# MODELLING THE EFFECT OF THE ECODESIGN AND LABELLING DIRECTIVES – BOTTOM-UP ANALYSIS OF EU-27 RESIDENTIAL ELECTRICITY USE

Sibylle Braungardt, Rainer Elsland, Joris Dehler

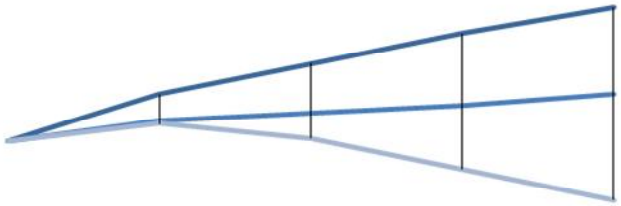
Competence Center for Energy Policy and Energy Markets

Fraunhofer Institute for Systems and Innovation Research ISI

Contact: Sibylle.Braungardt@isi.fraunhofer.de

IEPEC Berlin

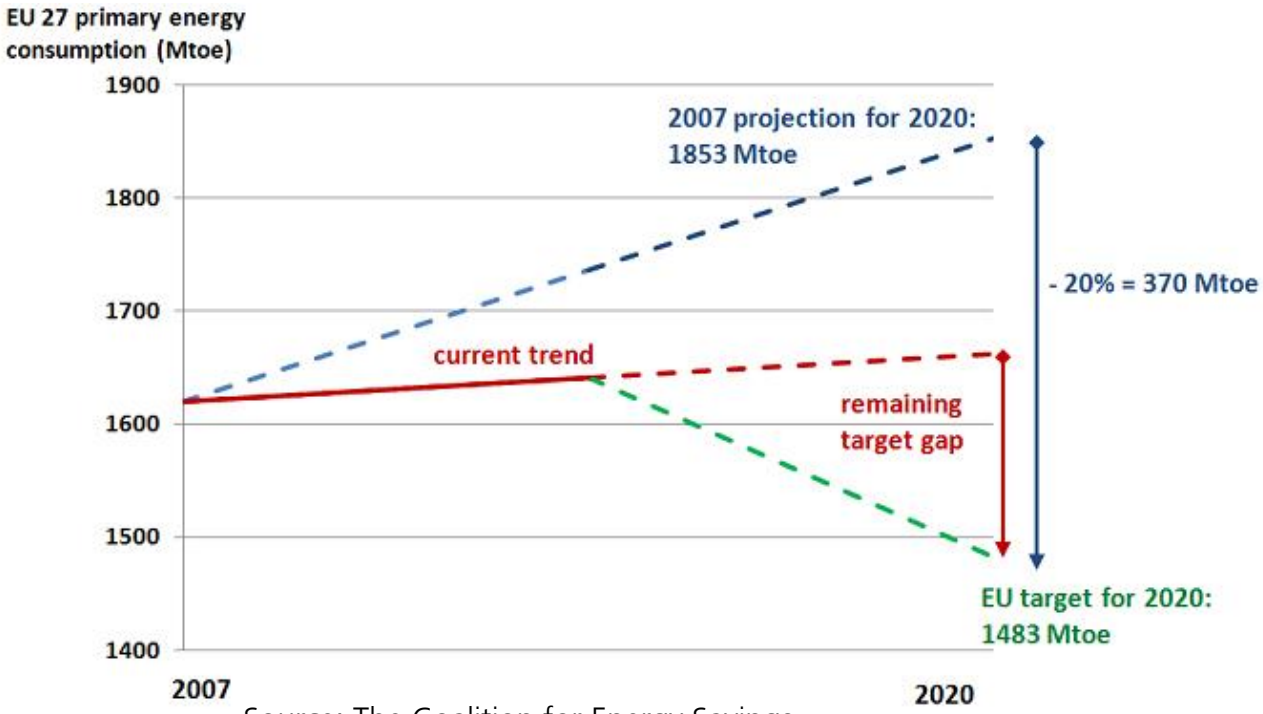
09/09/2014






Fraunhofer ISI

# Motivation: EU 2020 and 2030 targets




Source: The Coalition for Energy Savings

Energy demand projections required for defining and monitoring energy efficiency targets



