



Developing Future Indicators for Energy Efficiency in Buildings

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Indicators for Buildings

As a part of the G8 Gleneagles Plan of Action

- IEA is as requested:
 - ◆ to review efficiency policies,
 - ◆ study building regulation,
 - ◆ to identify best practice
 - ◆ and make recommendations for policies
- For this we need to develop methods compare energy efficiency and identify best practices
- This creates the need to develop new indicators
 - ◆ Since indicators will be an important input for the work to compare, to show the impact of policies and find best practices
 - ◆ To give an overview



Comparison of Energy Efficiency, G8

- A large part of the study to analyse the problems, challenges and criteria's is already done
- And a new methodology for this process is under development
- Some of these results are described in a working paper which were presented at the last meeting in the EEWP comity (will be happy to provide this !)
- I will give a small brief on this study and the need for new future indicators, which comes out of this
- But first I will show:
 - ◆ how existing indicators fit into this work
 - ◆ and why there is a further need



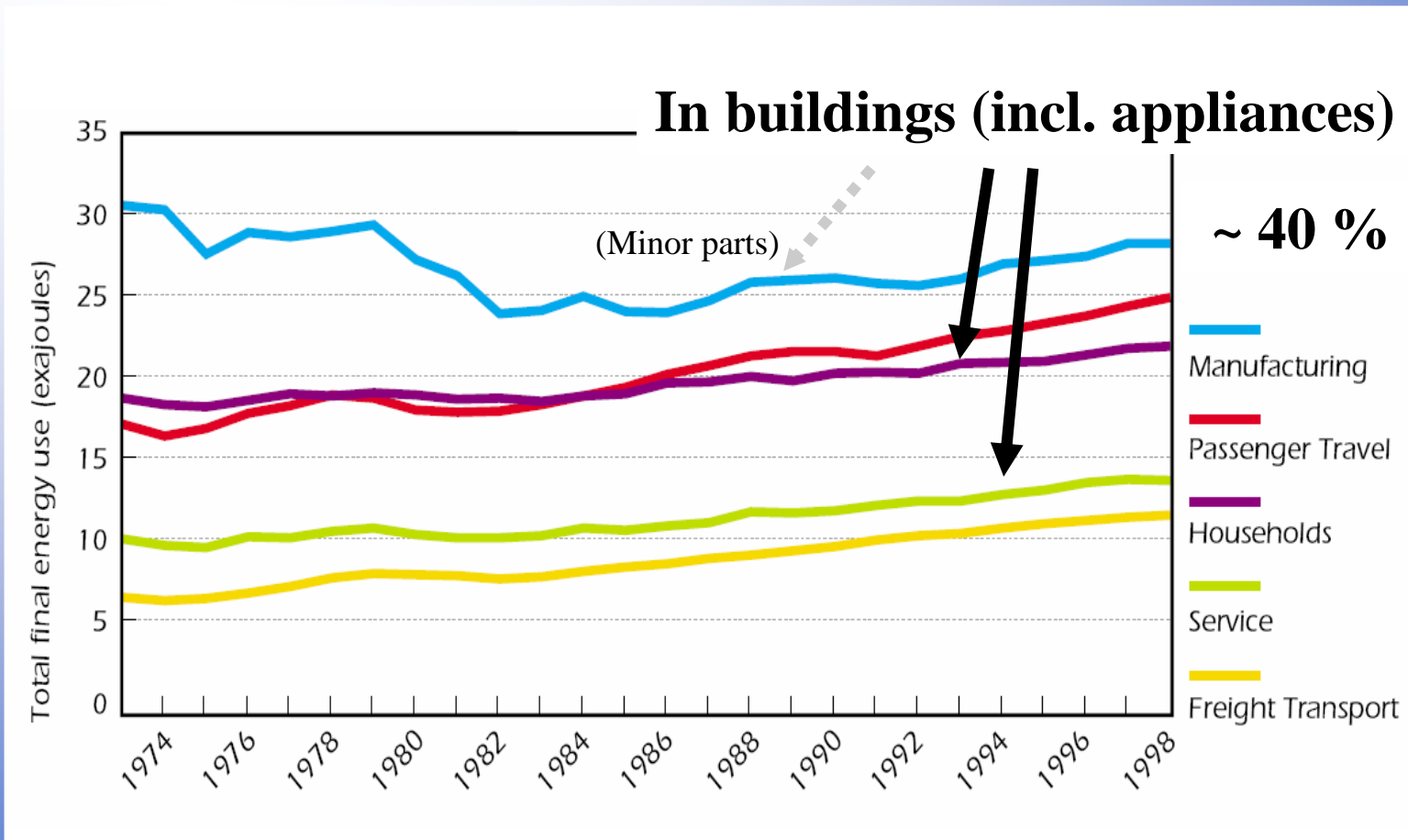
Existing indicators for buildings

- I will do the existing indicators fast since it might repeat input from previous speakers
- The general indicators in the 30 years book are based on national statistics and figures
- Will lead to overall values or national comparison
- Which can be useful for overall comparison but which will never give the whole picture or be able to analyse details

- Some examples and problems:



