
ANALYSIS OF THE EUROPEAN RESIDENTIAL BUILDING STOCK UNTIL 2050

- CONTRIBUTION OF AN ENERGY-EFFICIENT BUILDING ENVELOPE TO REDUCE SPACE HEATING DEMAND -

Rainer Elsland, Tobias Boßmann, Martin Wietschel

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Agenda

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 - I. Characteristics Energy Model (FORECAST)
 - II. Structural model framework and drivers
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 - II. Calibration, assumptions and level of detail
 - III. Sensitivity analysis of EU27 building stock
- IV. Conclusion and outlook

Introduction

- **Key challenge for energy economy**

- Mitigation of climate change and necessity to transform energy system

- **Most significant driver**

- Lowering energy demand

- **Substantial contribution**

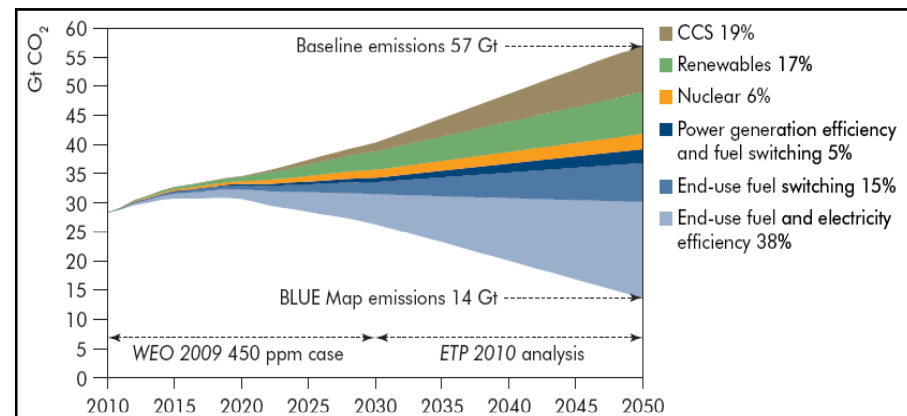
- Reduction energy demand for space heating in residential sector ...
... EU-wide 8,595 PJ (2010)
... equivalent to **17.8 %** of

overall final energy

demand in the **EU 27** (48,291 PJ)

- **Major driver** to decrease space heating demand: **thermal efficiency** of the **building envelope**

- **Aim:** In which way will space heating demand develop until 2050 in the EU27 (due to significance specific focus on climate change)?



