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Better Buildings through Energy Efficiency

A Roadmap for Europe

June 2007

outline

- 3 Eurima studies:
  - Price Sensitivity Analysis of Cost Effective Climate Protection in the EU-Building stock
  - NEW (Sept. 2007):
    U-values for better Energy Performance of Buildings
  - BETTER BUILDINGS THROUGH ENERGY EFFICIENCY
    A Roadmap for Europe

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Sensitivity Analysis of Cost Effective Climate Protection in the EU Building Stock

Increasing energy prices

2007

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5 Energy price scenarios

Energy mix (for EU15 and for EU10) based on:

US$ 25 / barrel

- Scenario 1: energy price 2003 = Eurostat +1,5% increase/anno
- Scenario 2: energy price 2005 = actual dec. 2005 +1,5% /anno
- Scenario 3: energy price 2005+price CO_2-certificate ($23/tonne)
- Scenario 4: high price scenario=

  deferred investment scenario WEO2005
- Scenario 5: peak price scenario=average $70/barrel (2032=$117)

US$ 70 / barrel

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What does it mean for a roof construction?

		Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
u-value before	W/m²a	1,50	1,50	1,50	1,50	1,50
u-value after	W/m²a	0,17	0,17	0,17	0,17	0,17
reduction energy demand	kWh/m²a	96	96	96	96	96
reduction gas consumption	kWh/m²a	106	106	106	106	106
gas price 2002	cent/kWh	4,03	4,44	4,91	5,63	10,82
increase rate		1,5%	1,5%	1,5%	1,5%	0,0%
included price for CO_2 certificates	€/t_{CO2}	0,00	0,00	23,00	23,00	23,00
average gas price (30 years)	cent/kWh	5,16	5,69	6,15	7,08	10,82
annual saved energy costs	Euro/m²a	5,48	6,04	6,54	7,53	11,50
saved energy costs 30 years	Euro/m²	164,5	181,3	196,1	225,9	345,1
Investment costs	Euro/m²	30,00	30,00	30,00	30,00	30,00
Return per Euro invest	Euro/Euro	5,48	6,04	6,54	7,53	11,50
Amortisation	a	5,47	4,96	4,59	3,98	2,61

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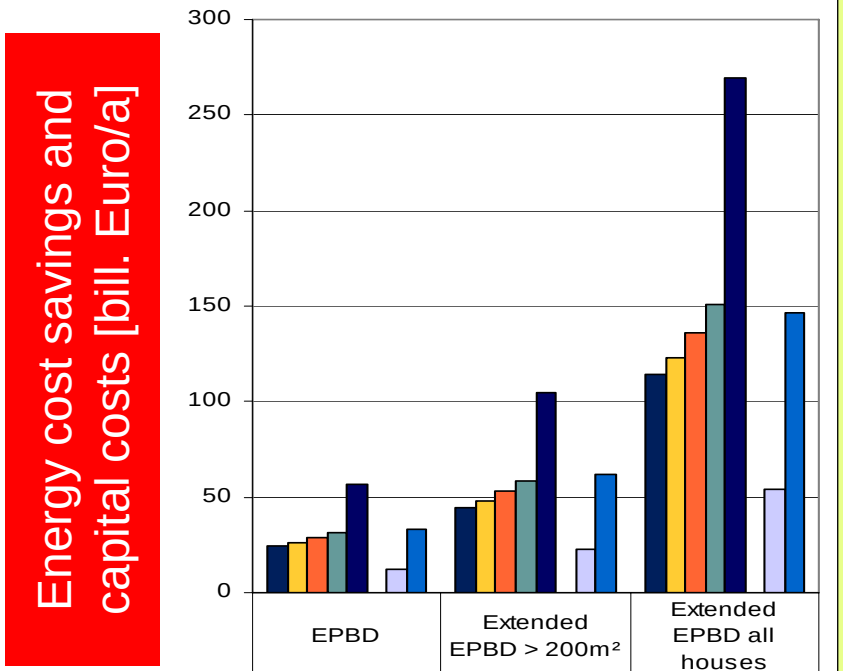
What does it mean for Europe?

Technical potential of energy cost savings

from price scenario 1 to scenario 5 savings have **more than doubled.**

- EPBD savings:
  24 → 56 Bill. €/anno
- Revised EPBD savings:
  114 → 270 Bill. €/anno

Technical potential: EU-25 energy cost savings



	EPBD	Extended EPBD > 200m²	Extended EPBD all houses
Price scenario 1	24	45	114
Price scenario 2	26	48	123
Price scenario 3	29	53	136
Price scenario 4	32	59	151
Price scenario 5	56	104	270
capital costs coupled retrofit	12	22	54
total capital costs	33	62	147

