

Modelling heating energy demand, related efficiency potential and economic viability of apartment buildings in the Czech Republic

Agne Toleikyte

Gusshausstrasse 25 / E370-3, 1040 Wien, Tel: +43-1-58801-370337, Fax:
+43-1-58801-370397, E-mail: toleikyte@eeg.tuwien.ac.at

Core objectives

- Calculate heating energy demand and related efficiency potential in typical apartment buildings
- Analyse the economic viability of renovation activities
- Assess the impact of economic parameters on cost-effectiveness of renovation activities
- Discuss the necessity of support instruments

Motivation

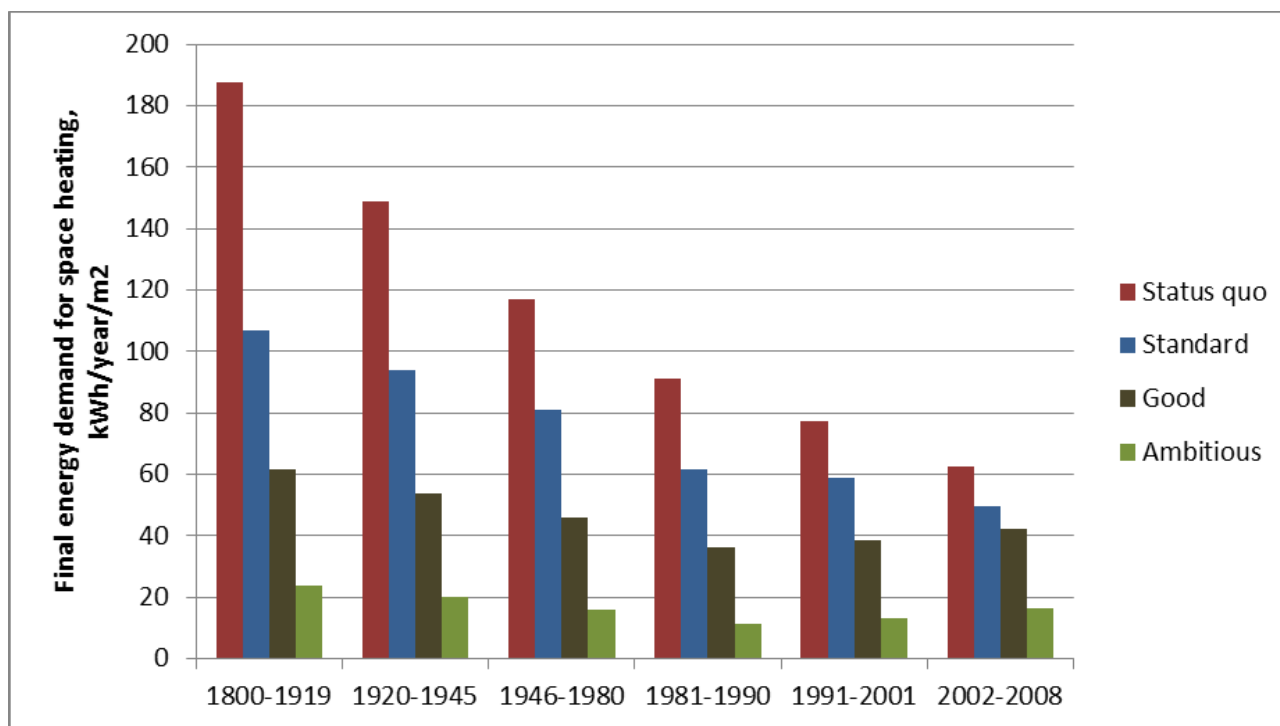
- The European residential sector (EU-27) was responsible for more than 23% of the gross final energy consumption in 2011 (Eurostat 2013)
- In several CEE countries, residential sector is related to even higher energy intensity (due to the apartment buildings built between 1950 and 1990)
- Apartment share of the total residential floor area built between 1950 and 1990 is 72% in CZE
- These buildings provide a high technical potential for efficiency improvement
- However, there are many barriers complicating these activities, like high investments, relative low energy prices, life time of the building

Methodology

- Data collection
 - Building stock (building geometry data, building thermal characteristics, heat supply technologies etc.)
 - Climate data
 - User profiles
 - Energy prices
 - Investment costs of refurbishment options
- Energy demand calculation (Bottom-up approach)
 - Calculation of energy need– monthly balance approach (Building simulation tool Invert-EE/Lab)
 - Final energy demand for space heating calculation
- Calculation of cost-effectiveness of diff. renovation option
 - Definition of three renovation measures (standard renovation, good renovation, ambitious renovation)
 - Net Present Value
- Impact of economic parameters on the cost-effectiveness
 - Sensitivity analysis