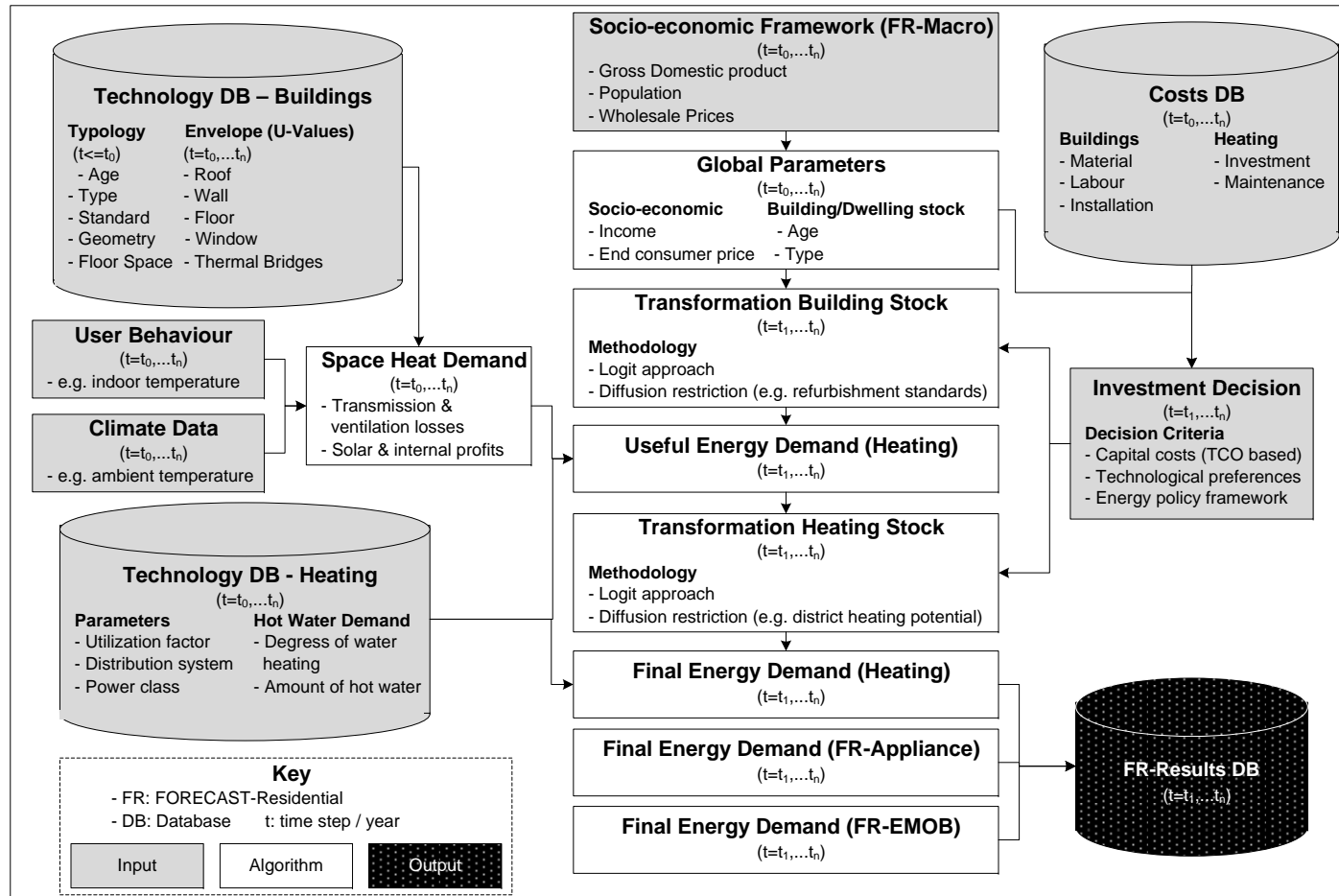
Methodological approach

- Characteristics Energy Model (FORECAST)

- **Coverage:**
 - Countries: EU 27+4 (4: Norway, Switzerland, Turkey, Serbia)
 - Sectors: Industry, Tertiary, Residential, Transport, Agriculture
 - Projection horizon: 2008 – 2050
 - Calculation: Yearly steps
- **FORECAST-Residential** (utilized for this study):
 - Contains: 4 Modules (FR-Macro, FR-Appliances, FR-Heating, FR-EMOB)
 - **Focus on heating modul (FR-Heating)**
 - **Methodology:**
 - Bottom-up-model
 - Vintage stock model
 - Simulation
 - Investment decision: TCO-based / Logit-approach

Methodological approach

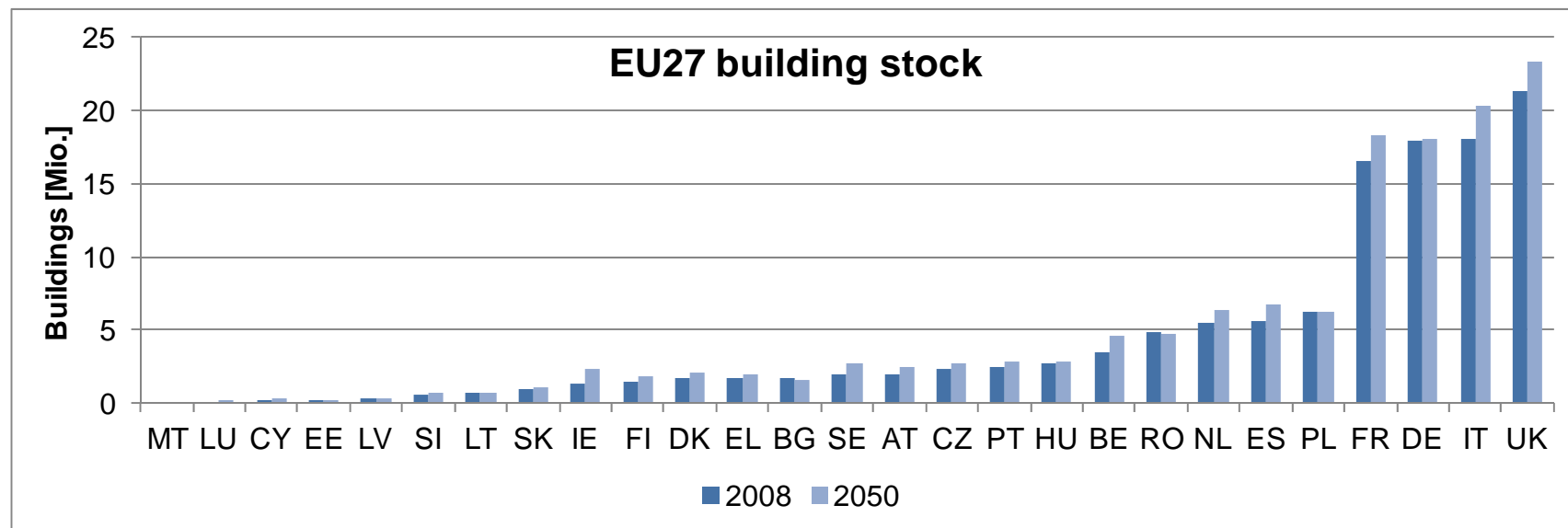
- Structural model framework and drivers