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Energy cost savings in 2010

phased implementation

Energy cost savings 2010		EU-25	
In billion EURO		EPBD	Ext. EPBD all houses
Price scenario 1: 2002 EU-15 prices	**US$ 25 / barrel**	8,6	18,5
Price scenario 2: 2005 EU-15 prices			19,8
Price scenario 3: 2005 plus current price for CO2 certificates			22,0
Price scenario 4: high price scenario			4,3
Price scenario 5: peak price scenario	**US$ 70 / barrel**	17,8	38,0

2x **4x**

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Total annual profit in 2010

phased implementation

Total annual profit 2010	EU-25	
In billion EURO	EPBD	Ext. EPBD all houses
Price scenario 1: 2002 EU-15 prices	4,3	8,7
Price scenario 2: 2005 EU-15 prices		10,1
Price scenario 3: 2005 plus current price for CO2 certificates		12,3
Price scenario 4: high price scenario		4,6
Price scenario 5: peak price scenario	13,4	28,3

US$ 25 / barrel

US$ 70 / barrel

3x

6x

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Ecofys VII

U-values for better energy performance buildings in Europe

Two criteria

- Article 6 EPBD ‘Existing buildings’:
  - When buildings with a total useful floor area over 1 000 m2 undergo major renovation, their energy performance should be upgraded in order to meet minimum requirements in so far as this is **technically, functionally and economically feasible**.
- Climate change: what does **the target of 60-80% CO2 emissions reduction** by 2050 mean for the maximal energy consumption (minimal insulation standard) of retrofitted houses in different European climates?
- What the study does not take into account …

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Key findings

- In 2007, most of required U-values for wall, roof and floor **in new buildings are far from the economic optimum.**
- U-values recommended in the study **are valid for new as well as for existing buildings**
- Almost identical U-values, whether calculated base in **cost effectiveness or post Kyoto target.**
- **Insulation reduces energy demand for cooling** of residential buildings, in Southern Europe

