IS THE EUROPEAN BUILDING SECTOR ON THE WAY TO DECARBONISATION?

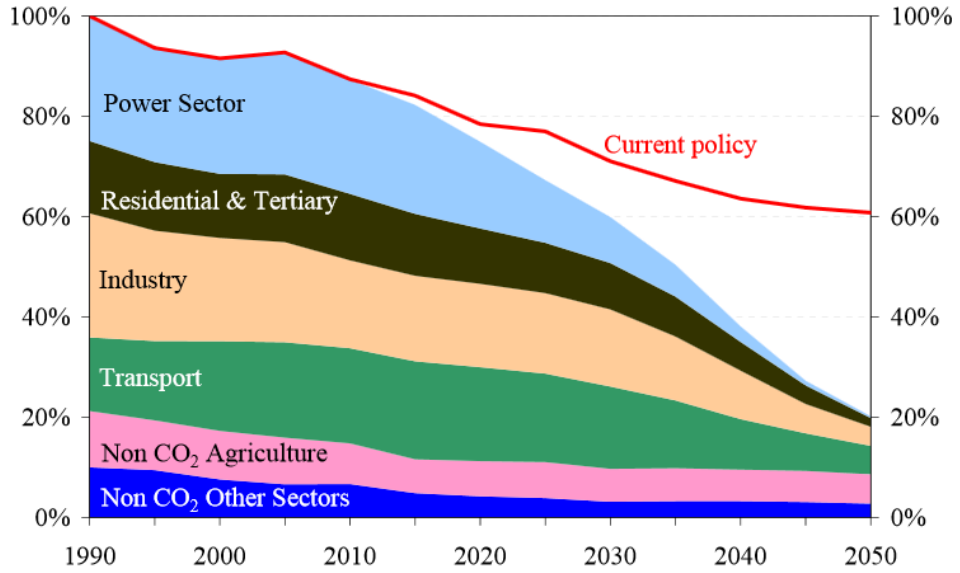
Agne Toleikyte, Lukas Kranzl, Andreas Müller, Raphael Bointner

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

Content

- Motivation
- Methodology
- Results

Motivation



Source: A Roadmap for moving to a competitive low carbon economy in 2050, European Commission, 2011

- Emissions could be reduced by 90% by 2050 in the building sector (acc. to the Commission´s analysis)
  - Through improvement of the energy performance of the buildings
    - New building standard
    - Refurbishment of the existing building stock
    - Use of the renewable energy
- Main instrument is the EU building directives: EED & EPBD
  - nZEB standard
  - Renovation minimum requirement