Case study

- Framework and building stock development

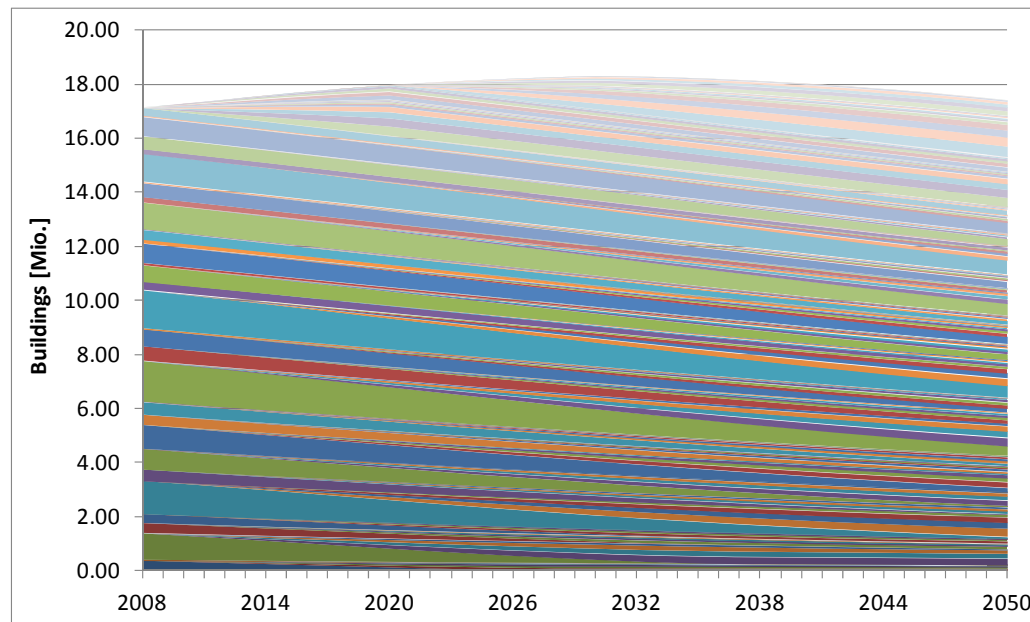
- **Explorative scenario:** Ambitious Climate Policy Scenario (ACS)
- **Coverage: EU 27**
 - results are grounded on framework parameters of EU Energy Roadmap 2050 (KIC)
- **Modeling horizon:** 2008 – 2050
- **Sensitivity analyses:**
 - Refurbishment rate: +0%, +50%, +100% (until 2020 and beyond constant)
 - Ambient temperature increase (Climate change): +0°C, +2°C, +4°C