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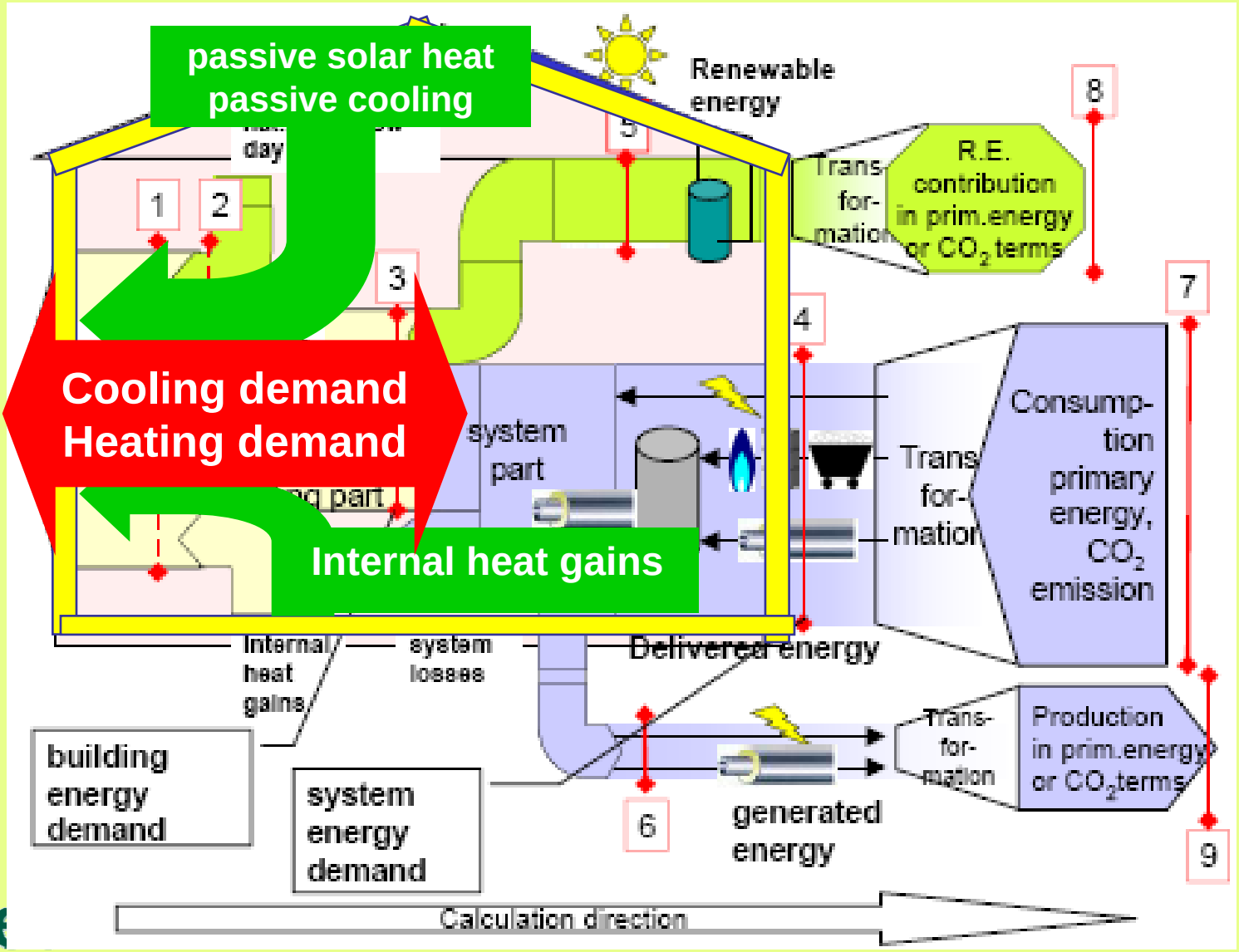
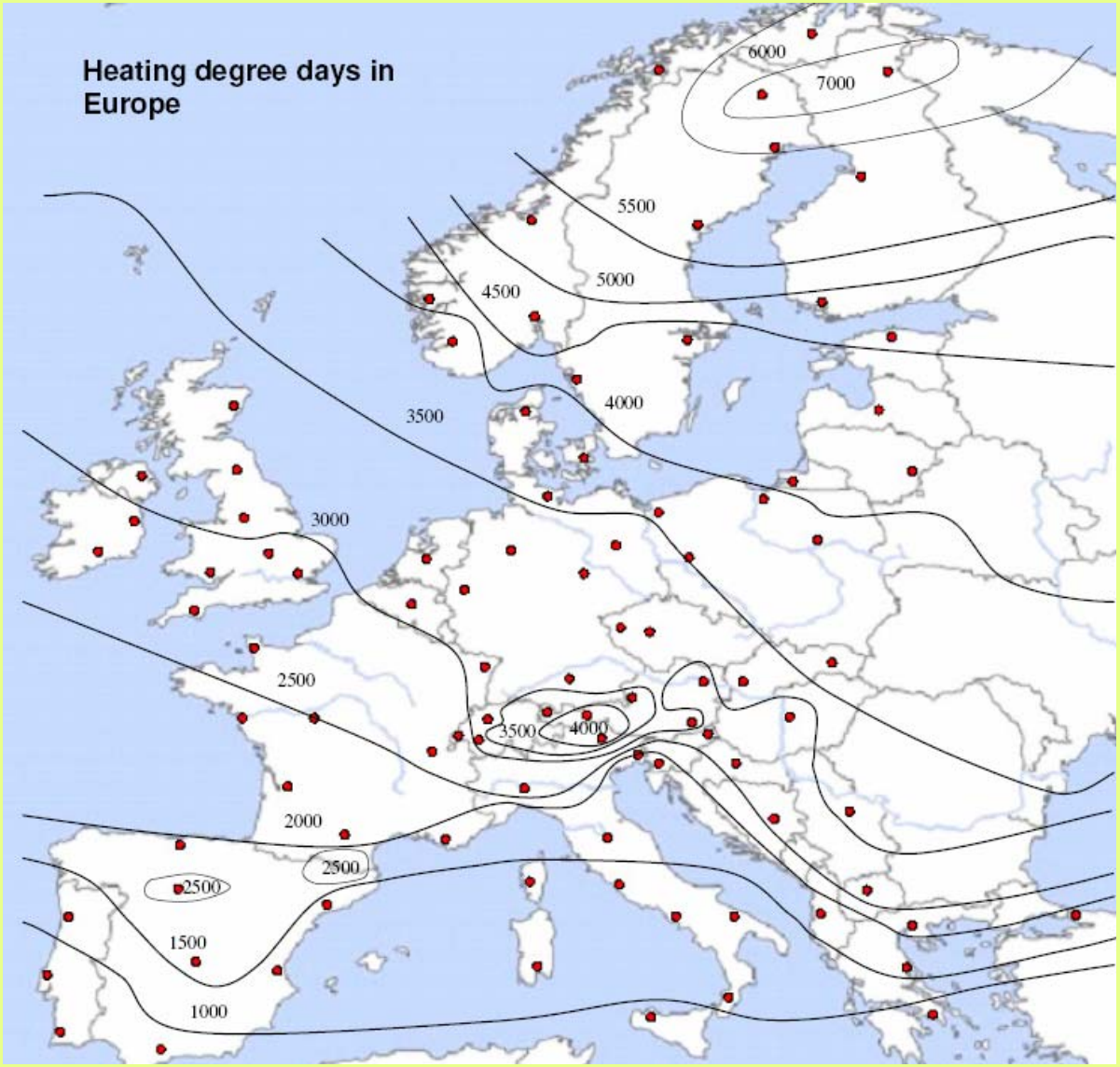
EPBD: Whole building energy balance