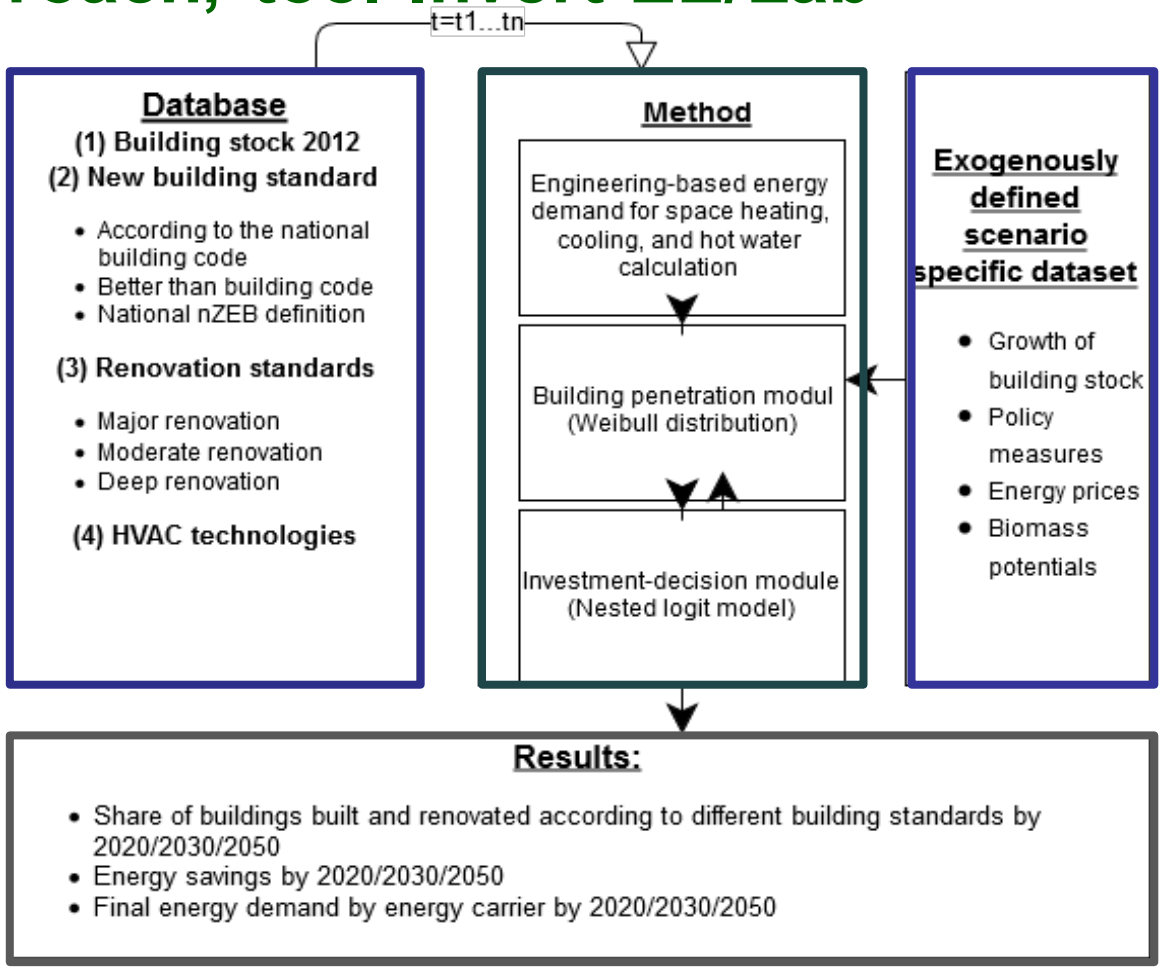
Research questions

- What CO_2-emission reduction and energy demand reduction can be achieved until 2050 in Italy and Norway due to the
  - Energy efficiency (renovation rate and depth)
  - Renewable energy

Main objectives

- Survey and assessment of the building stock data
- Analyze current national building codes and national definition of the nZEB
- Modelling long-term energy demand scenarios and assess two main drivers:
  - Renovation and new construction rates
  - Renovation depth

Methodological steps. Bottom-up techno-economic approach, tool Invert-EE/Lab

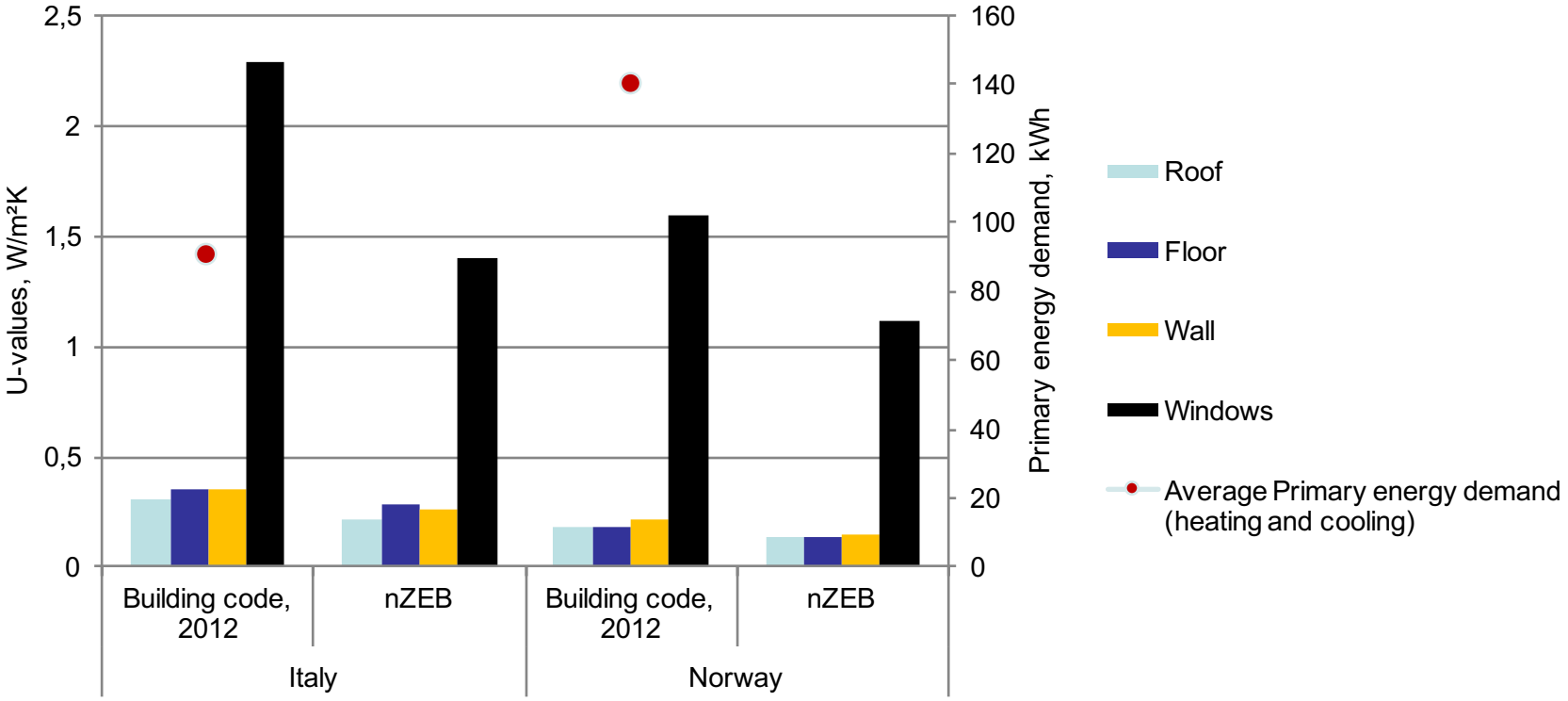


Source: Simplified flow chart of the model Invert-EE/Lab (own illustration based on Müller A., 2014. The development of the built environment and its energy demand for space conditioning and domestic hot water supply. A model based scenario analysis. Doctoral thesis