End use of energy - Buildings

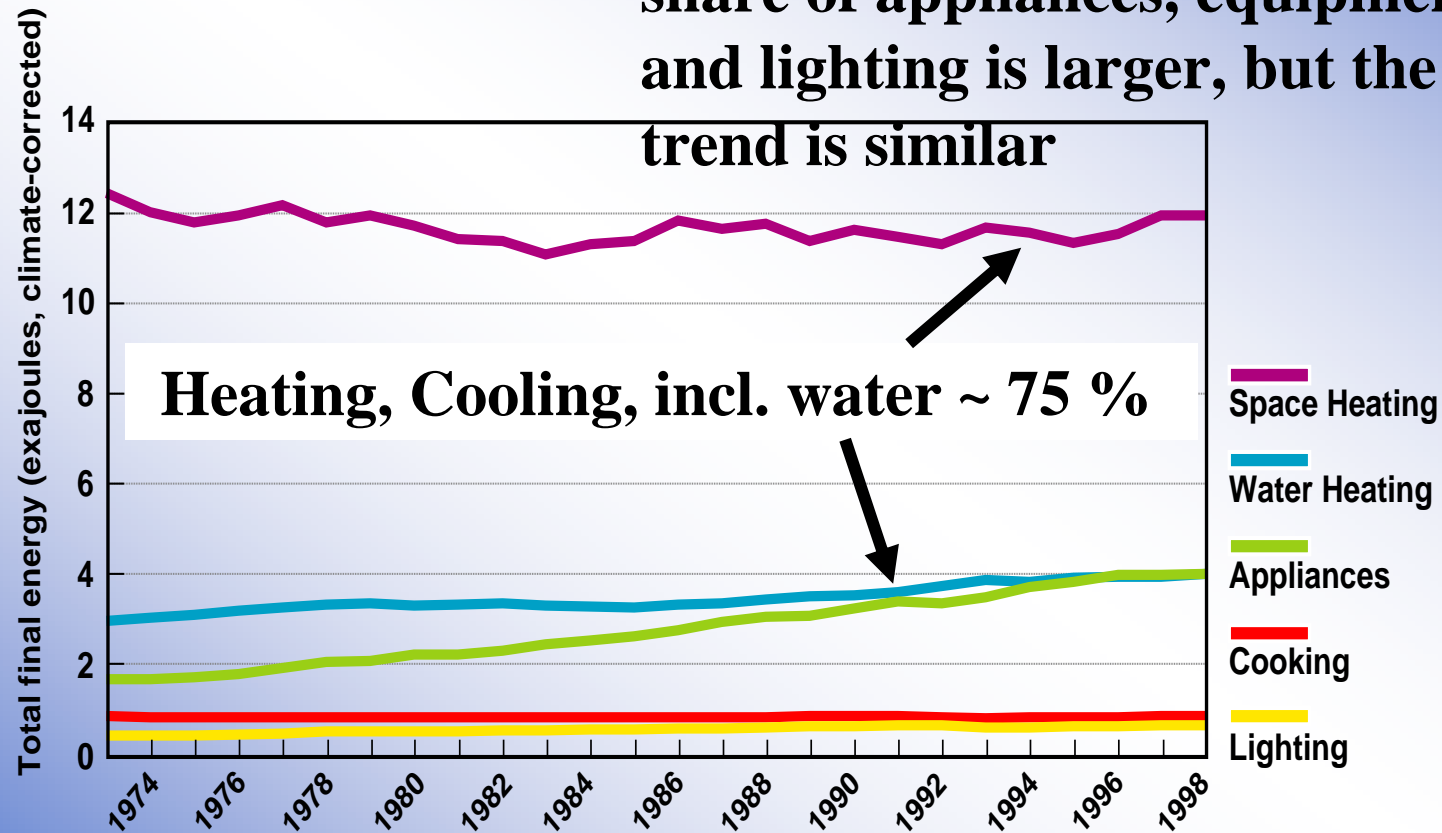


Source 30 years of Energy Use in IEA Countries



Energy services in Residential

For commercial buildings the share of appliances, equipment and lighting is larger, but the trend is similar

