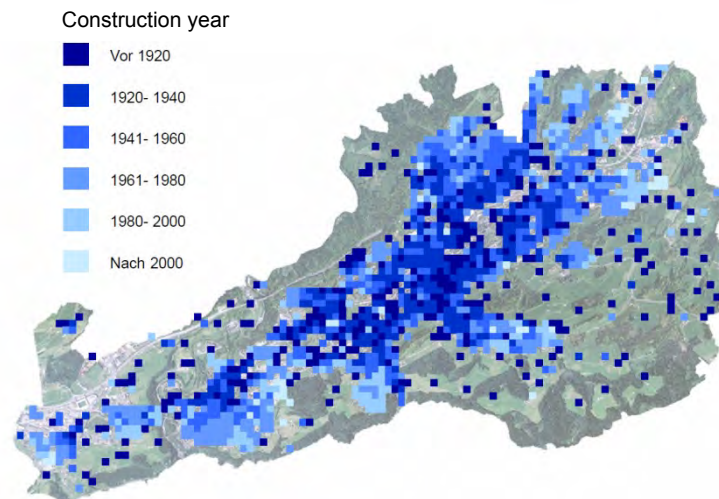
■ Solution: Development of the heated area and change of energy carrier within the heat supply

- The development depends on time and is given by the building stock .
- For each construction period is one heat demand coefficient defined.