Renovation standard & New building standards

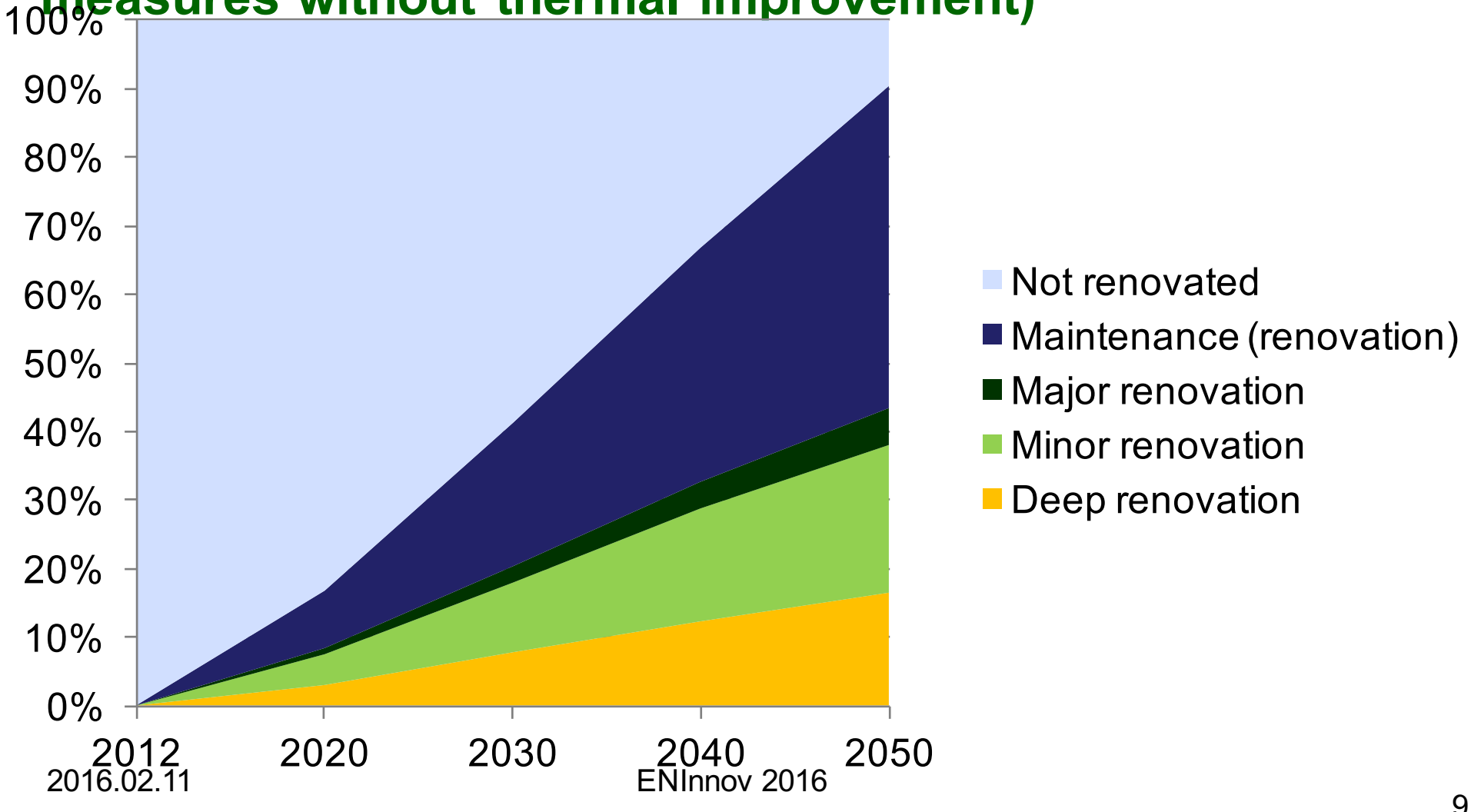
- Renovation options
  - **Major renovation** (Building codes for building renovation 2012)
  - **Minor renovation** (lack of compliances, U-values are increased by 30% compared to the building codes)
  - **Deep renovation** (U-values are reduced by 30% compared to the building code)
  - **Maintenance renovation**
- New building standards
  - 2012 – 2020: Building code, 2012
  - From 2021: national nZEB definition (obligation for renewables)