Case study

- Calibration, assumptions and level of detail

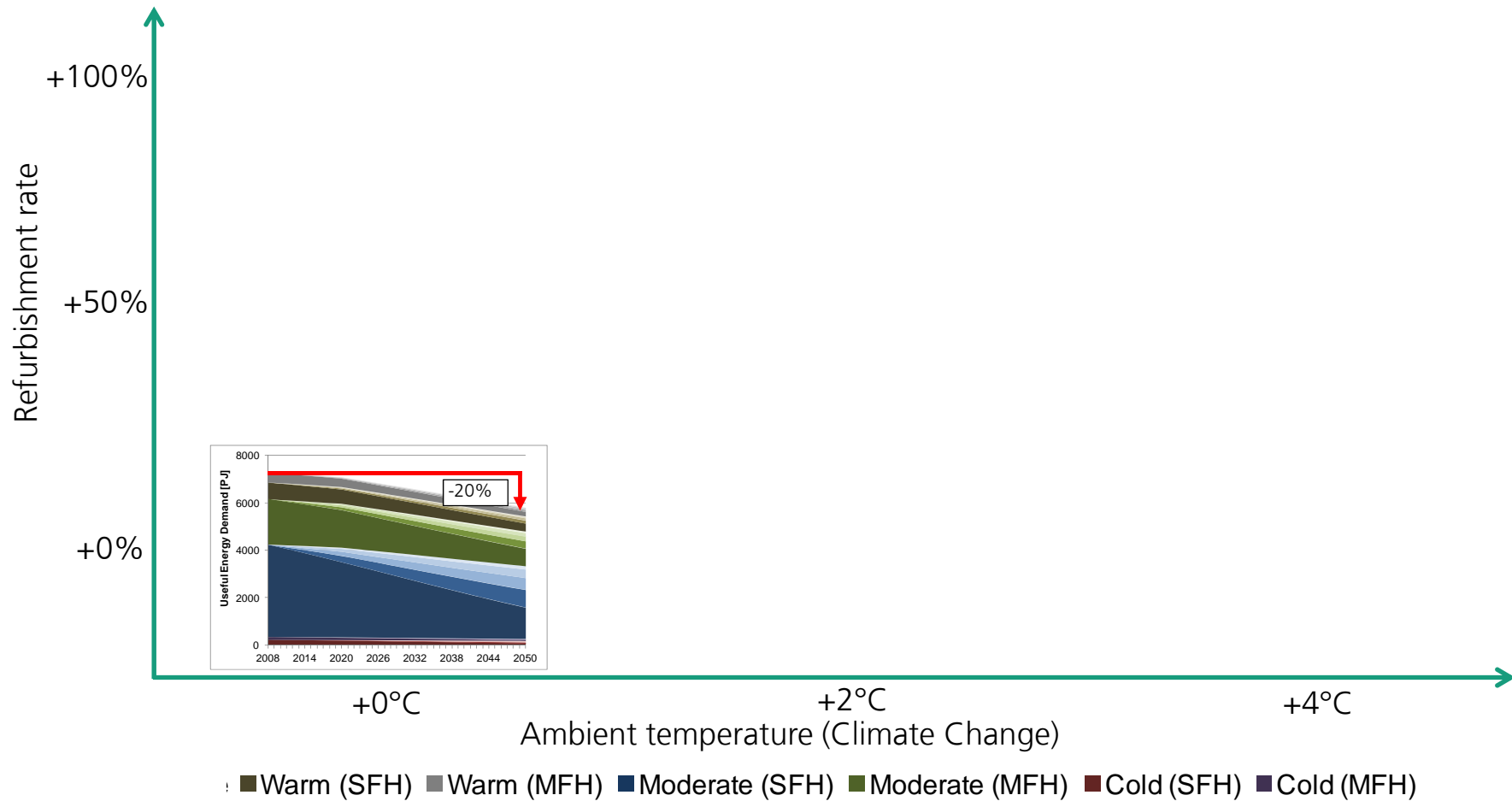
- **Calibration:** Most recent studies mainly: BIPE, 2011, BPIE, 2011, Fraunhofer ISI, 2009a, Fraunhofer ISI, 2009b, IWU et al., 2010
- **Assumption:** The yet to be taken energy policy regulations will be implemented and beyond progression of energy regulations (e.g. EPBD)
- **Level of detail of FORECAST-Residential** (example **Germany** → 240 categories):



[BIPE, 2011, BPIE, 2011, Fraunhofer ISI, 2009a, Fraunhofer ISI, 2009b, IWU et al., 2010; EU, 2010]