Results

Heating energy demand and relative efficiency potential

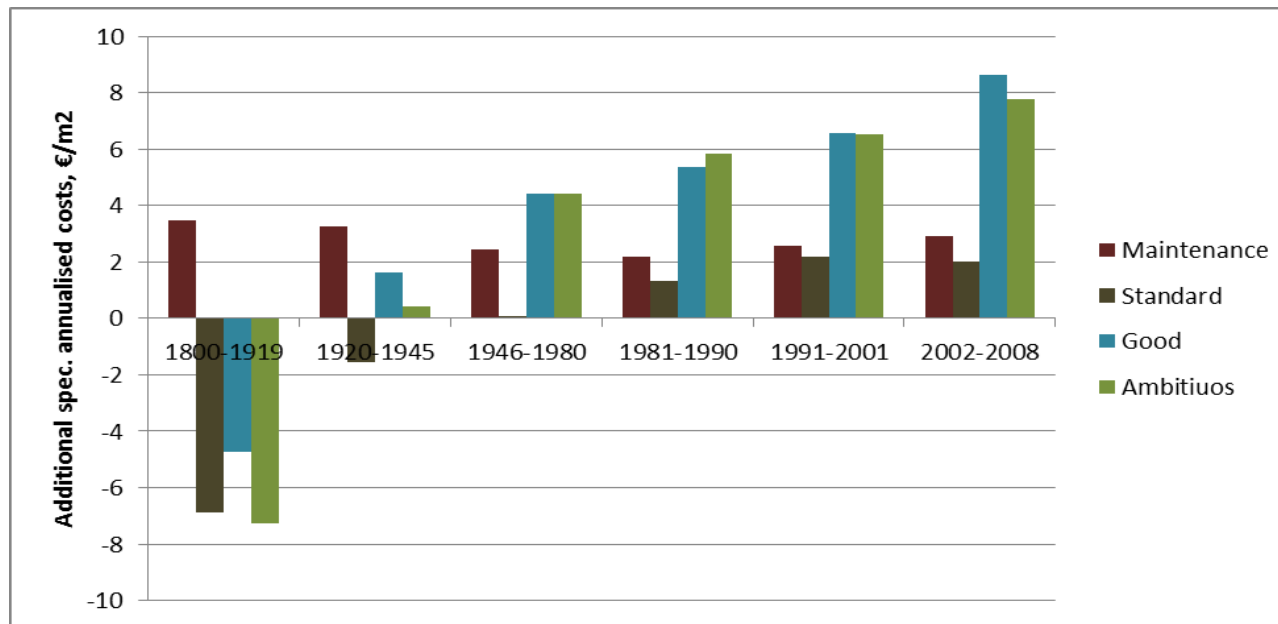


Results

Economic viability of different renovation options

➤ Used parameters:

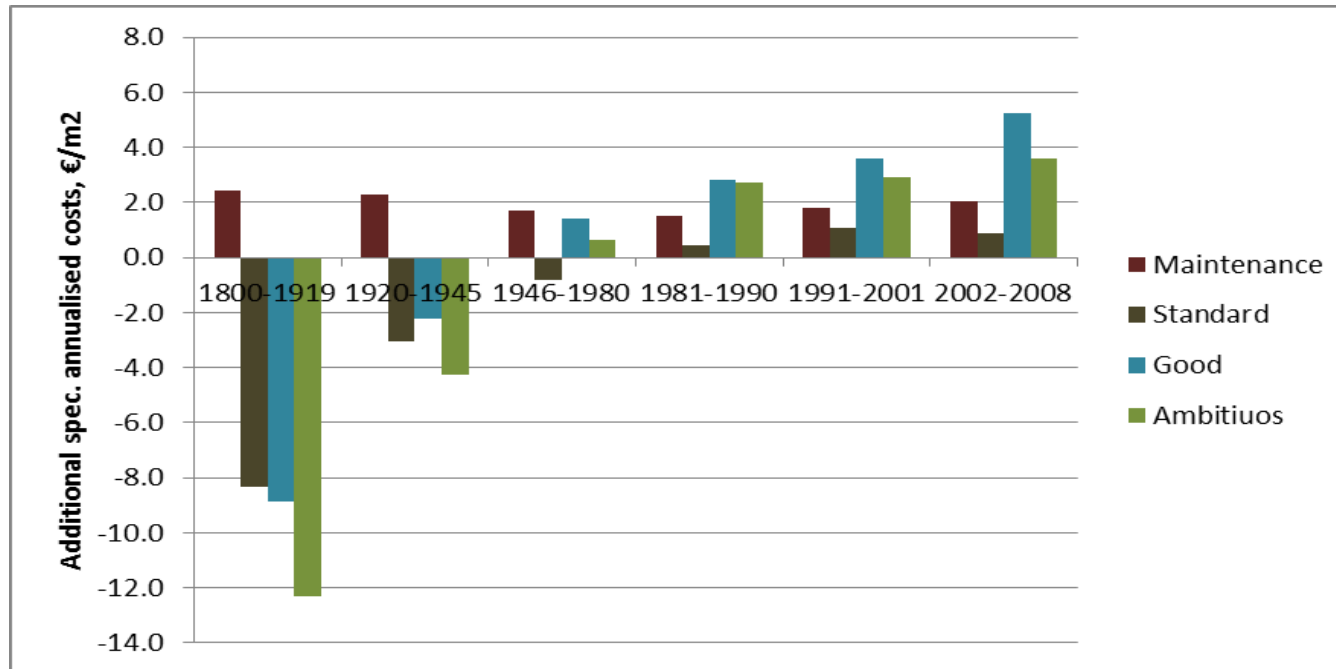
- Investment costs
- Interest rate
- District heat energy price
- Life time of the building components
- Energy demand before and after renovation