Policies: Building codes for new construction and building refurbishment

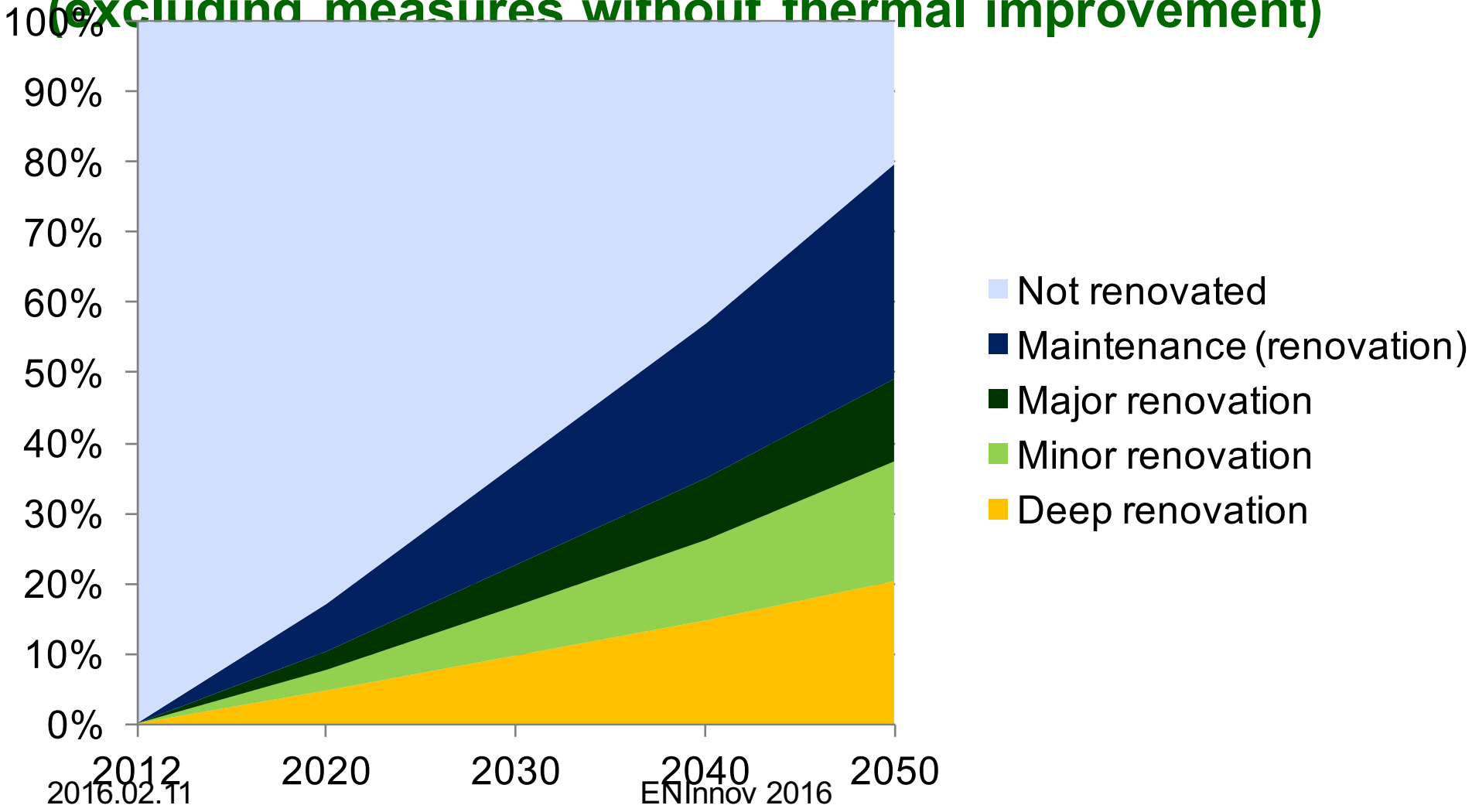


The minimum building transmittance value requirements for building elements according to national building standards in Italy and Norway. In Italy, the requirements are set in Legislative Decree 311/2006. These values are in force until 2016 and will be replaced with the requirements for nZEBs. There is no official national nZEB definition. An assumption was made 30% lower U-values compared to the building code. Minimum share of energy demand supplied by renewable energy sources: 20% until 2021 for all building categories (Single family houses, apartment buildings and service buildings) and 50% from 2021 in Italy. In Norway, minimum share of energy demand supplied by renewable energy sources: 20% from 2021 for all building categories. nZEB standard is used only for new building construction and building code, 2012 for both, new construction until 2020 and building renovation