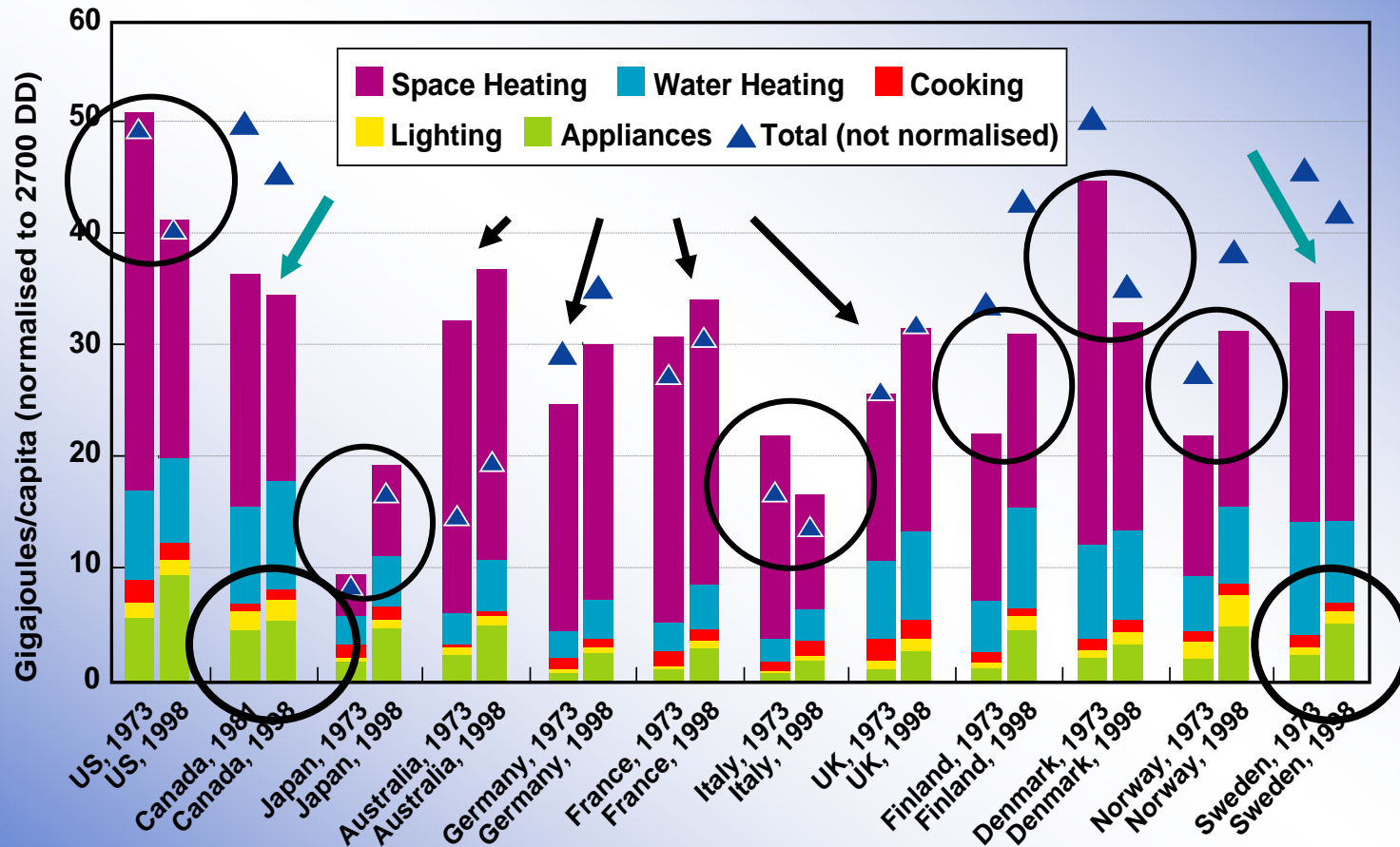


Source 30 years of Energy Use in IEA Countries



Residential Energy Use Per Capita

Trend ? Comfort ? Policy ?

