Session 2: Potential options and business experience with consumption – based environmental policies

Lessons learnt from EMInInn project FP 7 2011-2015
CO_2 reduction in the Built Environment – R. Massink

Carbon reduction strategies for households in the Built Environment:

- *Direct: by reducing the final energy consumption of residents, for instance by insulating their dwellings.*

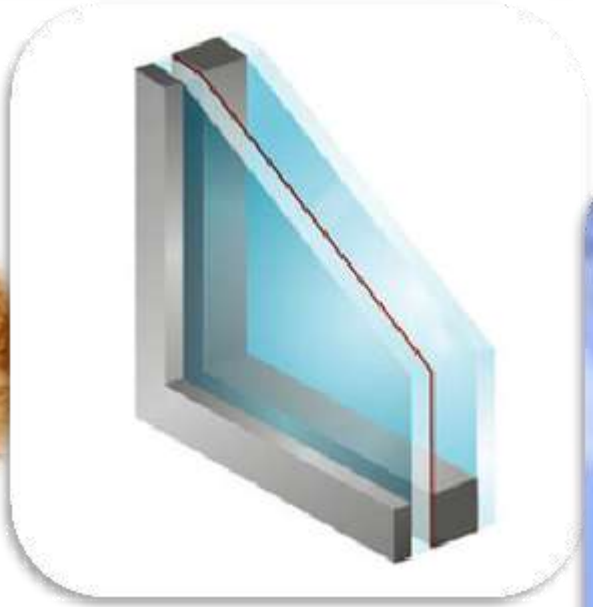
- *Indirect: by sustainable purchasing, for instance green energy in stead of conventional energy from fossil sources.*

- *Lessons learnt from EMInInn project FP 7 2011-2015*

Further reading:

- *Brouwer, J. and Klein Woolthuis, R.; CO2 reduction in the Built Environment: from building optimization to source replacement (2014).*
- *Brouwer, J. & Klein Wolthuis R., (2013), Report on the diffusion of innovations in the field of housing and its macro-environmental impacts, Brussels.*

To assess if these so called eco-innovations increased or decreased the environmental impact



when taking into account whole life cycle of the products, the aggregated effects (micro to macro), and the rebound effects.

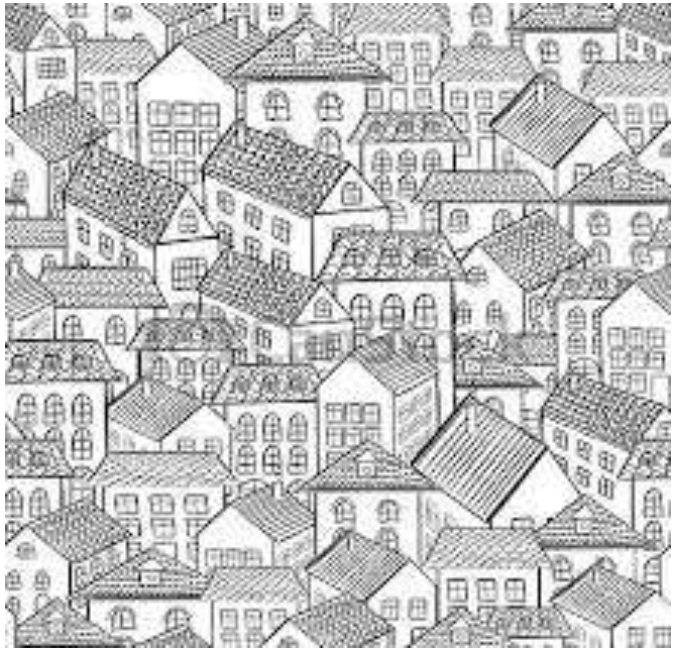
Methodology

- Bottom-up:
  - Estimate the net environmental impact (‘energy consumption’) of selected innovations per household with reference house model and scale up using diffusion data

- Input data:
  - Life Cycle Inventory of (eco)innovations on micro level
  - Diffusion data of (eco)innovations on macro level for various countries

- Output and analysis:
  - What is the difference between the theoretical (modeled) and actual (observed) environmental impact?

Impact assessment: From micro to macro



What are the savings on the macro level?