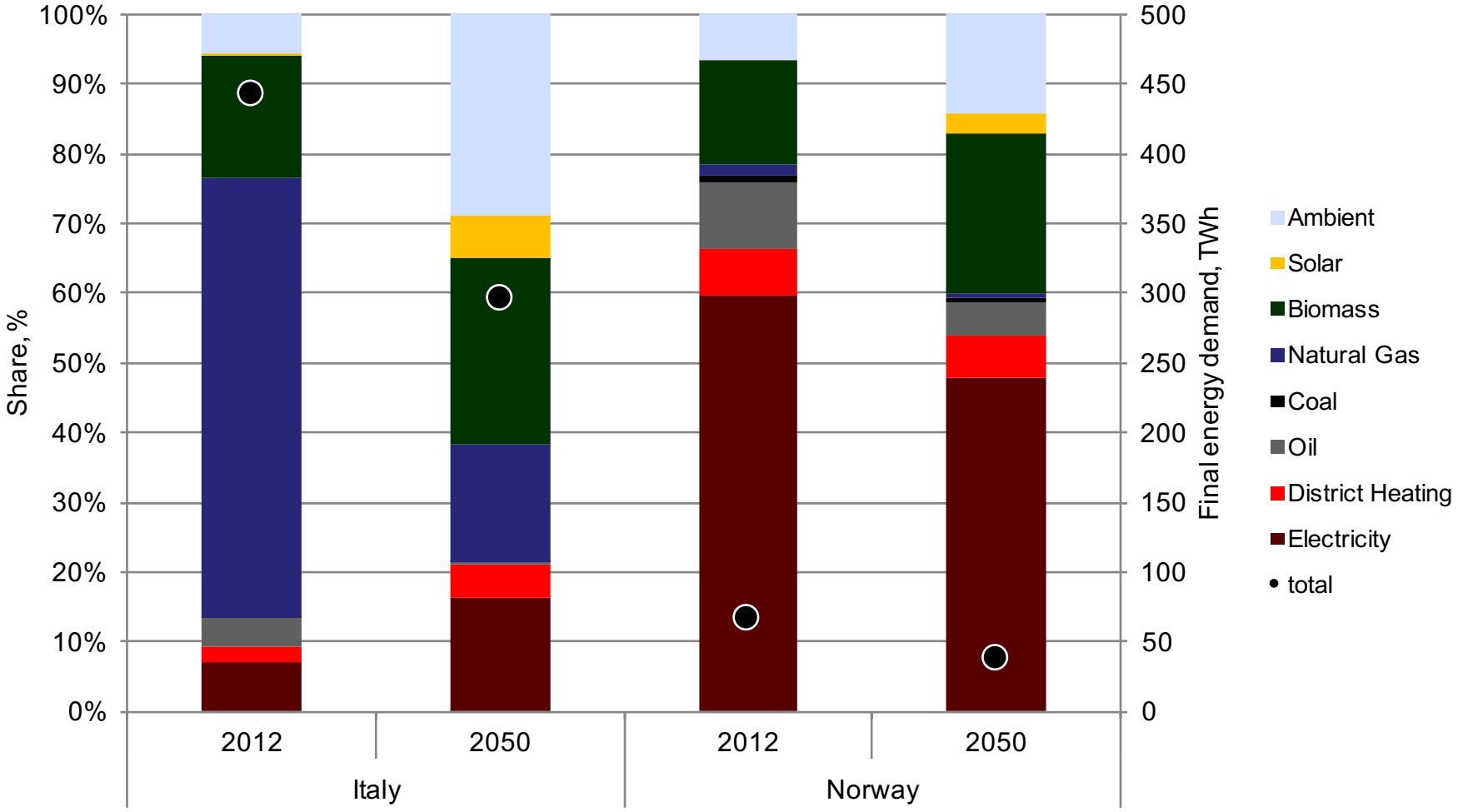
ITALY: Building stock development: cumulated floor area. Italy. Yearly renovation rate ~1% (excluding measures without thermal improvement)