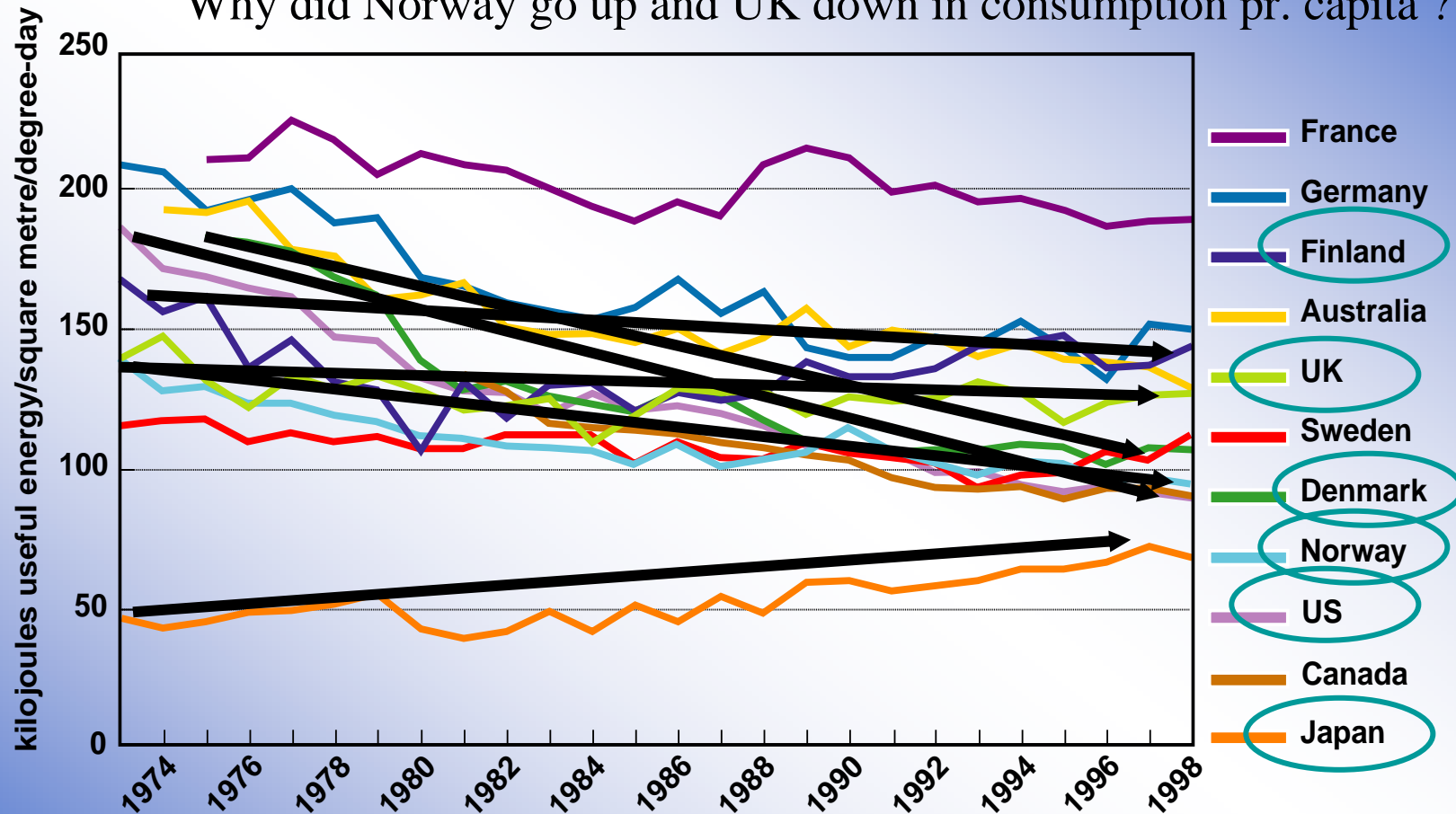


Source 30 years of Energy Use in IEA Countries



Space Heating Residential

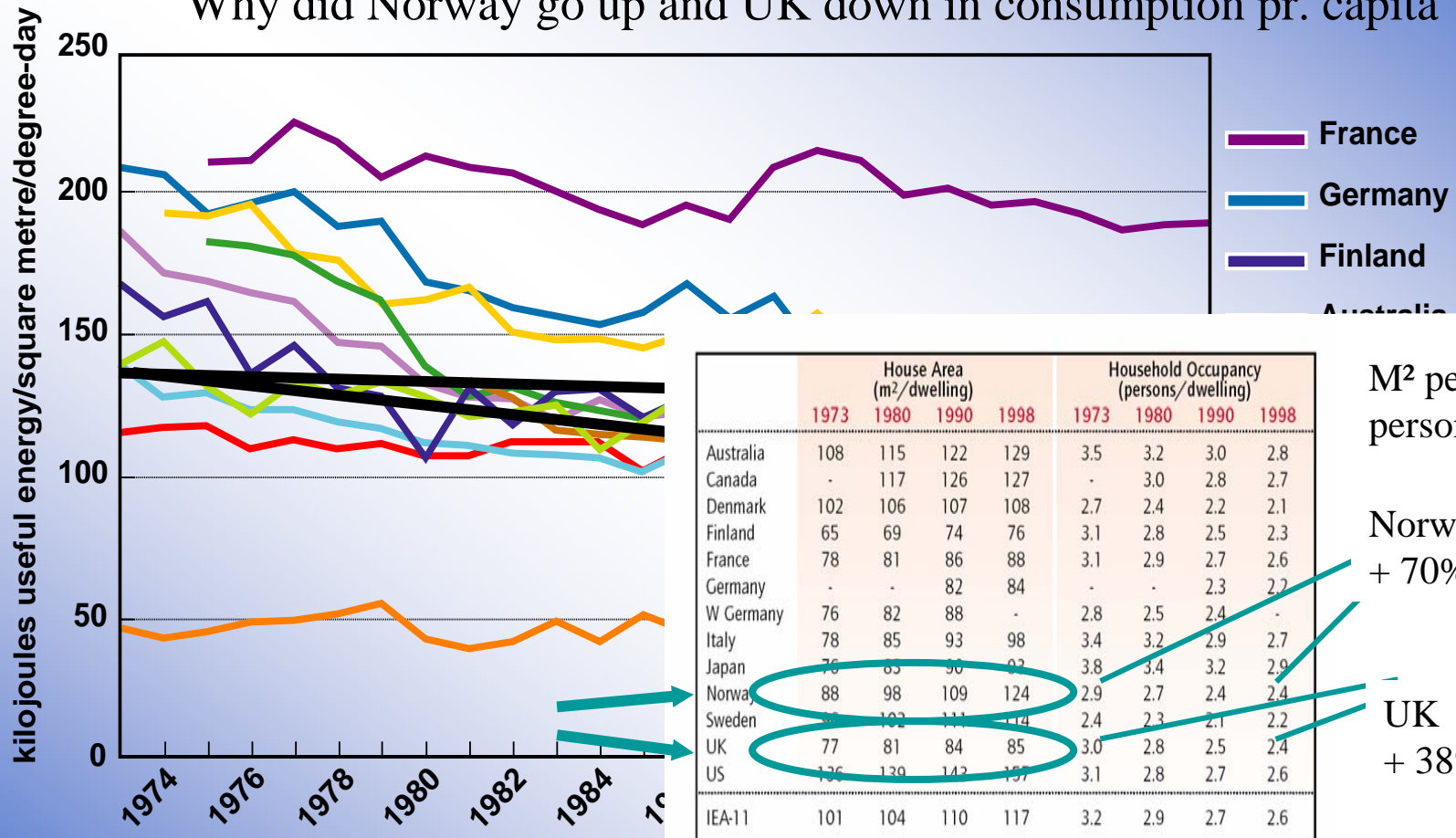
Why did Norway go up and UK down in consumption pr. capita ?





Space Heating Residential

Why did Norway go up and UK down in consumption pr. capita ?



M² per, person:

Norway + 70%

UK + 38%

But what about efficiency ?



Macro Indicators can

- **Macro indicators can help to find**
 - ◆ **General Developments**
 - ◆ **General trends (Mega Trends)**
 - ◆ **Over all policy Best Practices**
 - ◆ **And to ask questions – Why ?**
- **But they can't analyze development because of individual policies !**
- **Existing indicators are not very clear about cooling**



New Indicators Must Include Air Condition !

AC is the new challenge

- In developing countries as India and China people can now afford “climatization”
- So they install AC or heating, which are often inefficient
- 1.1 Billion in India
- 1.3 Billion in China
- ~ 1,000,000,000 air conditioners ?





If we want more answers !

- We need more indicators !**

- But what kind of new indicators do we need ?**



New versus Existing Buildings

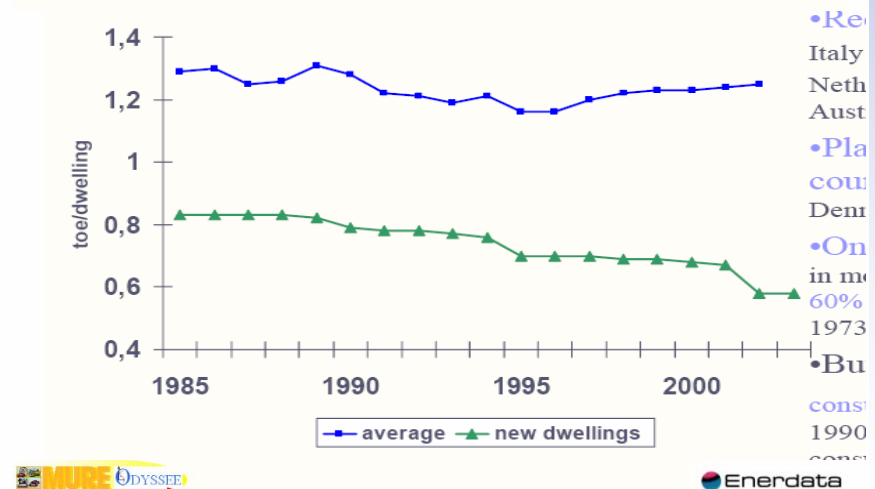
- In OECD less than 1% of buildings new every year
- New buildings use less energy than existing
- Need to separate new and existing buildings to see development in building codes etc.
- Example Mure Odyssey:

In existing buildings you might even need to split:

- on year of construction
- on type of building

if you want to see impact of policies !