Environmental impact per innovation
X
Nr. of dwellings having the innovation applied

Environmental impact per innovation, LCI

- Life Cycle Inventory:
  - Cumulated Energy Demand
  - Production costs (-/- substitution effect)
  - Operation stage
  - End of life

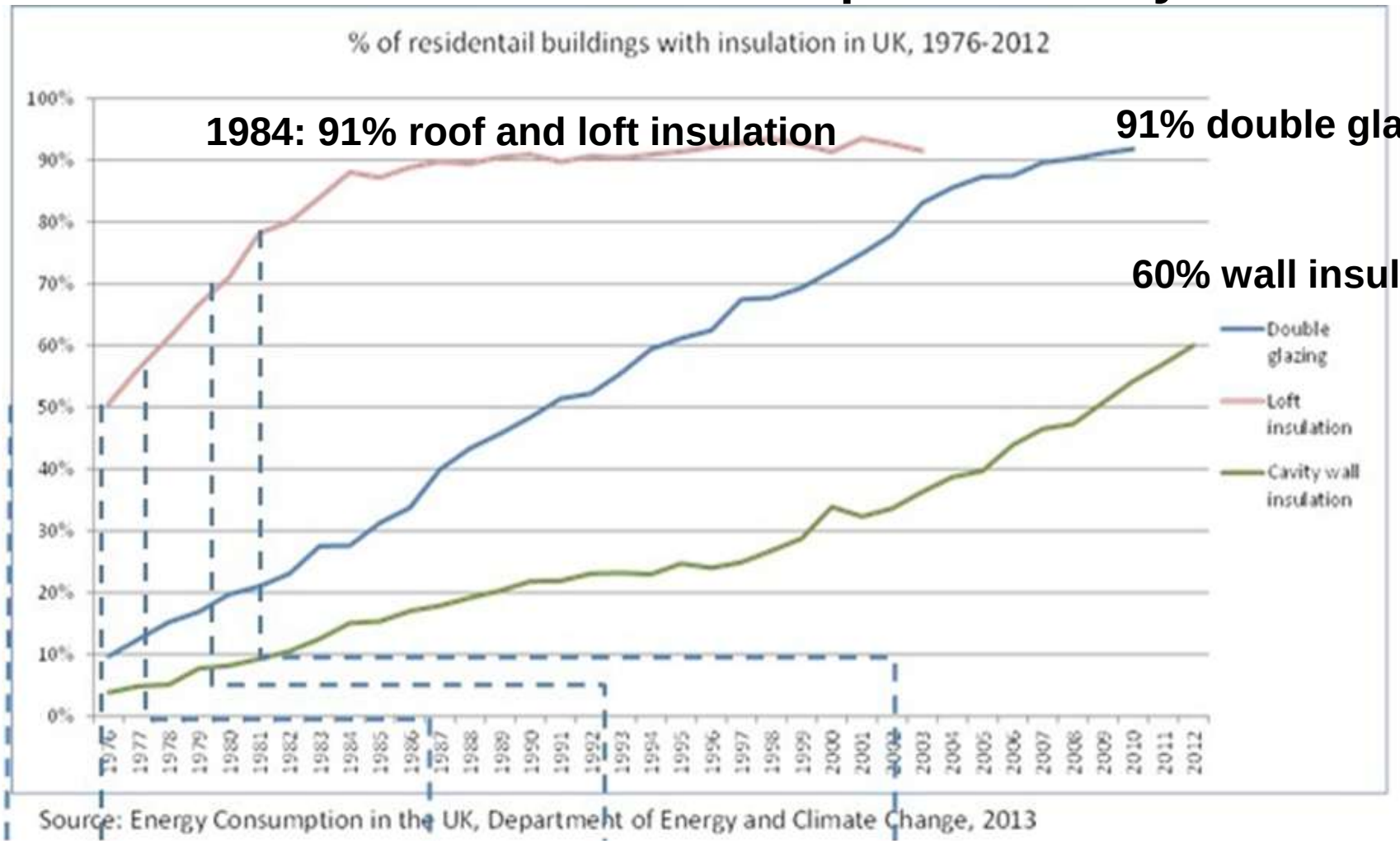
- Per standard house simulation
- Per climate zone