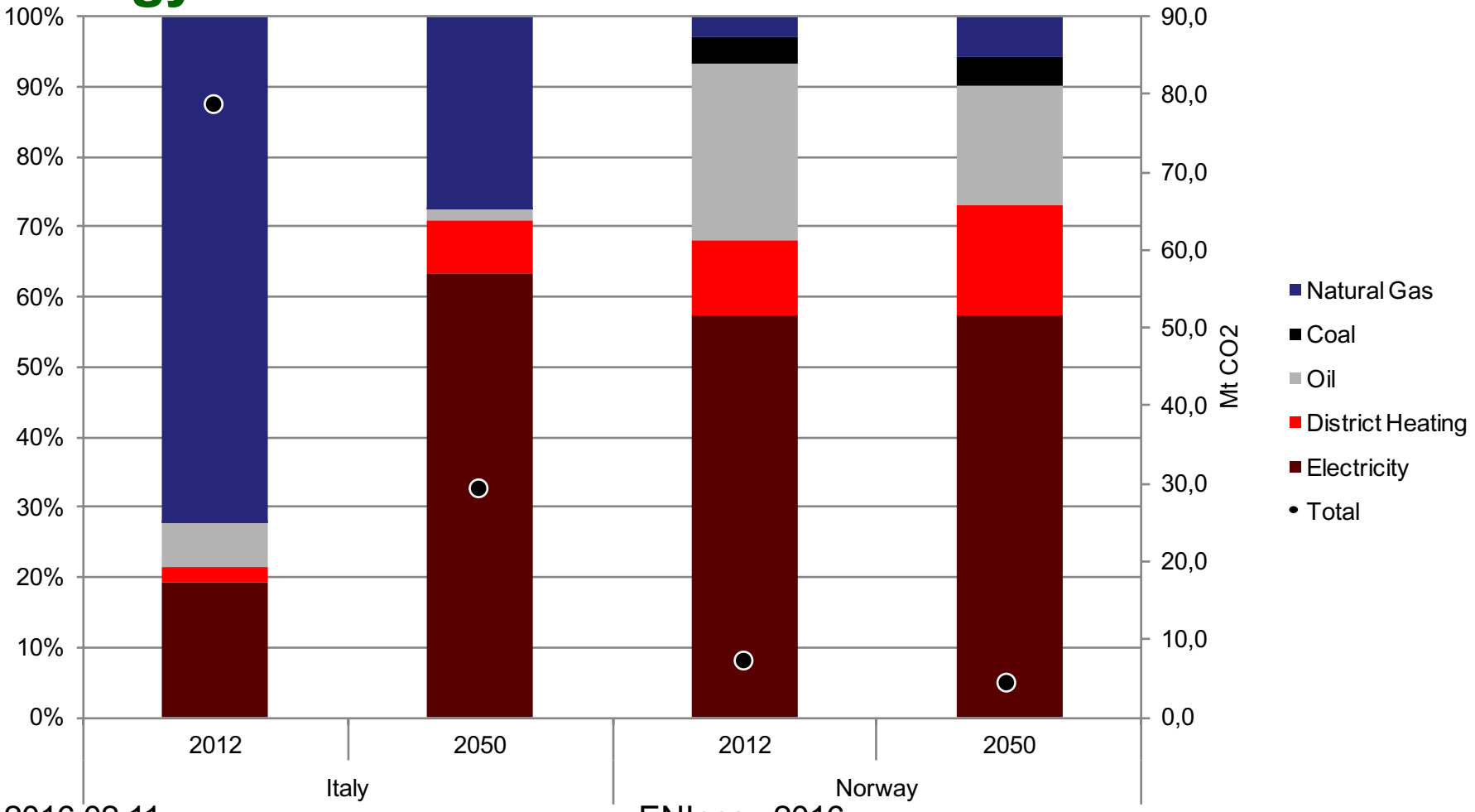
NORWAY: Building stock development: cumulated floor area. Italy. Yearly renovation rate ~1.4% (excluding measures without thermal improvement)



Final energy demand for space heating and hot water by energy carriers



CO2-emissions by energy fuels caused by the building stock´s space heating and hot water energy demand



Conclusions

- Cumulated renovation rate including measures without thermal improvement until 2050 is 78% in Norway and 85% in Italy, based on
  - Building construction periods and life times
- Cumulated renovation rate excluding measures without thermal improvement is 50% in Norway and 44% in Italy
- Energy savings, however, depends on
  - Renovation depth
- Implemented type of renovation is driven by policies and other parameters such as
  - National building codes; subsidies
  - Economic feasibility of the renovation (climate condition, building thermal conductivity before renovation, energy price, investment costs)
- Strong policy is needed to avoid lock-in effect
  - Financial to increase the building skills of craftsmen and planners (to avoid lack of compliances)
  - Subsidies to increase cost feasibility of the investments
- Obligation to use renewable energy in Italy lead to the high share on the total energy demand
- In the BAU scenario, the CO2 emission factor for electricity remains constant due to an unchanged generation mix, which leads to untapped potential of CO2 savings