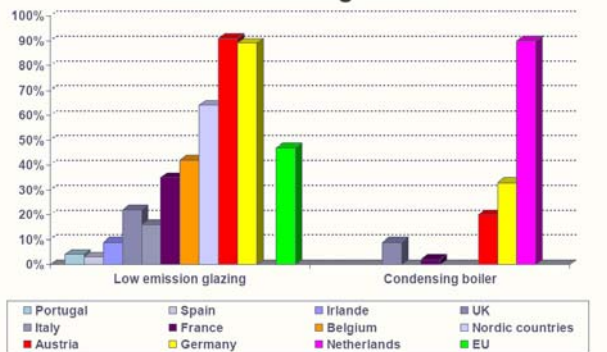
Heating consumption per dwelling in the EU15 ; regular reduction for new dwellings because of reinforcement in standards





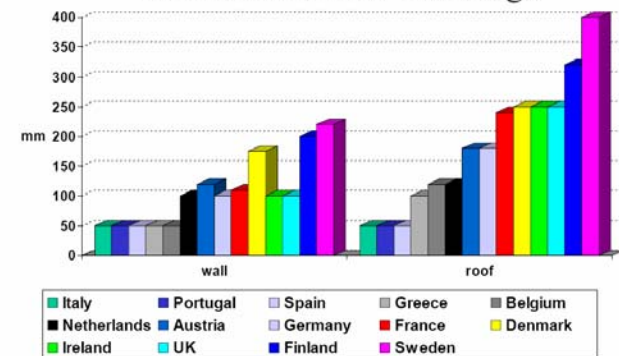
Diffusion indicators

Indicators of diffusion: low emission glazing and condensing boilers



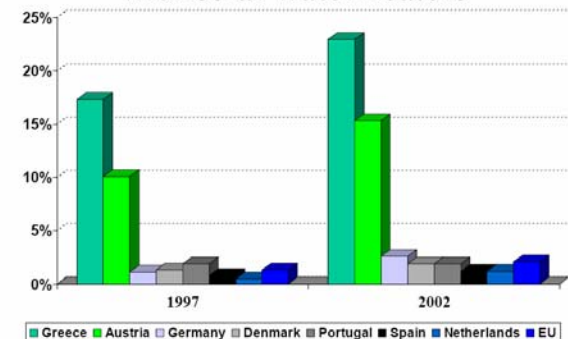
Source : Saint Gobain, STEM, Enerdata

Indicators of diffusion: use of insulation materials in new dwellings



Source : Eurima

Indicators of diffusion: % of dwellings with solar water heaters



Source : own calculation from installed capacity in m2 from ObservER

Indicators could show diffusion of efficient products or the number of installed indicators.

Some examples taken from the Mure Odyssey Database

Other examples could be air-conditioners



New Indicator for Building Codes

- Good indicator for Building Codes should show how far the codes are from the lifetime costs optimum and from best practice !
- How can we develop an indicator to show how far each country:
 - ◆ are from best practice ?
 - ◆ and from the best possible LLC costs ?



Methodology Example BC

Working paper on Comparison of Building Codes:

- There is a need to develop a simplified model to compare Building Codes
- But energy efficiency in buildings and Building Codes are difficult to compare
 - ◆ Climate conditions will have a large impact on energy consumption and demands in Building Codes
 - ◆ Buildings codes are set in different ways – values on each part of building and HVAC systems or energy performance
 - ◆ BC might include lighting, boiler efficiency, air-conditioning, pipes, ducts, automatics etc. or not
 - ◆ Different codes for regions, states, residential / commercial
 - ◆ More than 1000 different Building Codes out there !