- **Calculate the Net Annual Savings**

Innovation	CED of innovation (MJ)	CED of substitute (MJ)	Net CED of innovation (MJ)	Lifetime (yr)	Annual costs (MJ)	Annual savings (MJ)			Net annual savings (MJ)		
						climate zone 1	climate zone 2	climate zone 3	climate zone 1	climate zone 2	climate zone 3
Doul	7,084	2,193	4,880	20	244	23,352	17,086	7,023	23,108	16,842	6,779

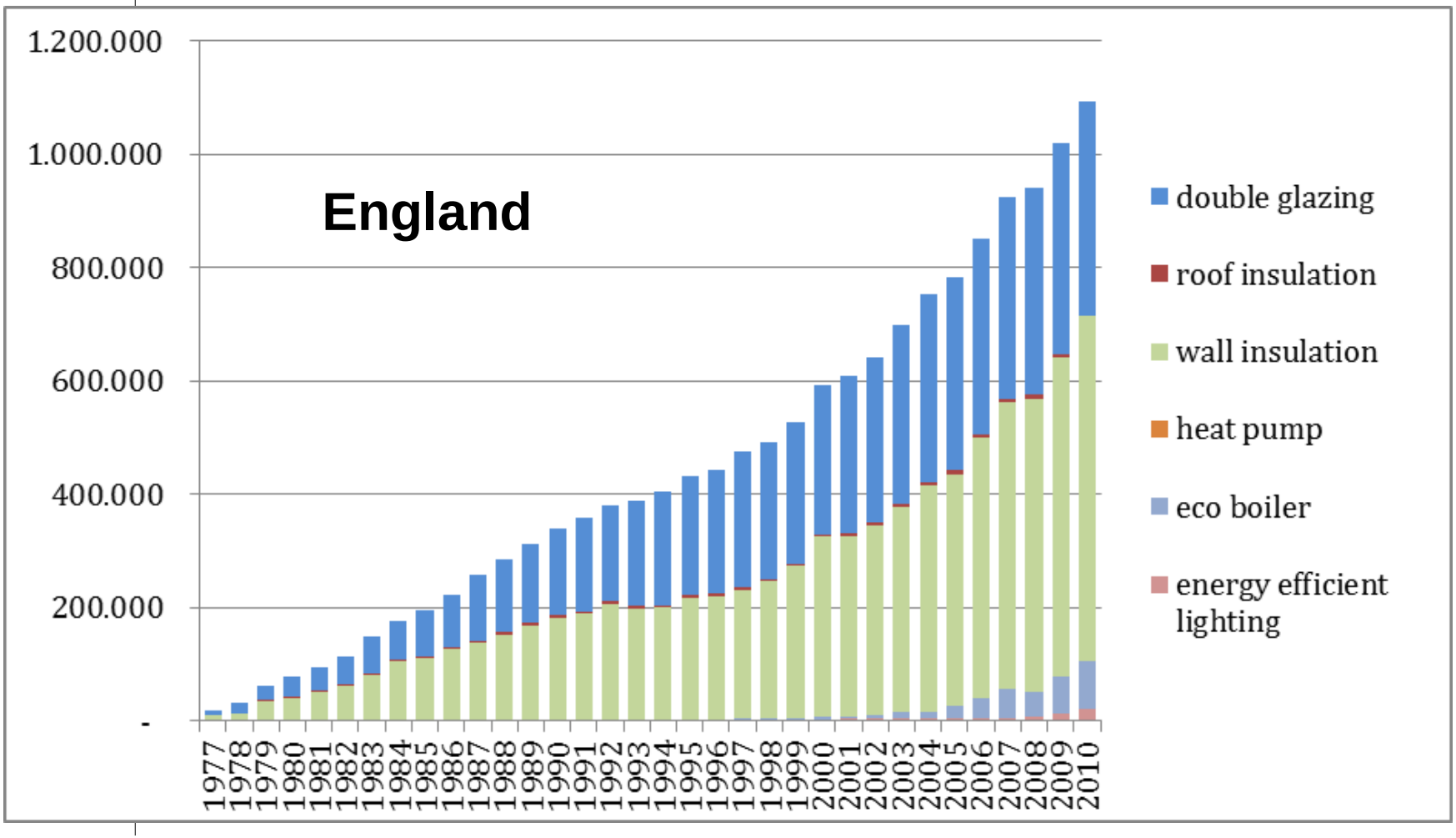
Double Glazing 16 m2

Diffusion of insulation in UK over period of 36 y.