HDD map



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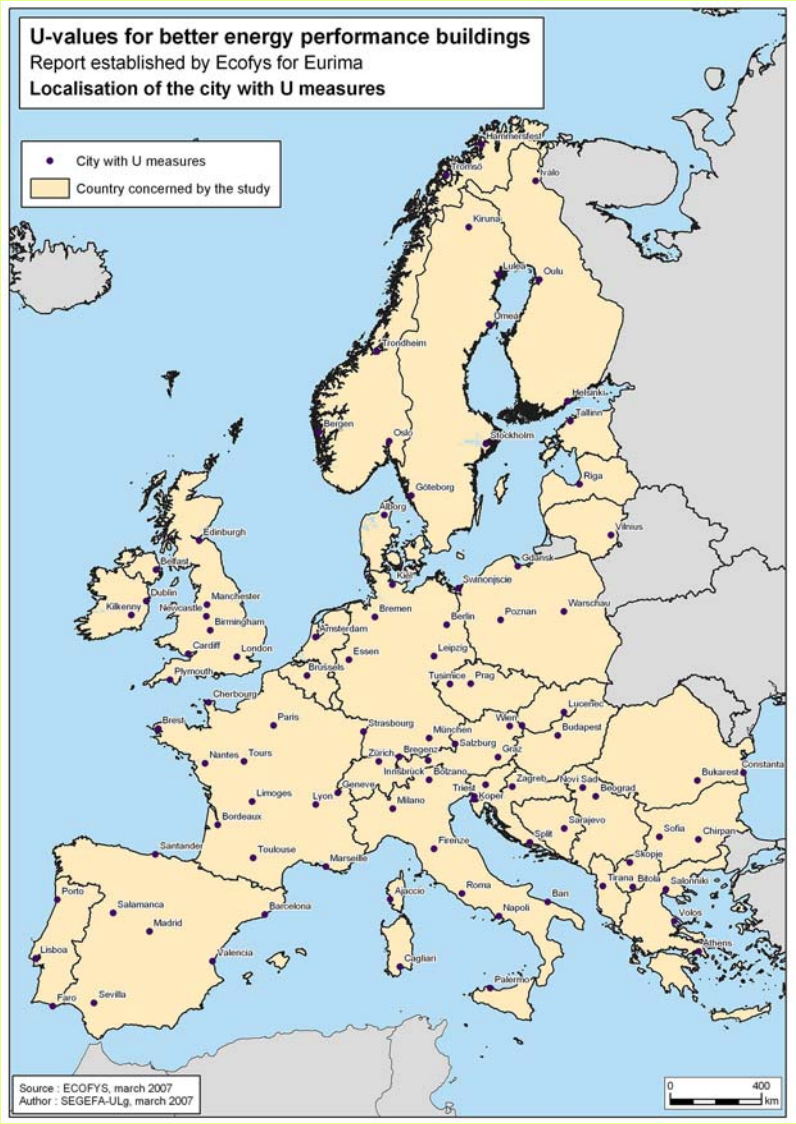
Geographical coverage

Europe

- EU15
  + Norway + Switzerland
- New EU-8 + Romania, Bulgaria, Croatia, Bosnia and Herzegovina, Serbia and Montenegro, Macedonia and Albania

100 cities

- Climate conditions for heating and cooling
- Local/regional conditions are not covered



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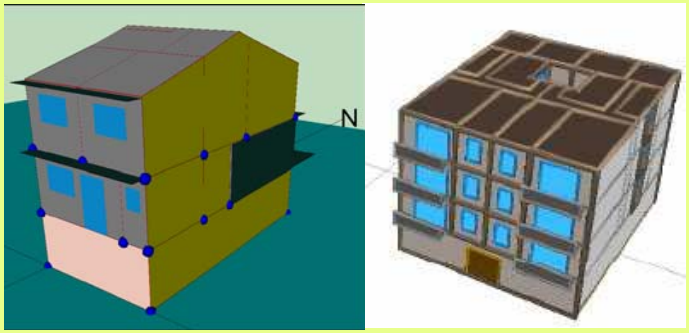
Impact U-value on the heating and cooling demand

Best-practice U-value for heating and cooling demand

- Criteria: cost effectiveness
  - Energy price and Energy mix
    - WEO 2006 – Peak Price ($70 / barrel)
  - Investment costs & Interest rate
- Criteria: Post Kyoto target