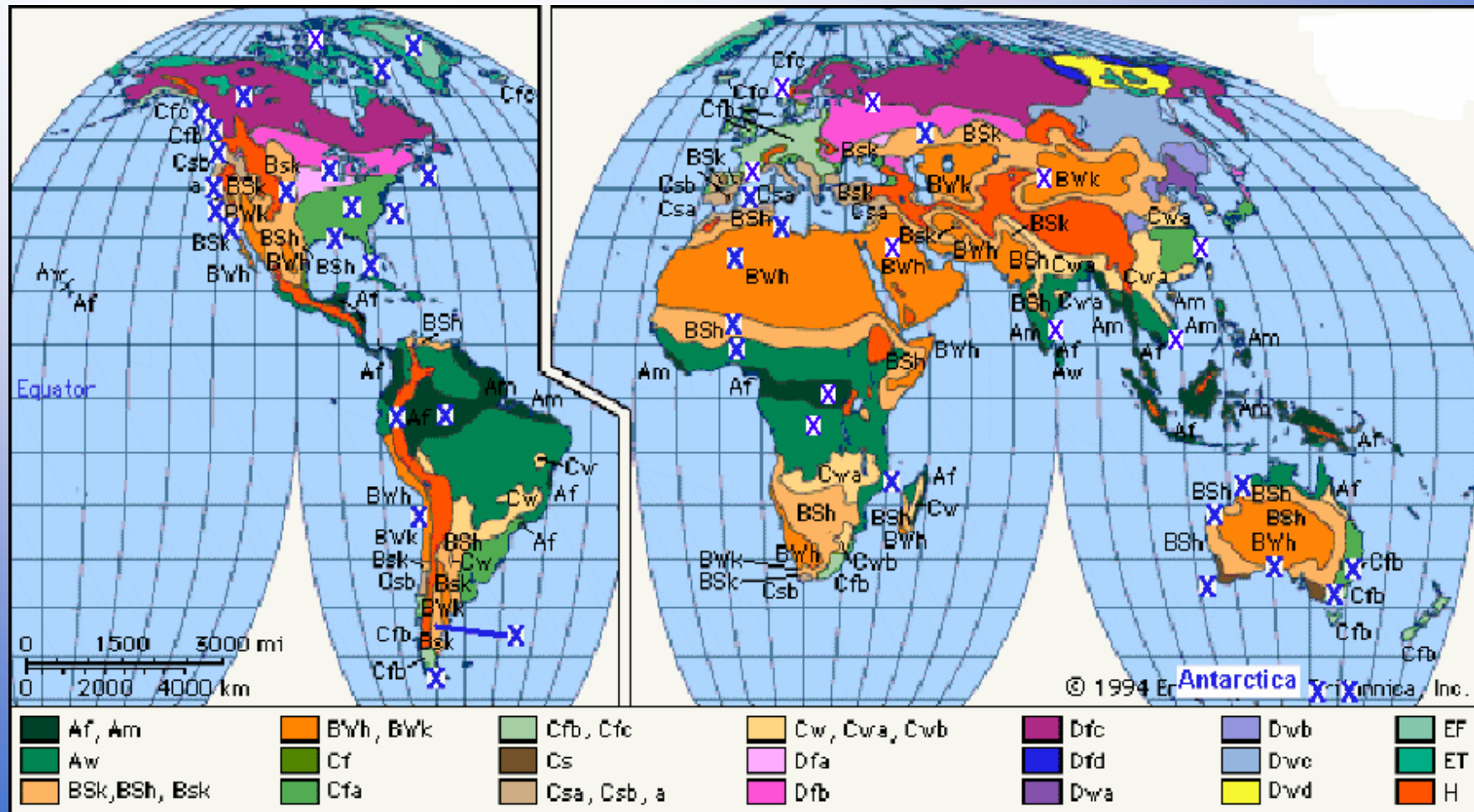


Climate Conditions

- It is not possible nor relevant to compare Building Codes through all different climates because:
 - ◆ In a cold climate there is a need to keep in heat, gain heat from sun and use efficient boilers etc.
 - ◆ In a hot climate there is a need to keep heat out, to reduce heat gain from sun (shading) and to make efficient or natural cooling.
 - ◆ In a mixed climate with hot summer and cold winter there is a need to find the right balance.
- What is the relevance in comparing the cooling demands from south India or Japan with heating demands from Sweden or north of Canada.
- A model for comparison of very different climates would be very complicated.
- So there is a need for climate classification =>



Koppens Climate Classification





Climate Classification

- **Koppen Climate Classification is one of the common used classifications for climates**
 - ◆ **Contains 6 general groups of climate**
 - Which respond very different to energy efficiency in buildings
 - ◆ **Contains at least 23 sub climate**
 - Which are too complicated for a comparison of building codes
- **Two American standards works with climate classification ASHREA and IECC:**
 - ◆ **ASHREA (American Society of Heating, Refrigeration and Air-conditioning Engineers, Inc) works with 12 heating and 8 cooling zones - all in all 26 alone for US**
 - ◆ **IECC (International Energy Conservation Code) worked with 19 zones in 1998/2000 version, and works with 8 zones and some sub-zones alone for US in the latest version from 2004**
 - ◆ **Will also be too complicated for the comparison of building codes**
- **Need for further simplification !**



Simplified Climates - 6 basic types

- **Cold Climate:**
 - ◆ Heating only
- **Heating based:**
 - ◆ Heating is major concern, cooling only to minor extend
- **Combined or Mixed Climate:**
 - ◆ Both need for cooling and heating
- **Moderate Climate:**
 - ◆ Only minor needs for cooling and heating
- **Cooling Based:**
 - ◆ Cooling is major concern, heating only to minor extend
- **Hot climate:**
 - ◆ Cooling only

Based on heating and cooling degree-days



Simplified Climate Model

	Heating	Cooling
Cold Climate	2000 HDD 18 °C	CDD 13 °C < 1000
Heating based	2000 HDD 18 °C	1000 CDD 13 °C < 2000
Combined Climate	2000 HDD 18 °C	2000 CDD 13 °C
Moderate Climate	HDD 18 °C < 2000	CDD 13 °C < 2000
Cooling Based	1000 HDD 18 °C < 2000	2000 CDD 13 °C
Hot climate	HDD 18 °C < 1000	2000 CDD 13 °C



Types of Building Codes

Demands can be set in different ways:

- **Prescriptive:**
 - ◆ Demands set on U-values, efficiency HVAC
- **Trade off:**
 - ◆ As prescriptive but with possible trade off
- **Model building:**
 - ◆ Model calculated based on fixed values
- **Frame or over all u-value:**
 - ◆ Total values for losses or for over all u-value
- **Energy Performance:**
 - ◆ Total values for building incl. efficiency in HVAC, renewable energy etc. (GJ or CO₂)
- **Or a mixture:**
 - ◆ Half and half, Either or, As well as



Comparison / Best Practices

- **Not possible to compare through all climates**
 - ◆ Heating only and Heating Based (with little cooling)
 - ◆ Cooling only and Cooling Based (with little heating)
 - ◆ Mixed climate or Combined (both heating and cooling)
- **Not possible to compare all types of BC's**
 - ◆ Prescriptive, Trade Off, (Model Building)
 - ◆ Energy Performance, Energy Frame, (Model Building)
 - ◆ Include lighting, include HVAC demands, etc. (special)
- **Comparison and selection of best practices**
 - ◆ in similar climates,
 - ◆ in basic BC types,
 - ◆ special for light, HVAC etc.
- **Need for indicators for the comparison**