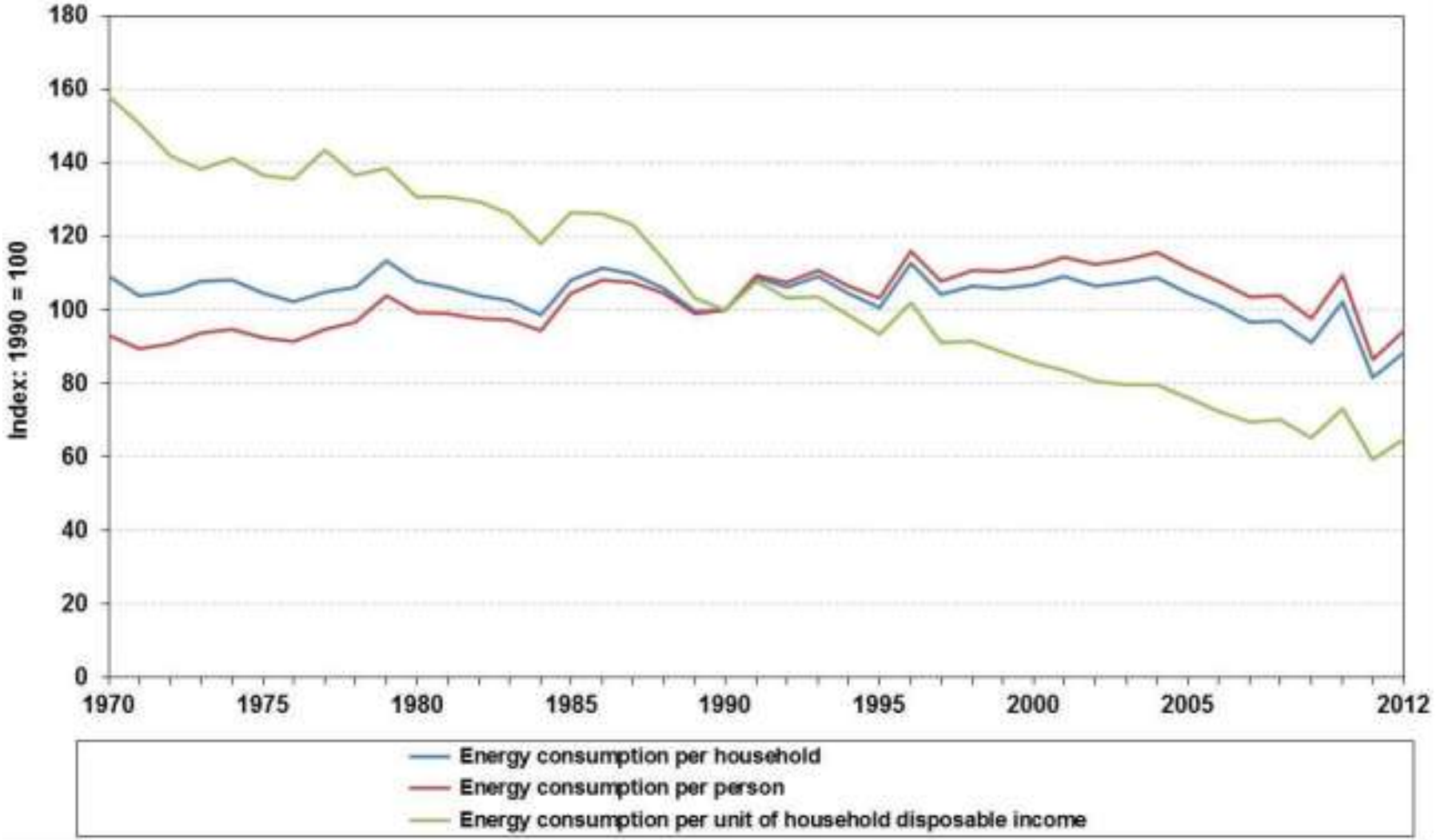
1976 → 2012

Great energy savings potential!