Single Family House

Multi Family House



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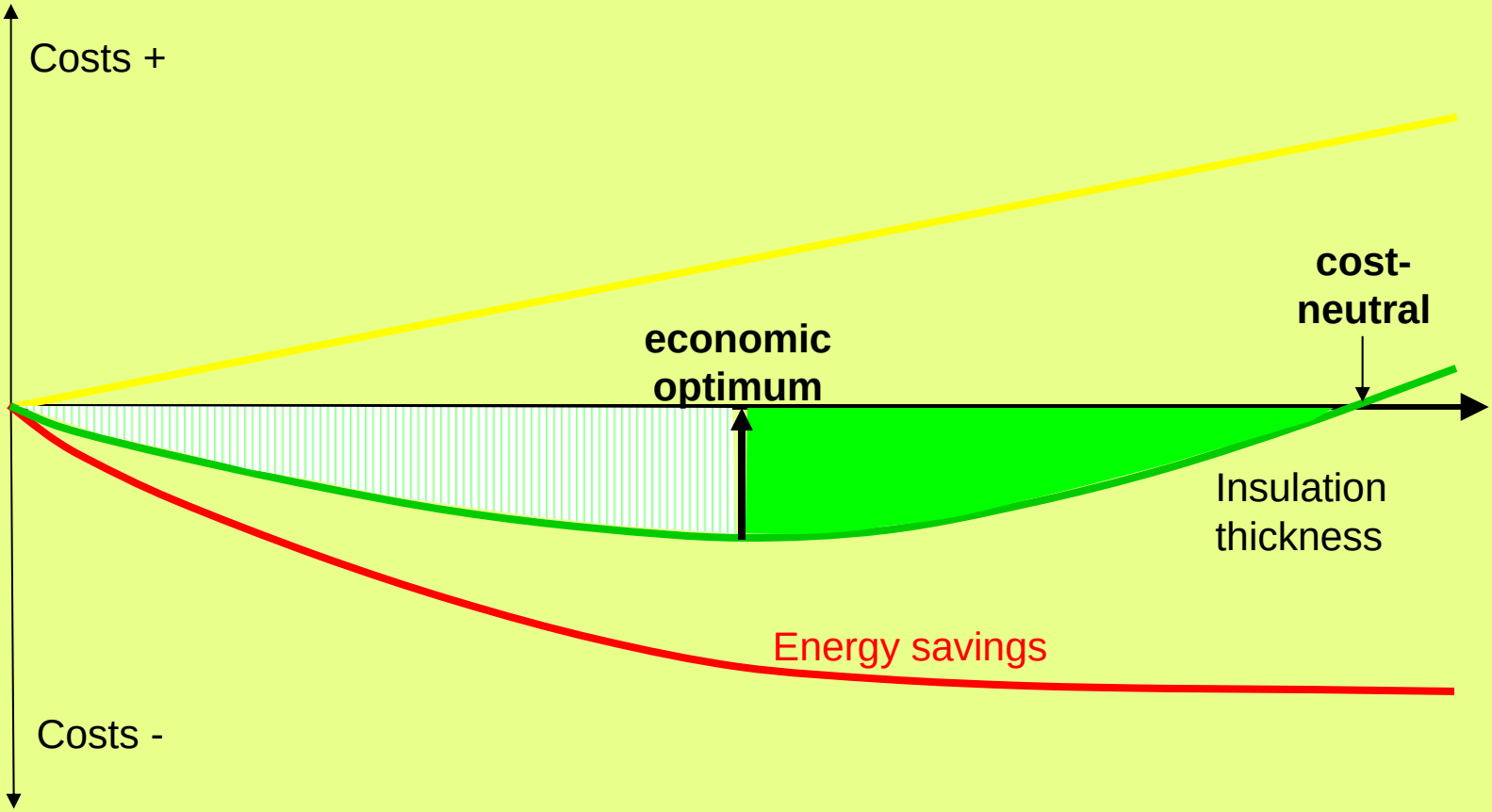
Profitable range