ZEBRA 2020

NEARLY ZERO-ENE NEARLY ZERO-ENERGY BUILDING STRATEGY 2020 RGY BUILDING STRATEGY 2020

Projekt-Dauer 1/4/2014 – 30/9/2016

Thank you for your attention

Back-up

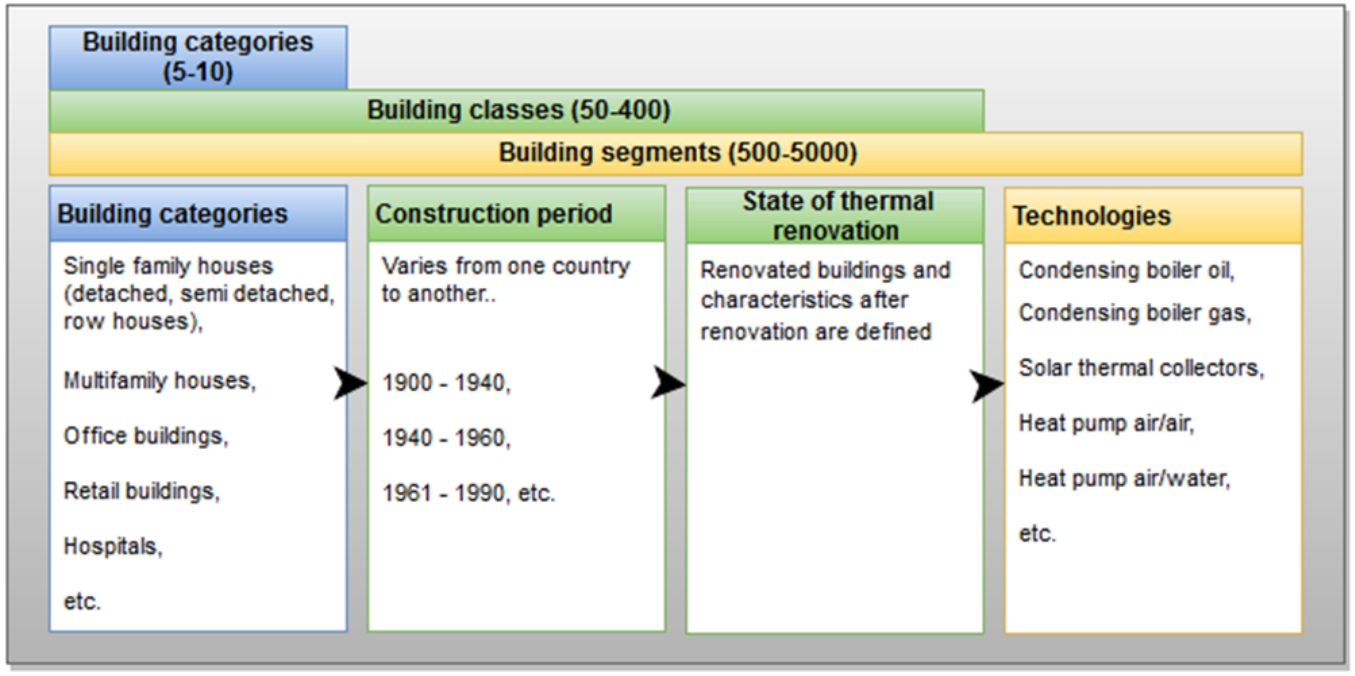
Invert/EE-Lab models the decision-making of building owners. Policy instruments may affect these decisions in the following ways:

Economic incentives change the economic effectiveness of different options and thus lead to other investment decisions.

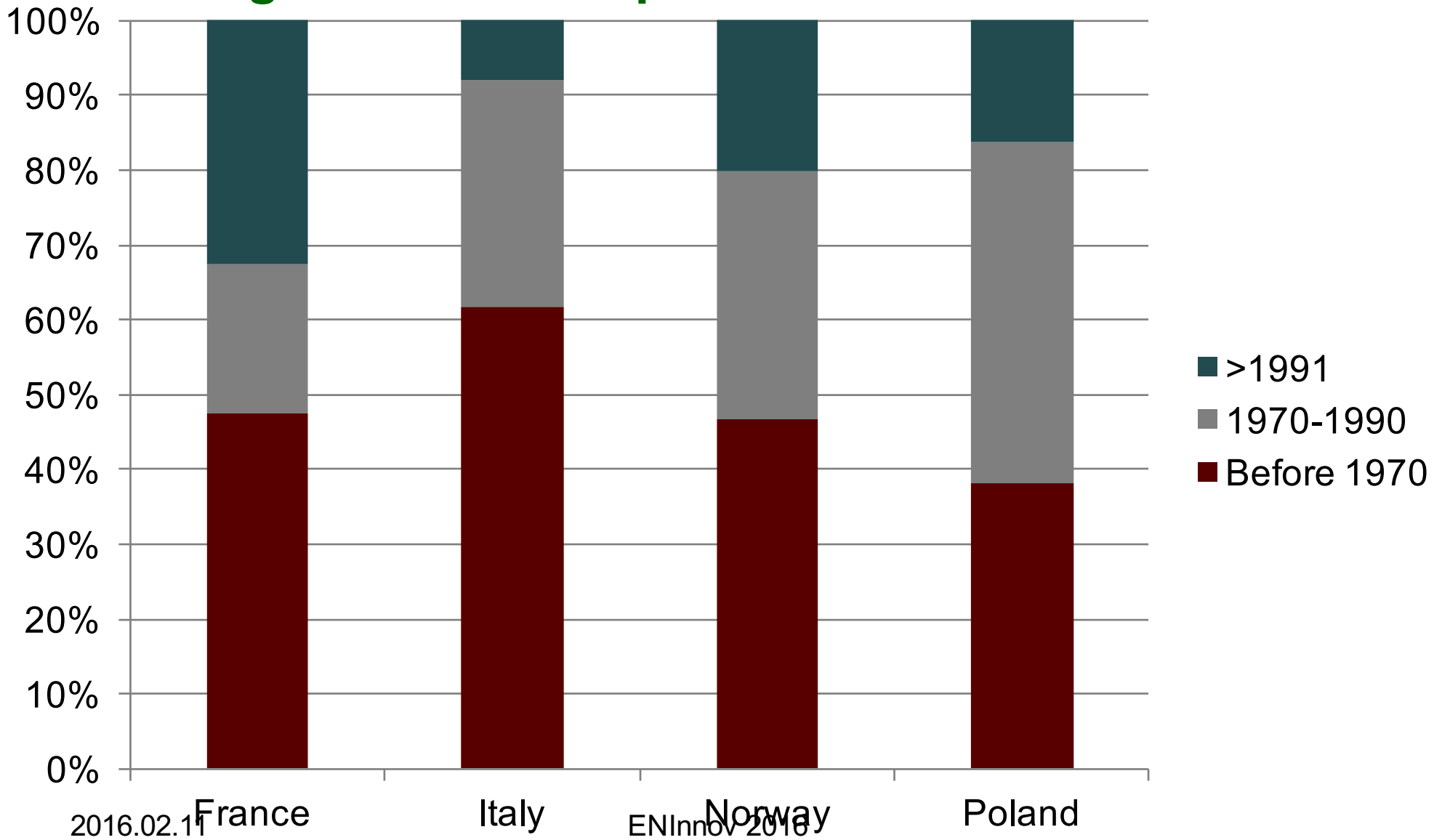
Regulatory instruments (e.g. building codes or renewable heat obligations) restrict the technological options that decision makers have.