Total energy savings compared to baseyear in UK (TJ) between 1977 and 2010

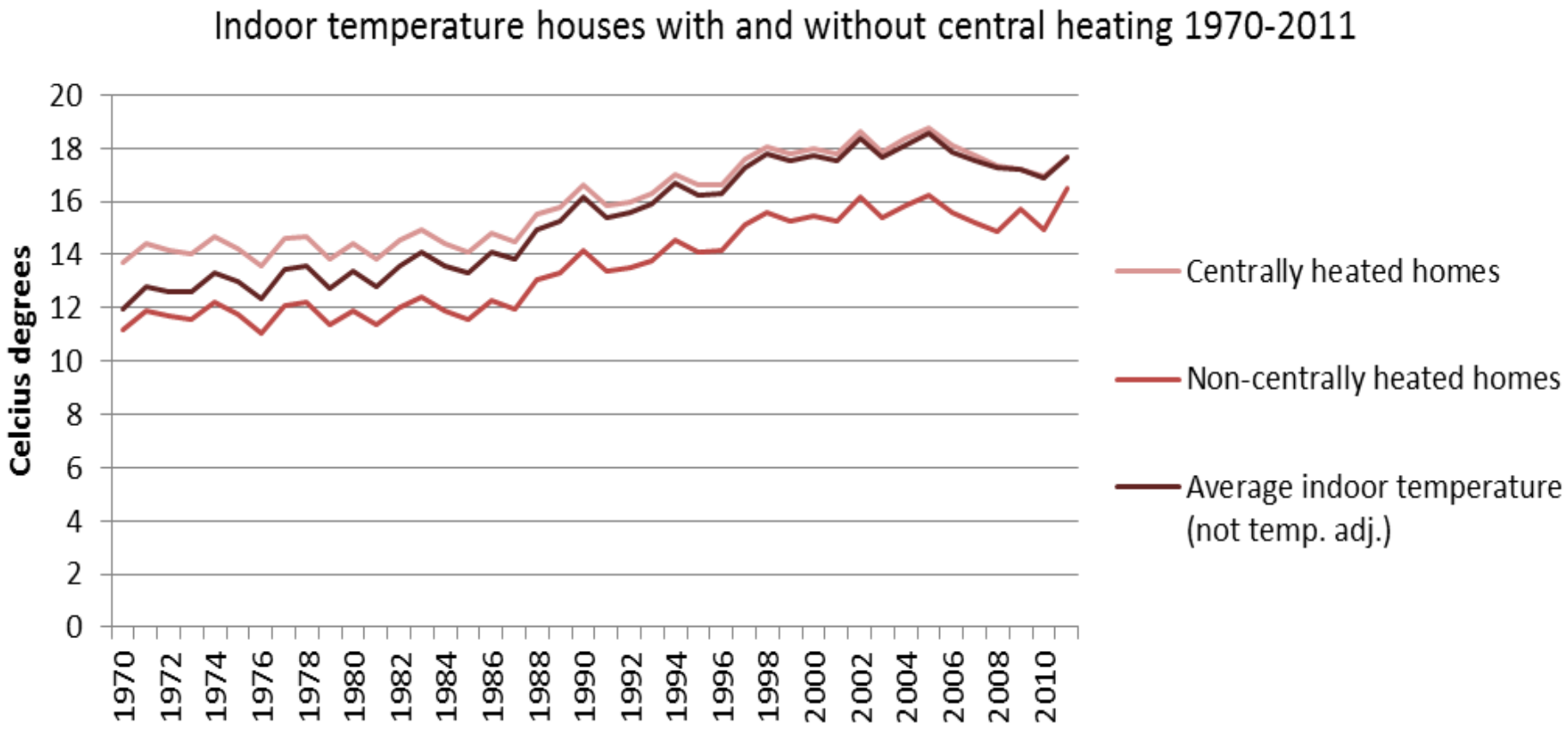
Actual UK figures – relative comparison: don't show much of the savings potential