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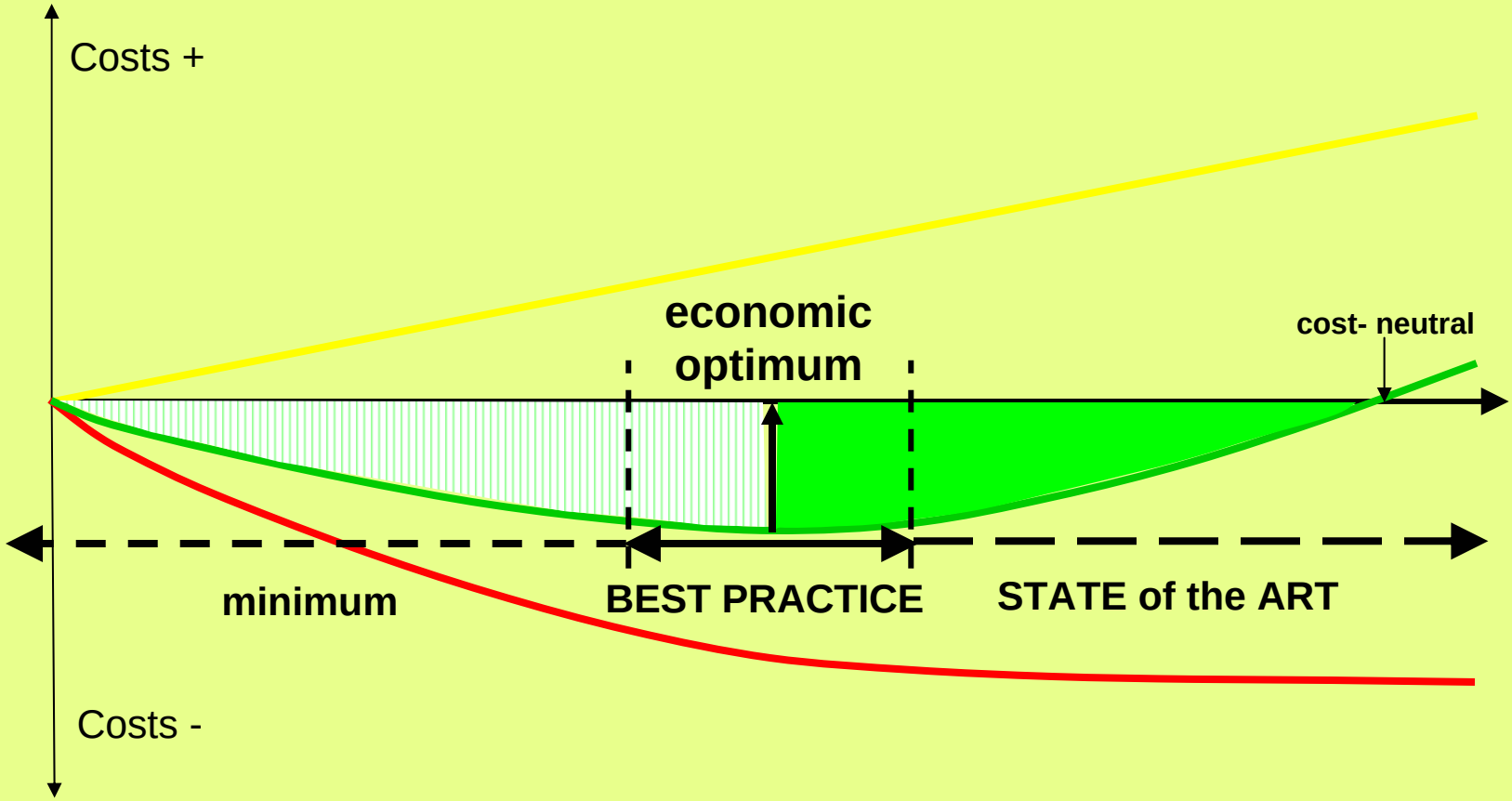
Best Practice



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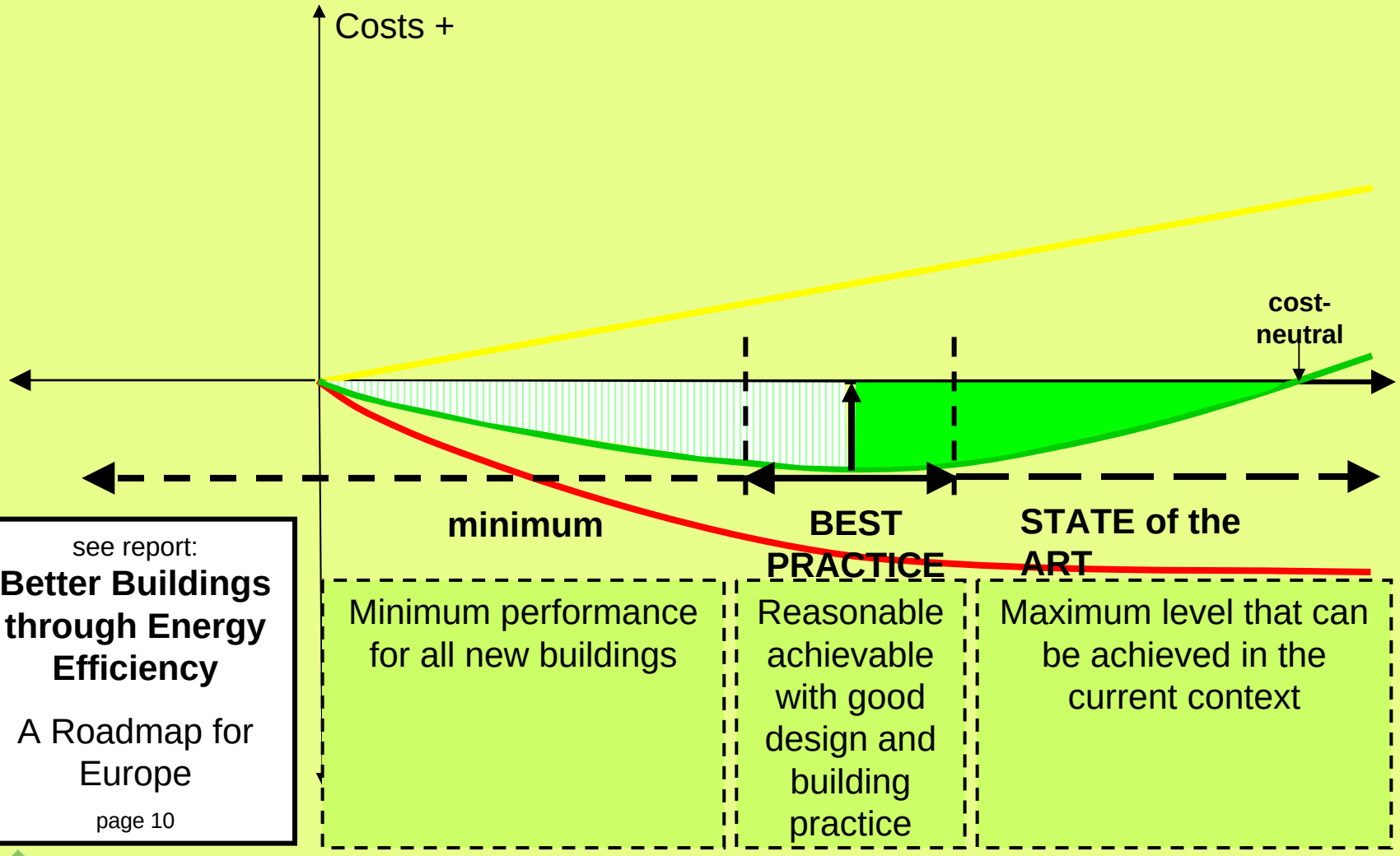
3 ambition levels