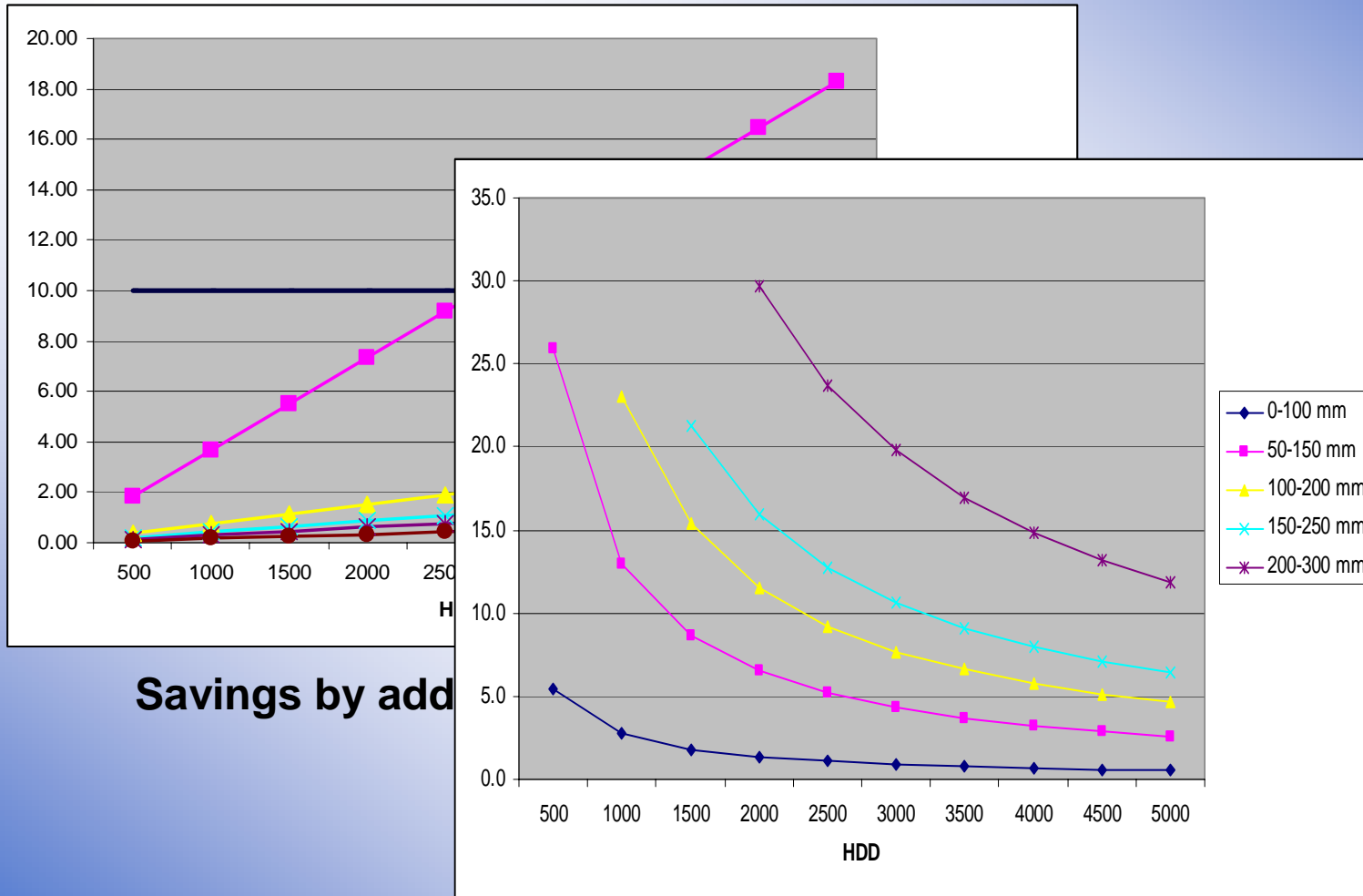
Example Methodology

**Comparison for heating based
climates and heating only climates**

Indicator based on Life Time Costs !



Life Cost Additional Insulation



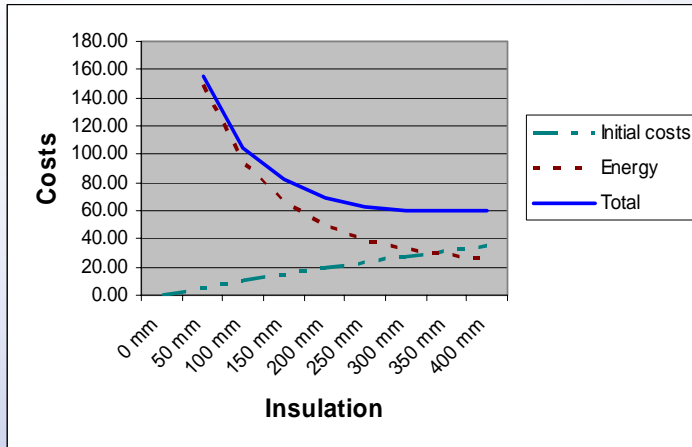
Savings by add

Simple payback time

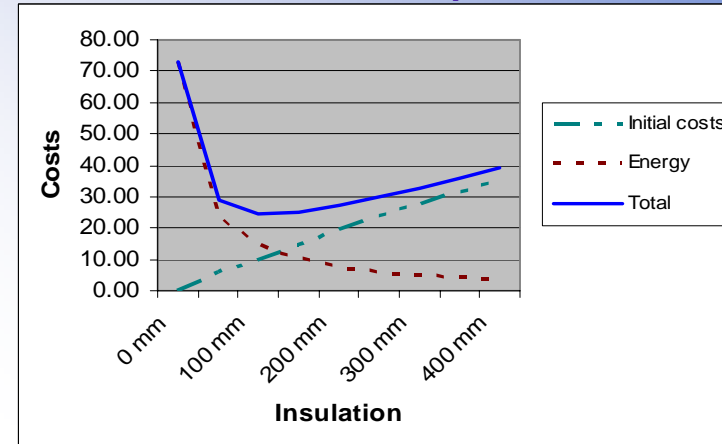


LCA on simple insulation (roof)