Information, advice, etc.: agents have different levels of information. Lack of information may lead to neglecting of innovative technologies in the decision making process or to a lack of awareness regarding subsidies or other support policies.

R&D can push technological progress. The progress in terms of efficiency increase or cost reduction of technologies.

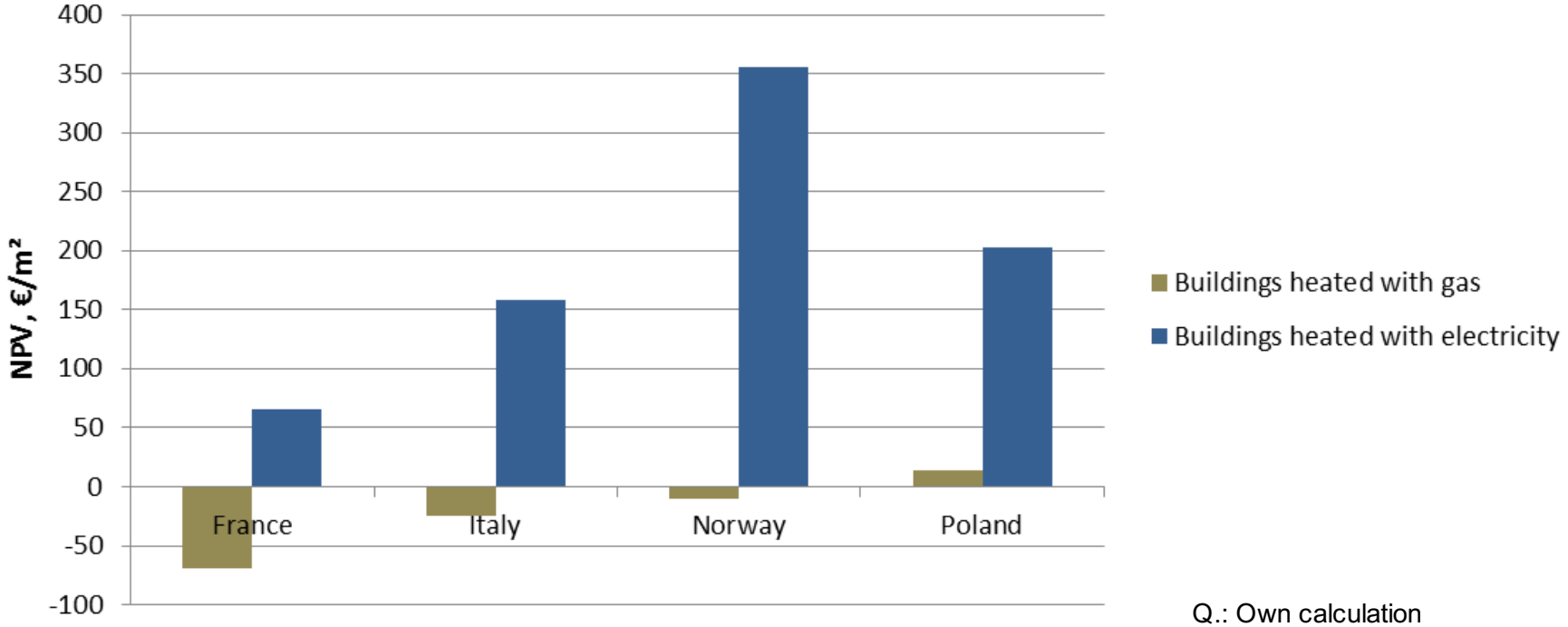

Building categories (5-10)
Building classes (50-400)
Building segments (500-5000)
Building categories
Single family houses (detached, semi detached, row houses),
Multifamily houses,
Office buildings,
Retail buildings,
Hospitals,
etc.
Construction period
Varies from one country to another..
1900 - 1940,
1940 - 1960,
1961 - 1990, etc.
State of thermal renovation
Renovated buildings and characteristics after renovation are defined
Technologies
Condensing boiler oil,
Condensing boiler gas,
Solar thermal collectors,
Heat pump air/air,
Heat pump air/water,
etc.

Building construction periods



Results: cost effektiveness of investment in building renovation

- Building renovation to achieve national minimum energy performance requirements
- Varies due to the different energy price, investment costs, energy savings



Q.: Own calculation