see report:
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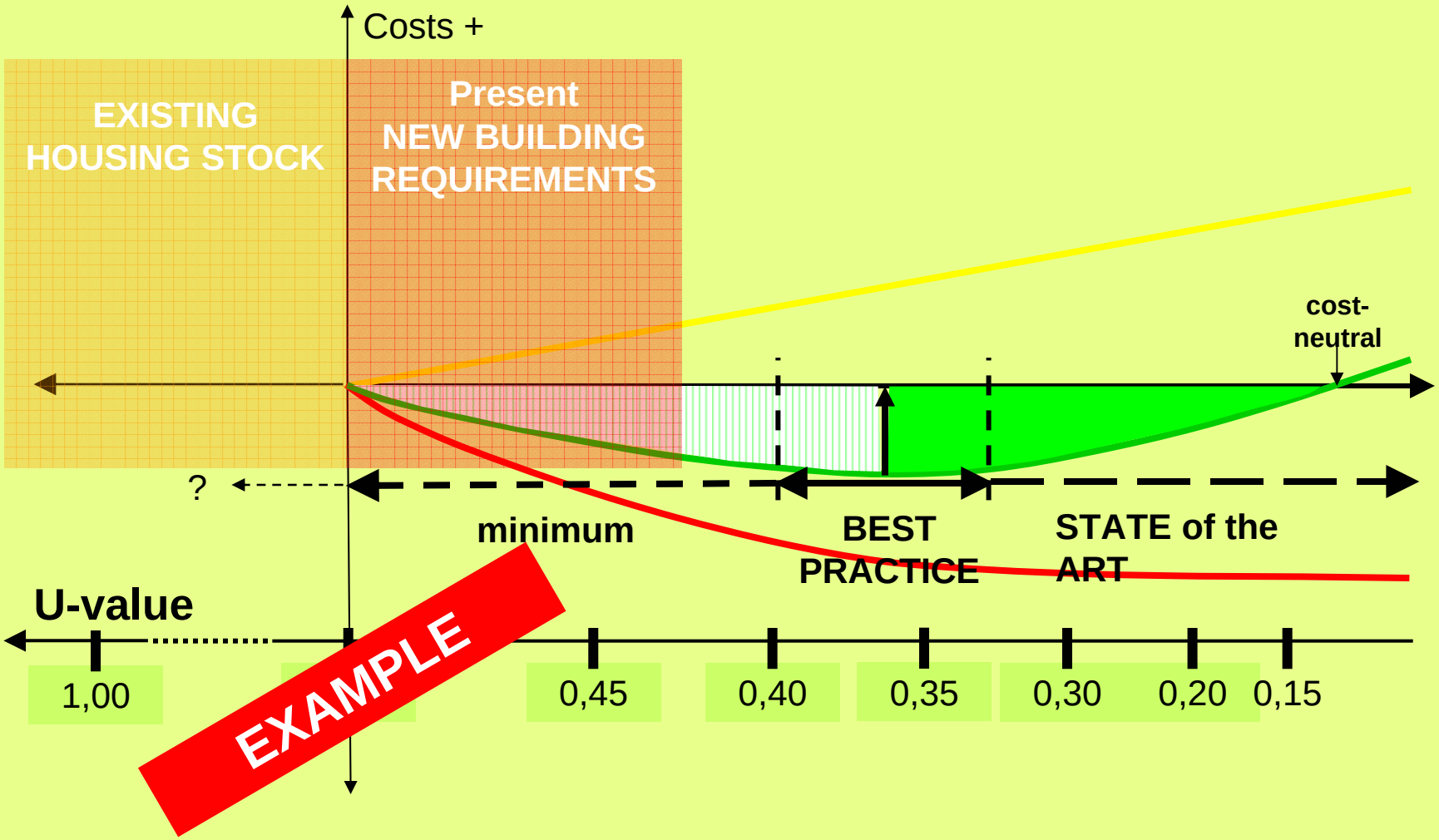
Where is the building stock?