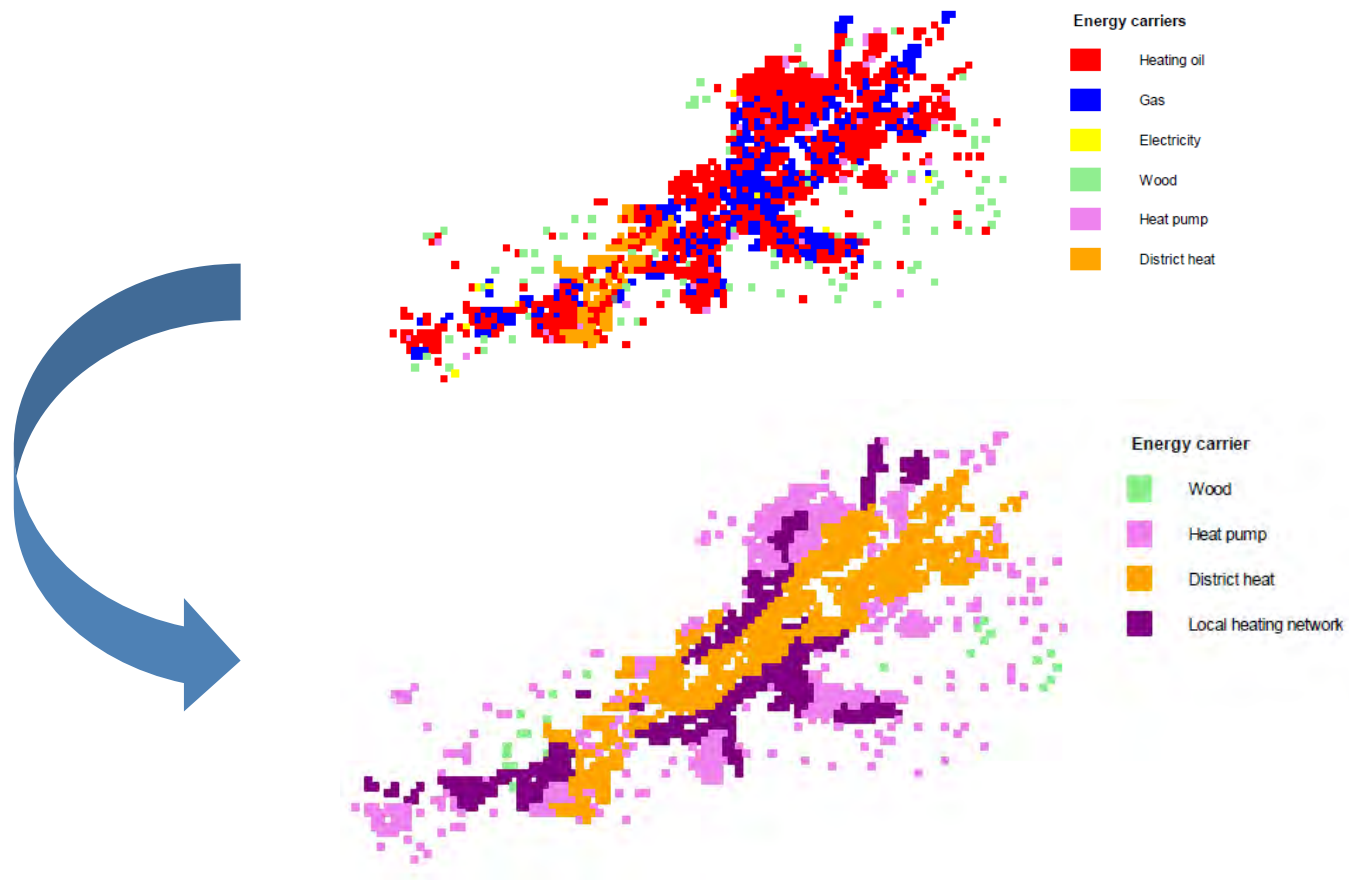
Results

■ Todays situation



Results

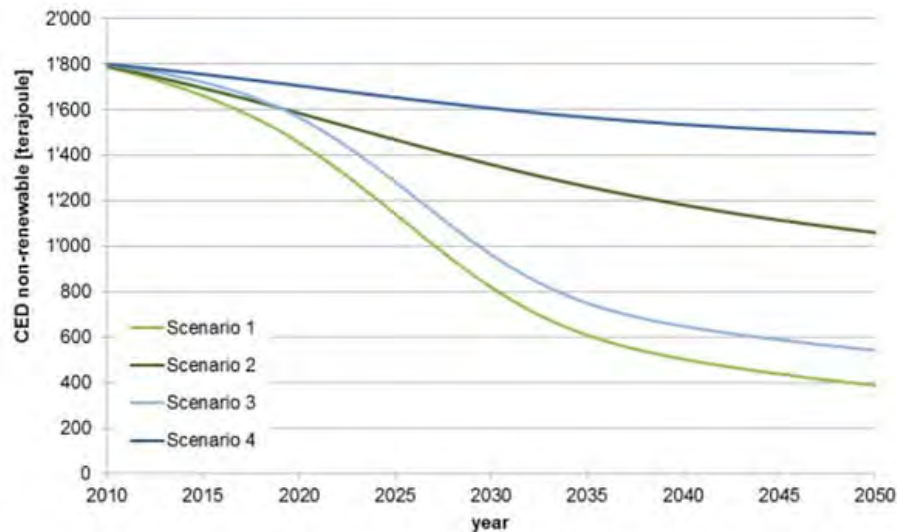
■ Todays and the future distribution of the Energy carriers



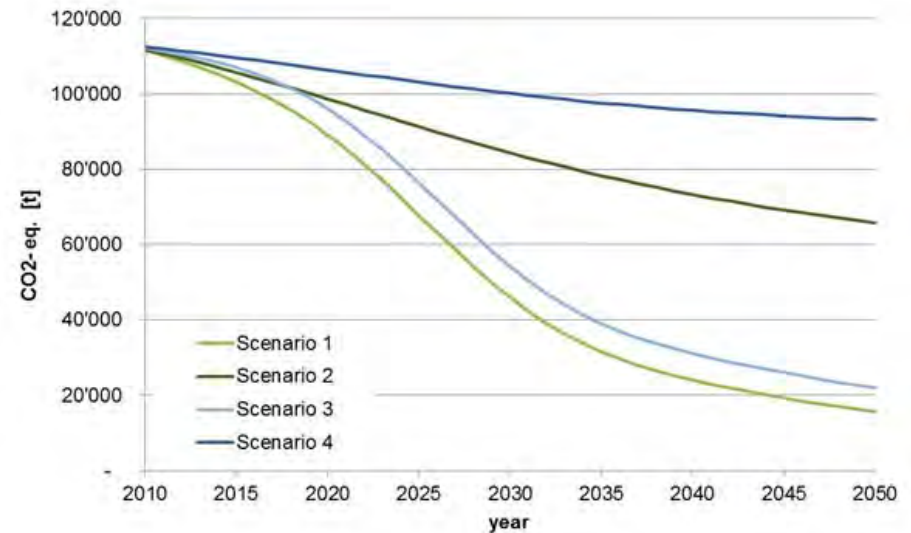
Results

- Scenario 1 «complete refurbishment with transformation of heat supply systems»
- Scenario 2 «complete refurbishment without transformation of heat supply systems»
- Scenario 3 «moderate refurbishment with transformation of heat supply systems»
- Scenario 4 «moderate refurbishment without transformation of heat supply systems»