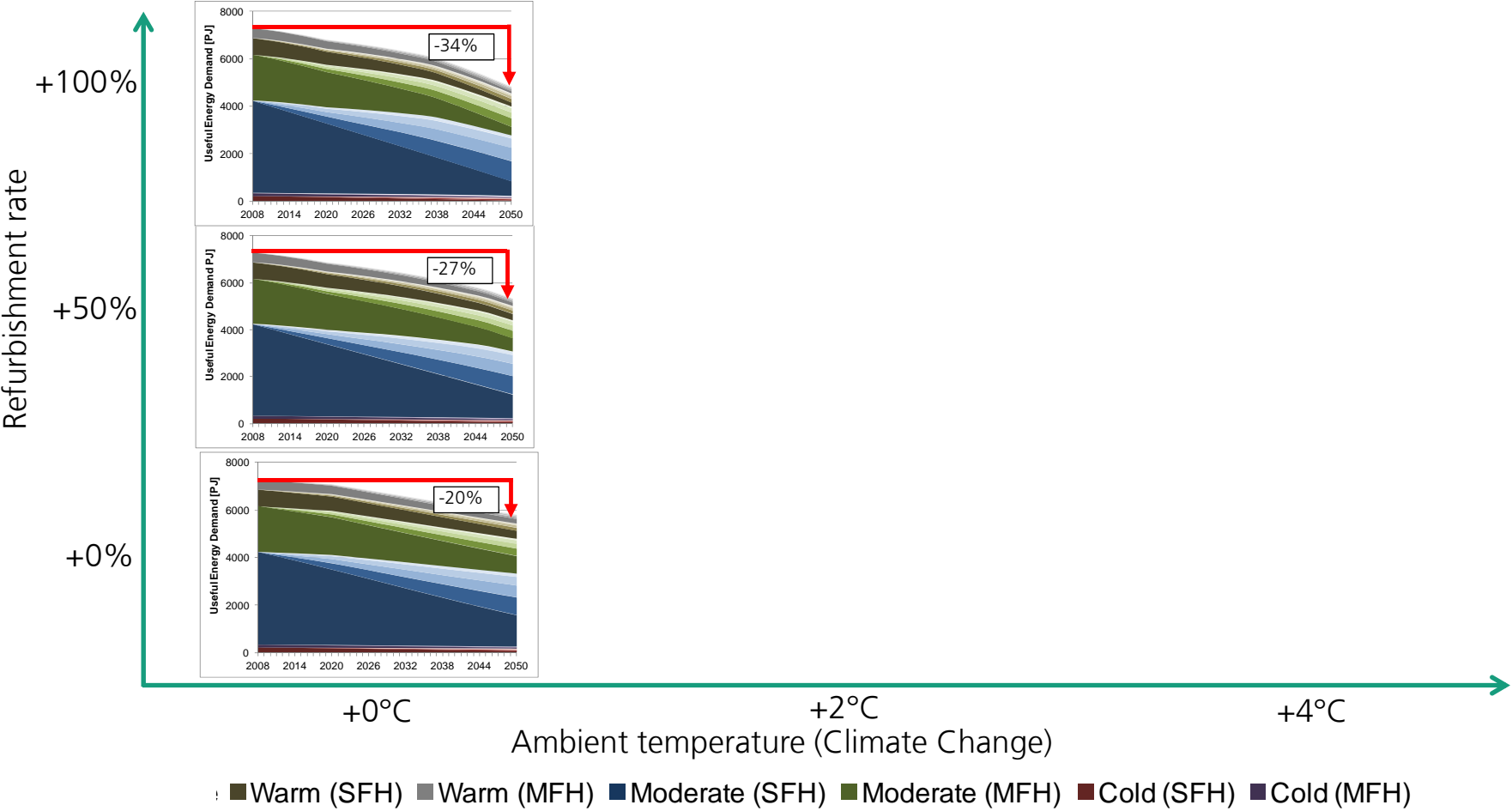
Case study

- Sensitivity analysis of EU27 building stock



Case study