Results

Economic viability of different renovation options and impact of financial support

- Investment subsidy of 30%

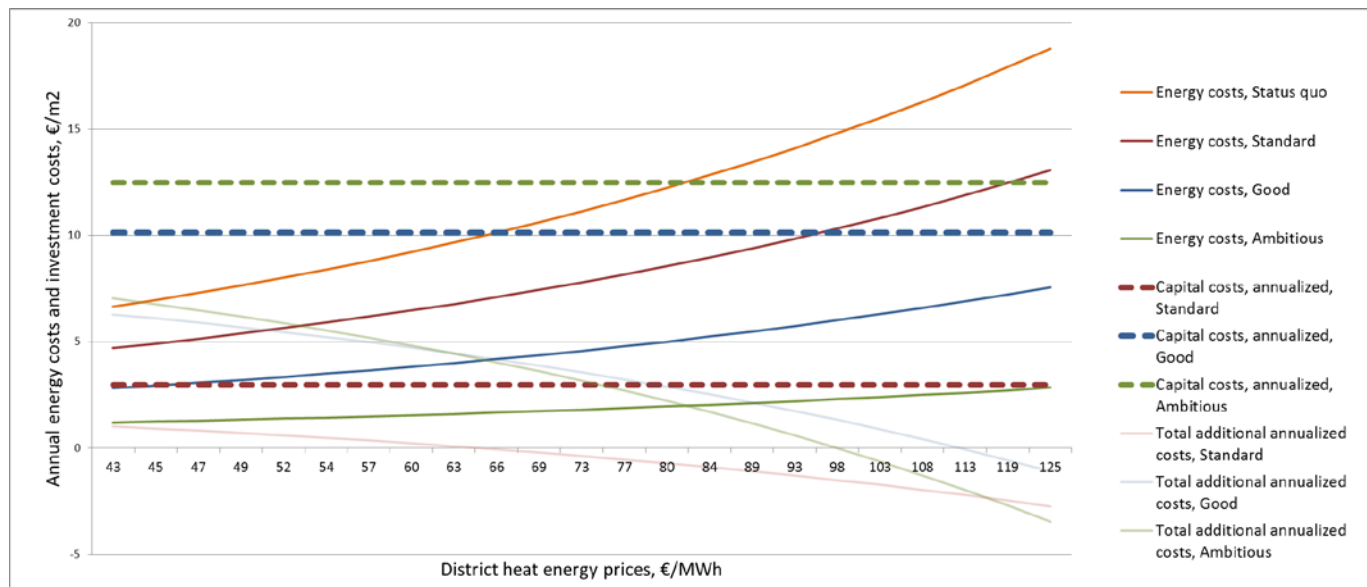


Results

Economic viability of different renovation options and impact of economical parameters

➤ Sensitivity analysis

- Energy price of district heating (from 43 to 125 €/MWh)
- Building built between 1946 and 1980 supplied by district heating



Conclusion

- Specific energy demand varies from 182 kWh/m²/year to 62 kWh/m²/year
- Energy savings of app. 43% and of app. 80% can be achieved with a standard and an ambitious renovation, respectively
- However, techno-economical assessment shows that these activities are related to high investment costs and corresponding additional annualised costs
- The cost-effective renovation option is standard or ambitious renovation applied for the buildings built between 1800 and 1919
- Investment subsidy of e.g. 30% can reduce the total additional annualized costs from 4.4 €/m² to 0.7 €/m² (building built between 1946 and 1980)
- The economic parameters like energy prices, interest rates have crucial impact on the cost-effectiveness of the renovation options

Outlook

- Evaluate recent experiences with financial support programmes and calculate their economic viability
 - Investment subsidies
 - Tax credits..
- Calculate final energy demand for space heating in all apartment buildings in order to estimate
 - Total investments
 - Total investment subsidies
 - Evaluate recent budget for the building renovation and calculate what energy savings could be achieved with the budget
 - Calculate investment subsidies and budget needed to achieve energy saving targets
 - (In order to fulfill NEEAP in CZE, end use energy savings of 1.5% or 13 TWh (5 TWh in building sector) should be achieved by 2020)
- Consideration of different tariff models for district heating and their impact of the cost-effectiveness of the renovation investment

Thank you for your attention

Objectives

- Analyse typical apartment buildings
- Calculate final energy demand for space heating
- Define renovation options
- Calculate final energy demand by applying different renovation options
- Analyse cost-effectiveness of the renovation options
- Analyse the impact of economic parameters e.g. energy prices and rate of return