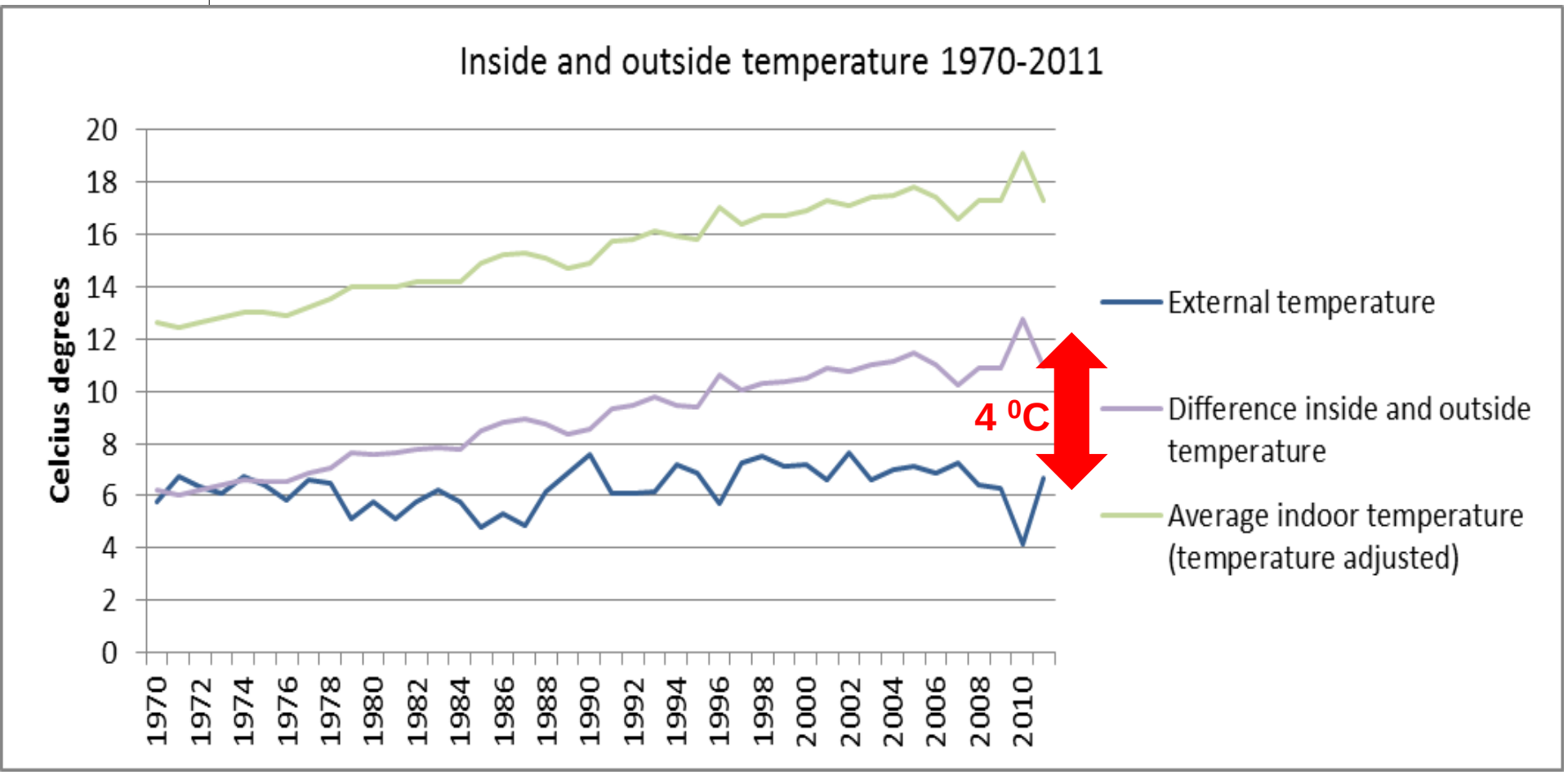
Explanation of large difference in calculated energy savings and actual behavior: rebound or ..

- Tendency to increase comfort and service level
- Central heating instead of local heating (per room)
- Programmed thermostat
- Less inhabitants per m2 livingspace (heated)
- Increasing number of households