Cumulative energy demand from 2010 to 2050

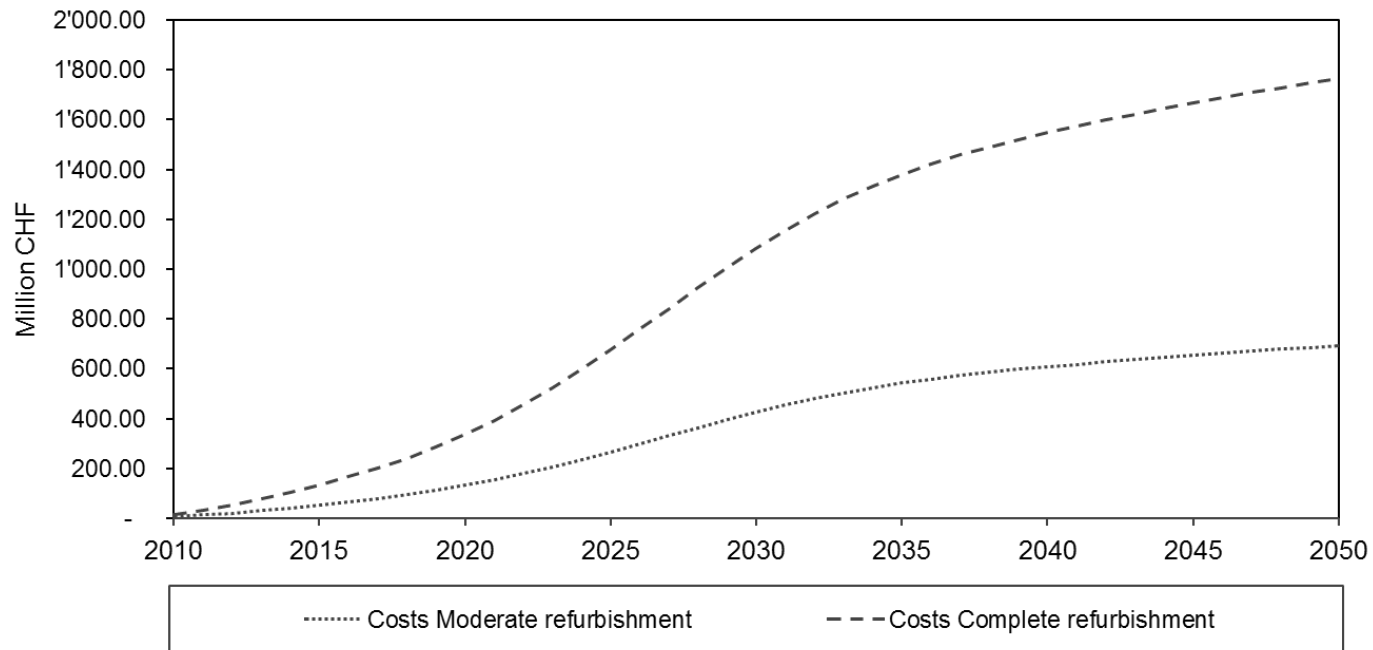


CO₂-Eq.-Emissions from 2010 to 2050



Results

■ Cumulated costs for complete and moderate refurbishment of the building stock of St. Gall



Summary

For the case study of the city of St. Gall:

- Energy goals of St. Gall can be reached by energy efficiency and transformation of heat energy systems
- Their strategy to support both by financial incentive can be confirmed
- Great efficiency gains can be gained from implementing the geothermal energy plant (as well as the realisation of the energy plan)

For the model:

- The model helps estimating the future heat demand of a certain building stock (e.g. a city) and the effects of efficiency gains by refurbishment and change of heat systems according to the communal energy plan
- Because of the good data base, it can easily be updated

QUESTIONS?

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