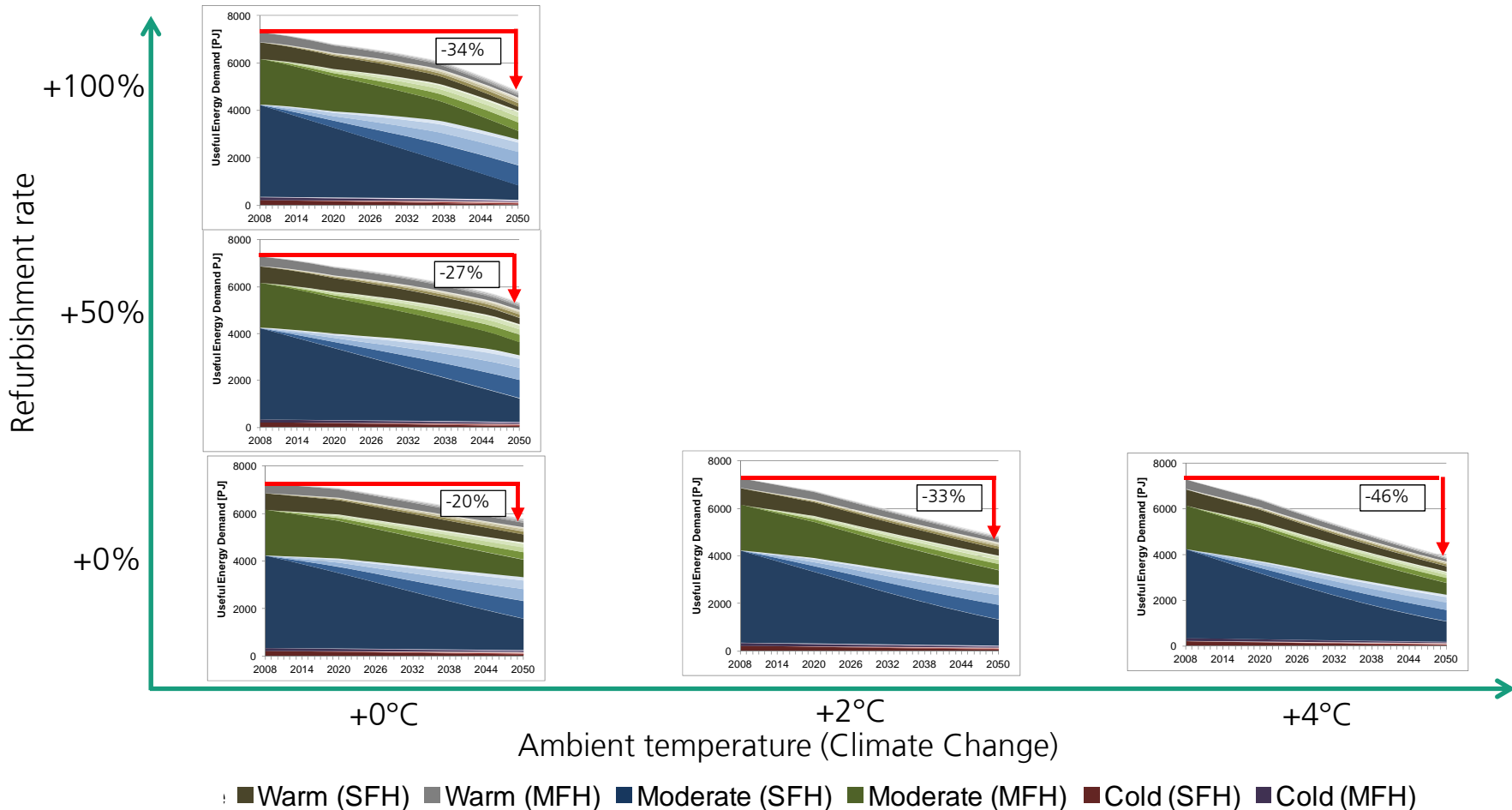
- Sensitivity analysis of EU27 building stock



[Fraunhofer ISI, 2009a]