Fraunhofer ISI

# Outline

- Presentation of the model
- Definition of Scenarios
- Results and Discussion




Fraunhofer ISI

# The FORECAST-Residential Model: Overview

FORECAST
FORecasting Energy Consumption Analysis and Simulation Tool

- **Developed by the Fraunhofer Institute** for Systems- und Innovation Research, **TEP Energy** GmbH and **IREES** GmbH
- **Bottom-up approach** considering the dynamics of technologies and socio-economic drivers
- **Long-term scenarios** for future energy demand until 2050
- **Individual countries** and regions (EU 28 member states, Norway, Switzerland, Turkey)
- **Individual end uses**: Large appliances, cooking, information and communication technologies (ICT), air conditioning, lighting




Fraunhofer ISI

# Date requirements and modelling approach

**Current appliance stock:** Total number of Appliances, efficiencies and user behaviour

- ODYSSEE database (http://www.odyssee-mure.eu/)
- Ecodesign Directive preparatory studies
- Market research data from GfK

**Future appliance stock:** Projections for ownership rates, socioeconomic development, lifetime

- Bass curve approach
- Ecodesign preparatory studies

**Investment decisions:** Logit approach to model policy impact




Fraunhofer ISI

# Market share of energy efficient appliances – Logit approach

$$S_k = \frac{e^{-vU_k}}{\sum_{j=1}^{N} e^{-vU_j}}$$

**Market share** of technology k

Logit parameter

**Utility function** depending on total cost of ownership

**Total cost of ownership** depends on:
- Purchase price
- Energy cost (efficiency and electricity price)
- Maintainance costs
- Discount rates



Fraunhofer ISI

# Example: Market share

| |  |  |  |
|---|---|---|---|
| Purchase price (Euro) | 231,76 | 359,00 | 257,37 |
| Energy consumption (kWh/year) | 196 | 147 | 163 |
| Total cost of ownership (Euro) | 926 | 983 | 871 |
| Market share (high sensitivity) | ~0 | ~0 | ~100% |
| Market share (low sensitivity) | ~1/3 | ~1/3 | ~1/3 |

Electricity price: 29 ct per kWh, discount rates: 5%, lifetime: 10 years



Fraunhofer ISI

# Three Scenarios to illustrate policy impact

**Reference Scenario**: No new measures since 2008

**Policy Scenario**: Current (2014) policy measures

**LLCC Scenario**: Least Life Cycle Cost for all appliances




Fraunhofer ISI

# European product policy: The Ecodesign and Energy Labelling directives

**Ecodesign**

Minimum energy efficiency standards based on least life-cycle costs

25 implementing measures

**Energy Labelling**

Mandatory information about energy consumption


12 implementing measures

Focus of this presentation: Residential electricity use



Fraunhofer ISI

# Implementation of Ecodesign in the FORECAST-Residential model

## Restrict the available options in purchase decision

| |  |  |  |
|---|---|---|---|
| Purchase price (Euro) | 231,76 | 359,00 | 257,37 |
| Energy consumption (kWh/year) | 196 | 147 | 163 |
| Total cost of ownership (Euro) | 926 | 983 | 871 |
| Market share (high sensitivity) | ~0 | ~0 | ~100% |
| Market share (low sensitivity) | ~1/3 | **~1/2** | **~1/2** |