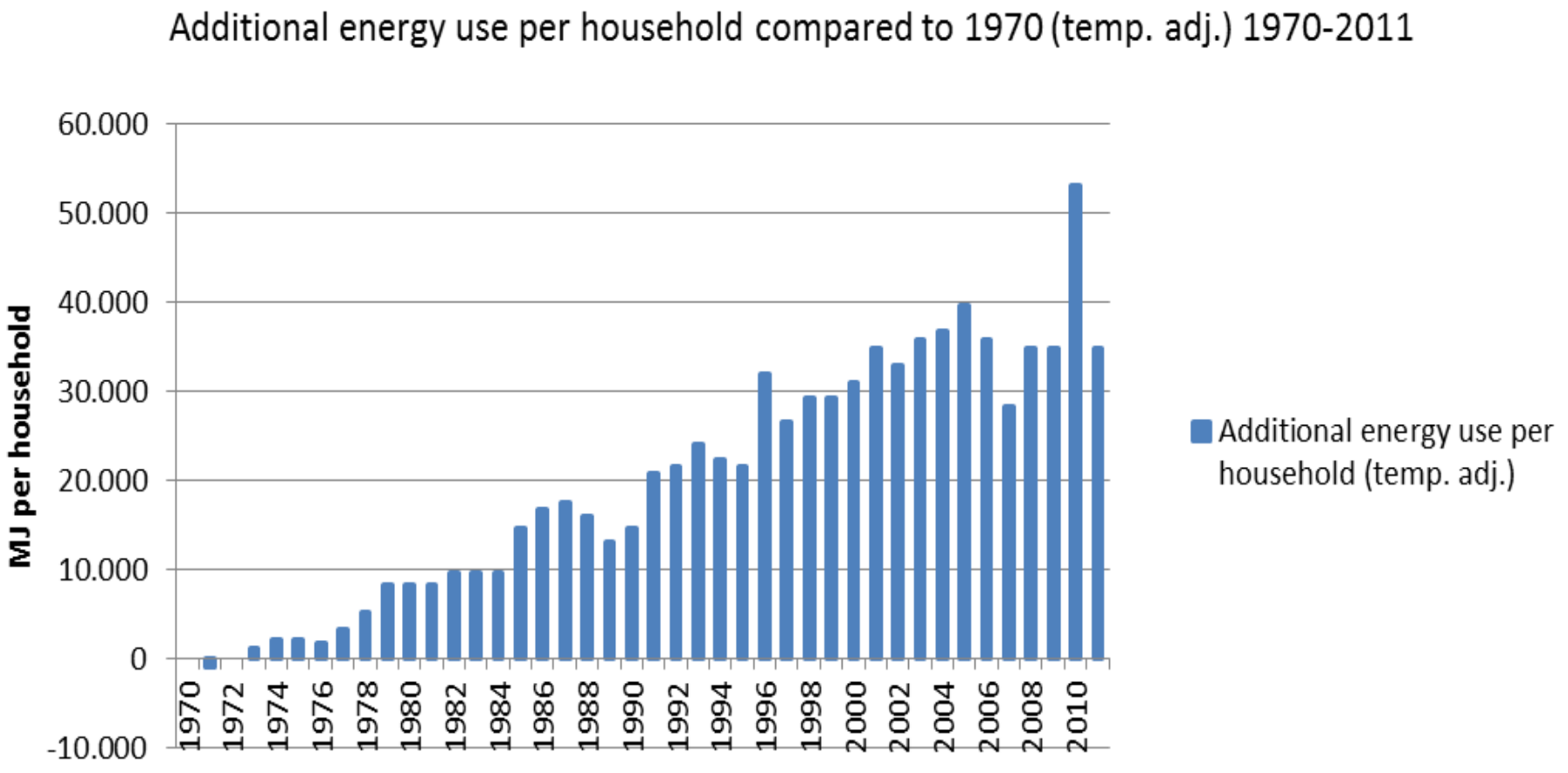
Increasing number of households with central heating, *and* average indoor temperature



As a result, increasing Delta temperature (inside – exterior), to be heated …



A significant additional energy use per household, to satisfy the heating demand



Between technological potential and actual carbon reduction is..

User-behaviour

Results

Complementary to efficiency measures: focus on energy source replacement – target the large energy companies, instead of 25 million individual households..

Leave the direct energy saving measures at the micro level, up to the financial argumentation of the individual (*with green energy coming from the socket, it doesn't make much of an environmental argument any more..*)

Further reading:

- *Brouwer, J. & Klein Woolthuis, R. (2014), CO_2 reduction in the Built Environment: from building optimization to source replacement.*
- *Brouwer, J. & Klein Wolthuis R., (2013), Report on the diffusion of innovations in the field of housing and its macro-environmental impacts, Brussels.*