Case study

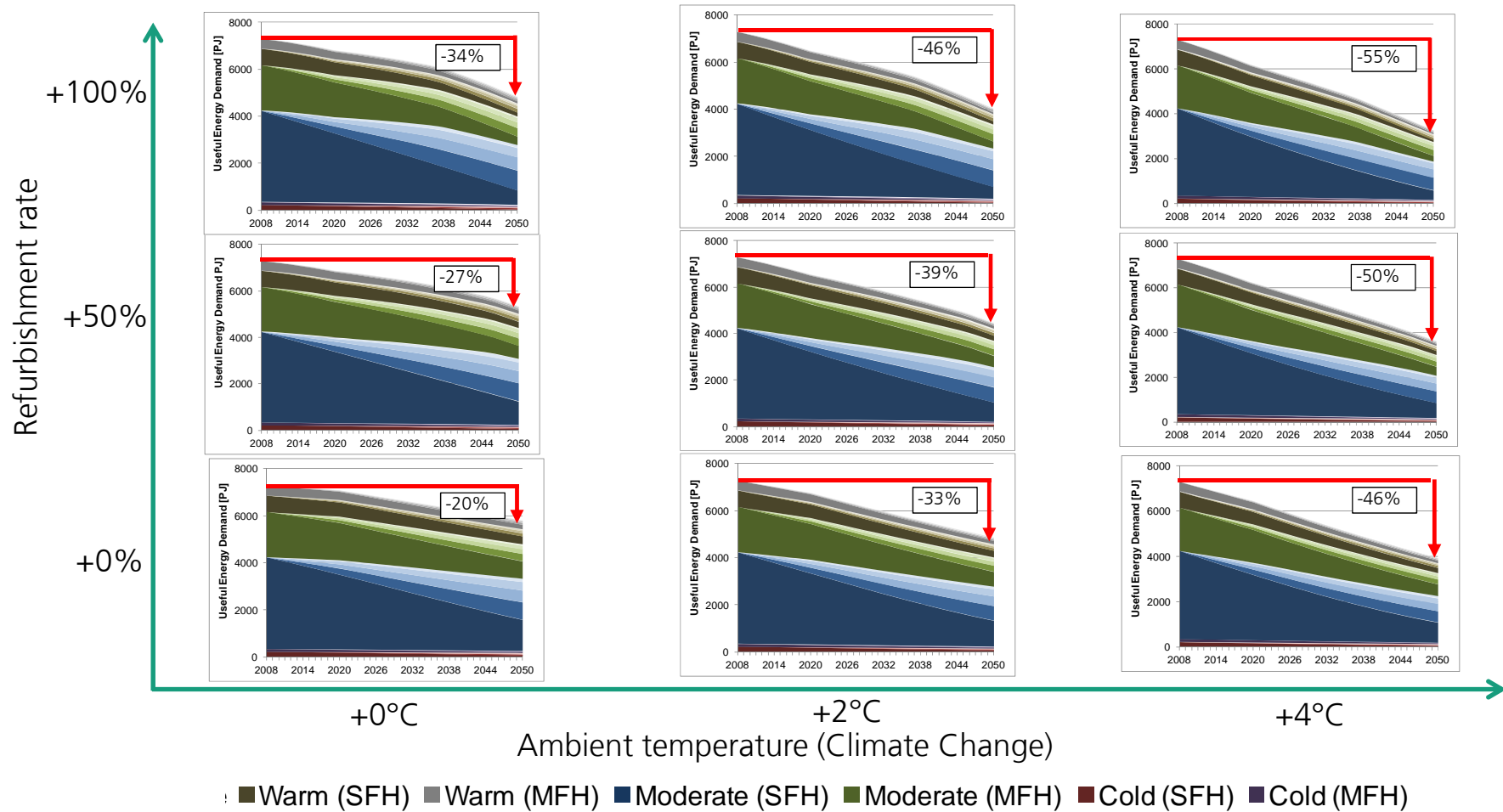
- Sensitivity analysis of EU27 building stock



[Fraunhofer ISI, 2009a]

Case study

- Sensitivity analysis of EU27 building stock



[Fraunhofer ISI, 2009a]

Conclusion and outlook

- **Conclusion**

- Despite an increase of the EU27 building stock **space heating demand** is **declining** even in the **reference case (-20%)**
- Impact on space heating demand of **+2°C ambient temperature** is **equivalent** to a **doubling** of the **refurbishment rate**
- General: **Results** are very **sensitive** regarding assumptions about the **refurbishment rate, demolition rate** and **non-compliance rate**

- **Outlook**

- Need to **quantify** the impact of **changing user behavior** on space heating demand
- Analyze **further potentials** through the diffusion of **efficiency heating systems** (e.g. heat pumps, condensing heating technology)
- To get an **holistic picture cooling demand** needs to be quantified as well (especially in southern countries)

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Thank you for your kind attention

Rainer Elsland
Fraunhofer-Institut für System- und Innovationsforschung ISI
Breslauer Straße 48, 76139 Karlsruhe
Tel.: +49 721 6809-438: Email: rainer.elsland@isi.fraunhofer.de