Fraunhofer ISI

# Implementation of Labelling in the FORECAST-Residential model

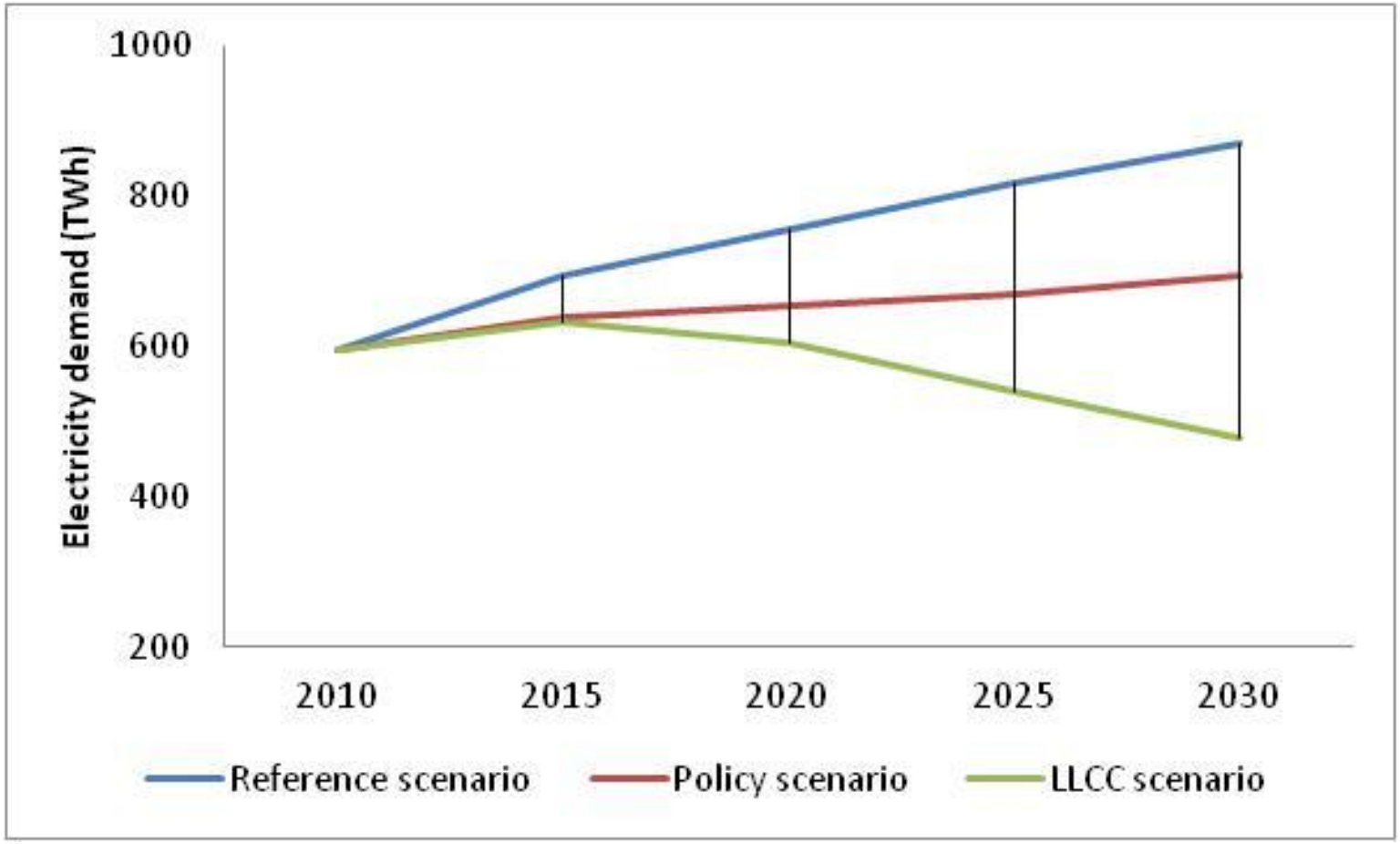
1) Impact on manufacturers: Accelerated introduction of high efficiency technologies

2) Impact on consumers: Higher sensitivity to life-cycle costs, lowering of implicit discount rates