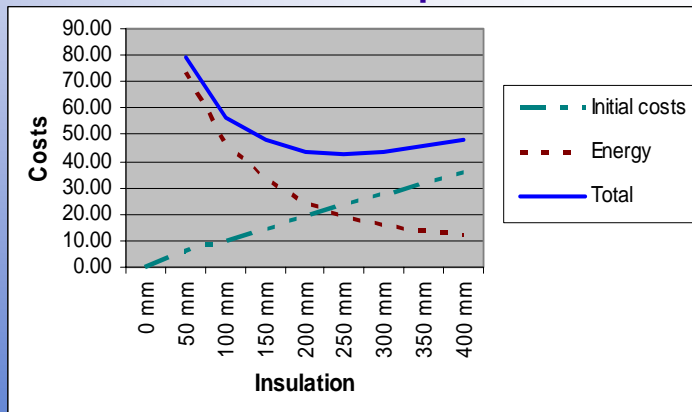
North Scandinavia



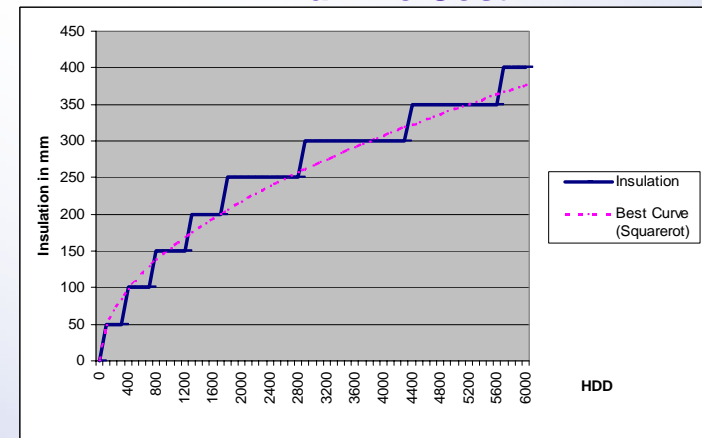
South of Europe



Central Europe



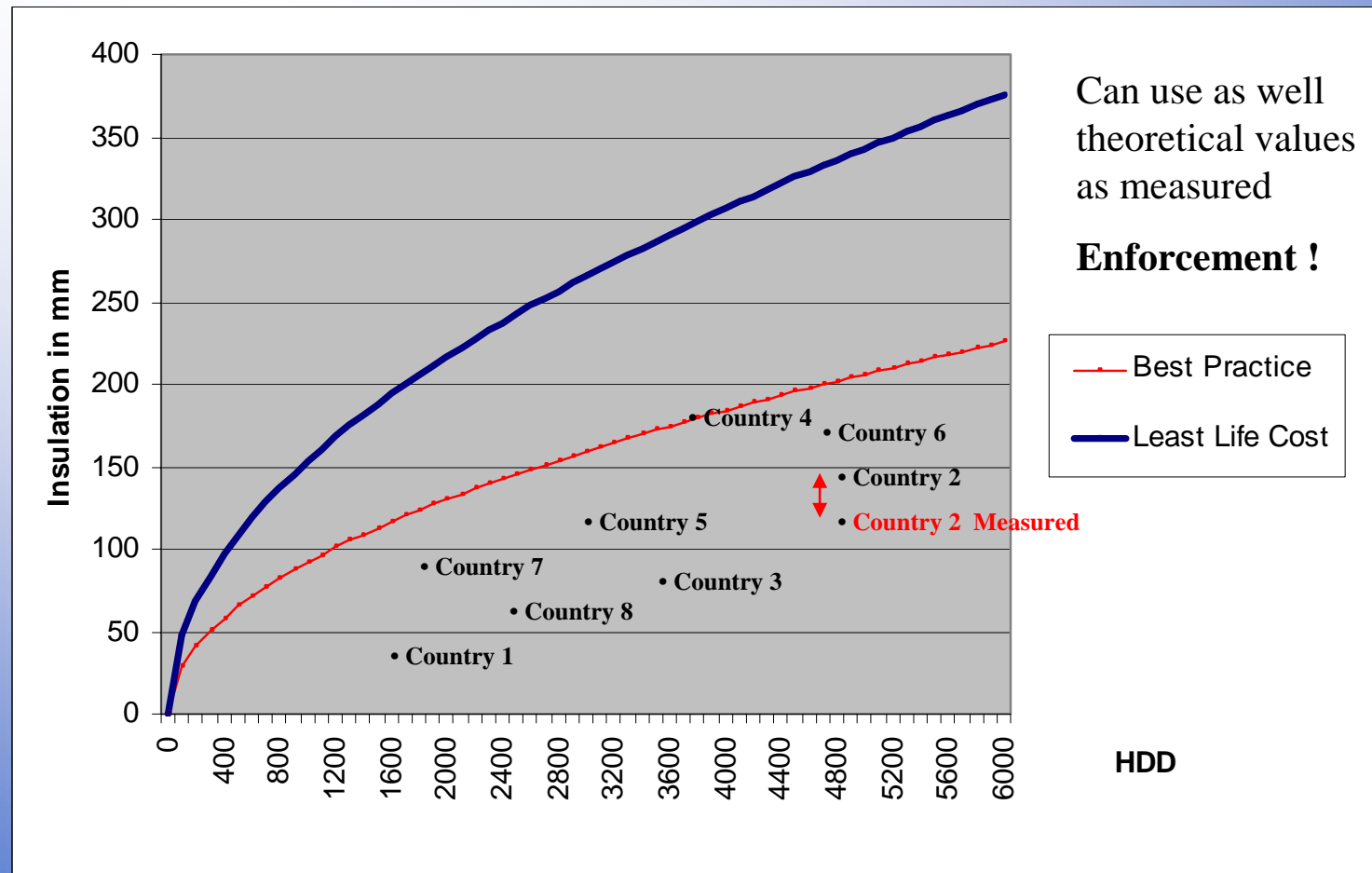
Minimal Life Cost





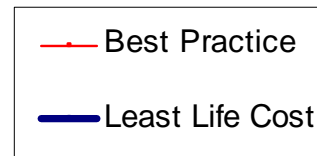
Indicator LLC and Best Practice

Simple insulation of roof or ceiling



Can use as well theoretical values as measured

Enforcement !





Conclusion

- There is need for new indicators to compare, select best practices and show impact of policies
- Especially for new indicators based on Life Costs and Best Practices
- This will show how far Building Codes and energy efficiency in general are from the lifetime costs optimum and best practice !
- Could be shown on parts of the building
 - ◆ u-values, overall u-value, efficiency for boilers or air-conditioner (HVAC)
- Could be shown on the overall value
 - ◆ energy performance or energy frame



● Thank you !