Fraunhofer ISI

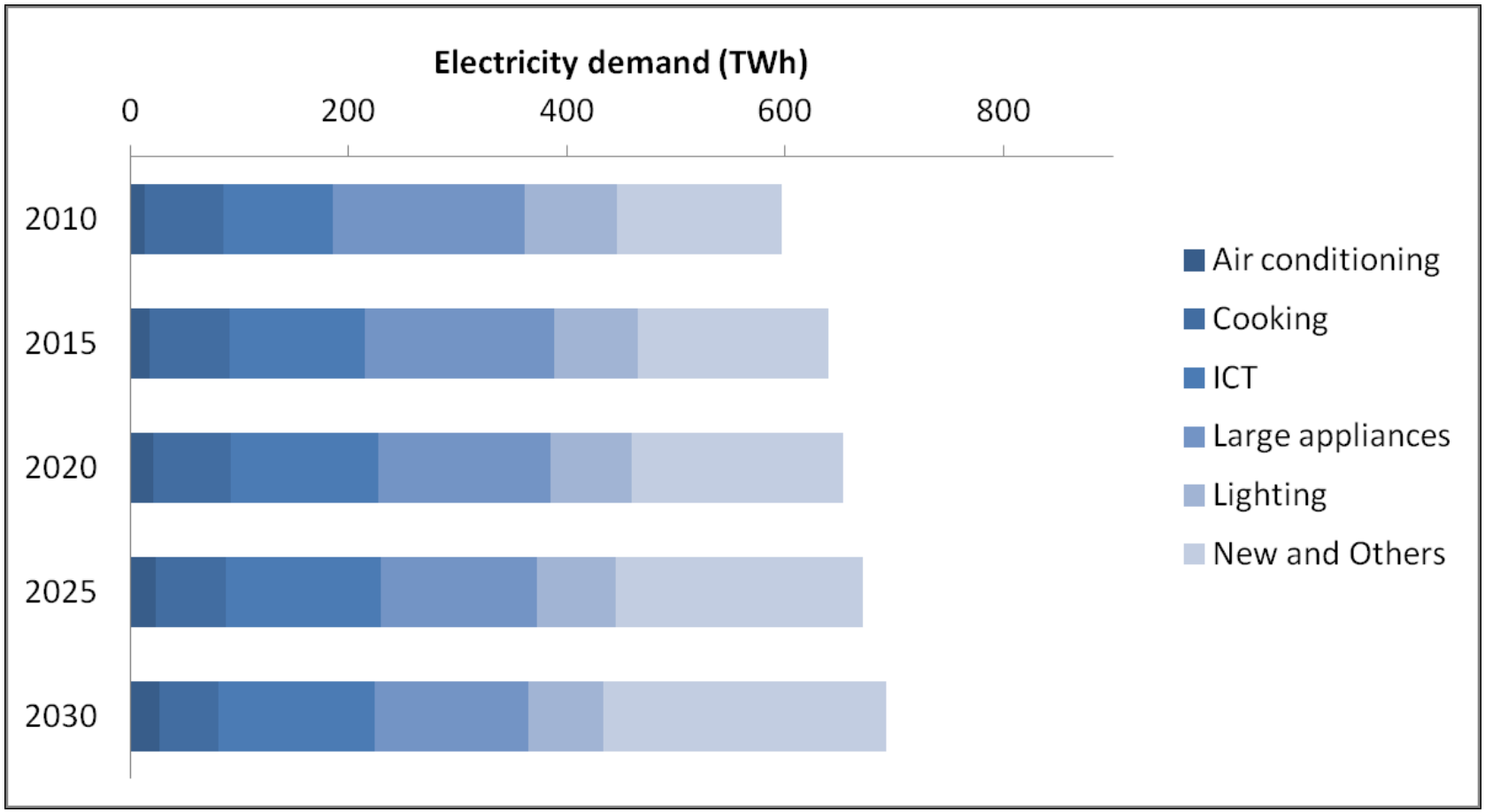
# EU 27 Residential Electricity demand (excl. Heating)






Fraunhofer ISI

# Policy Scenario: Electricity demand per appliance

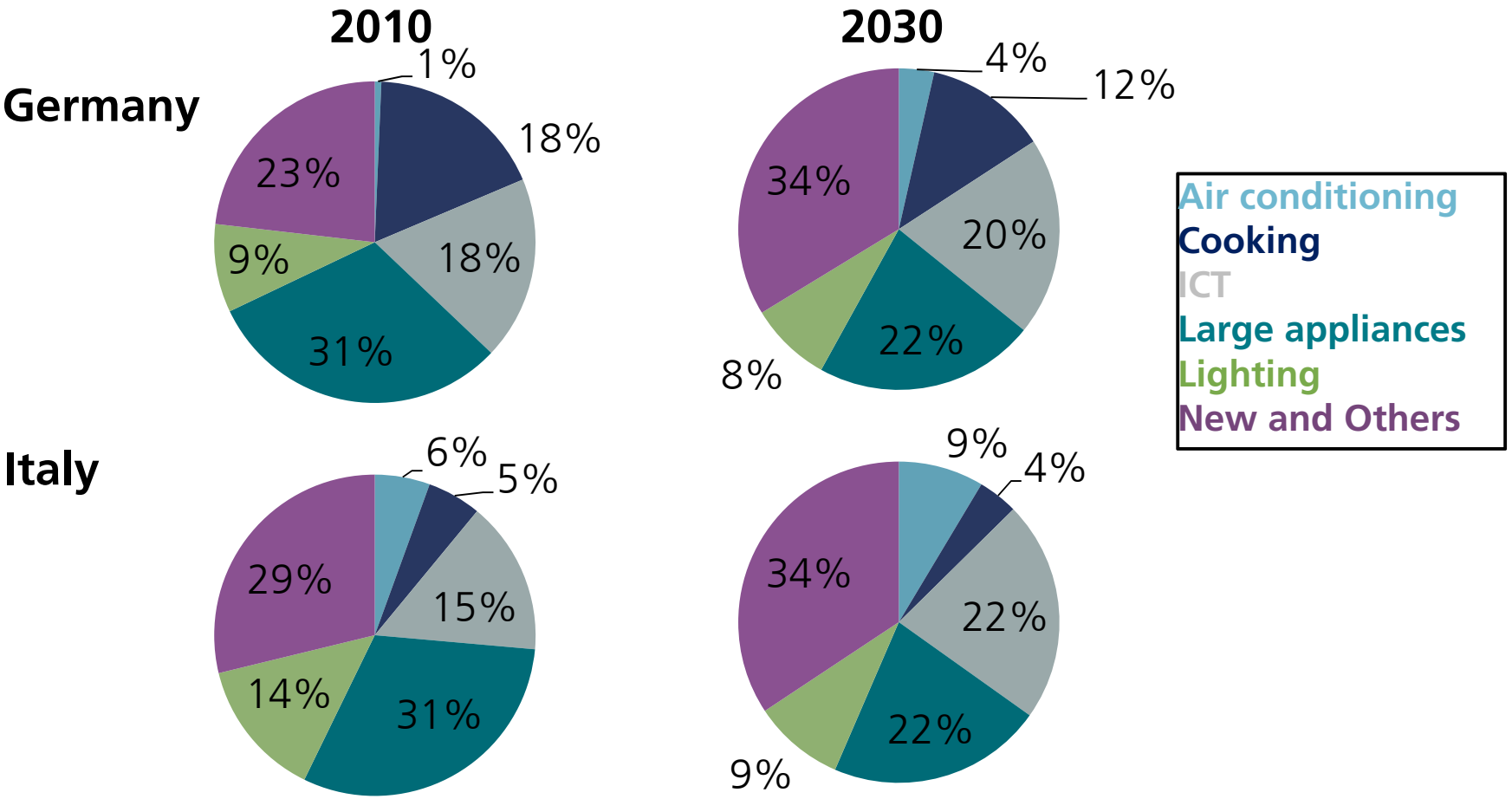






Fraunhofer ISI

# Policy Scenario: Electricity demand for individual countries






Fraunhofer ISI

# Conclusions and outlook

Detailed model for EU energy demand projections

Ecodesign and Labelling successful policy measures, however with further large saving potentials

Lack of empirical evidence measuring the effect of Labelling on

- purchase decisions
- Technological development




Fraunhofer ISI

# Thank you for your attention




Fraunhofer
ISI