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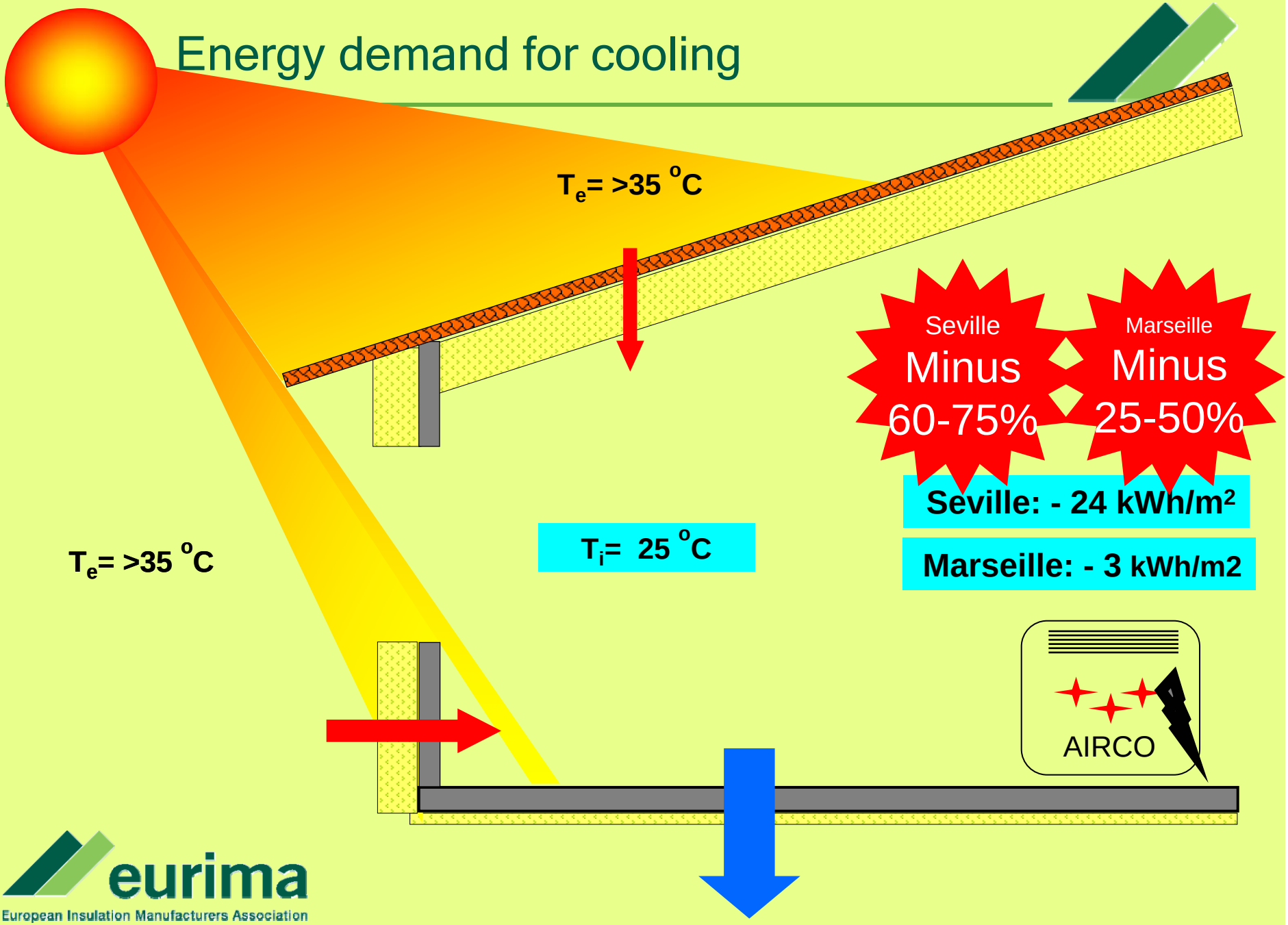
Energy demand for cooling



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Conclusions

Energy demand for **cooling**

well insulated buildings

- save energy in all climate conditions
- roof insulation most significant, followed by external wall insulation
- compromise ground floor insulation: energy - / condensation +

robust to user behaviour

- insulation still reduces energy demand if shading, ventilation, internal heat gain, is not optimum
- contrary to general perception: insulation is decreasing the energy demand for cooling (in RESIDENTIAL BUILDINGS)

insulation can compensate for low thermal inertia

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Energy demand for heating

Economic optimum:

- for WEO2006 and Peak price scenario

Environmental optimum to reach Post-Kyoto targets

- discussions on Post-Kyoto targets are starting now
- CO_2-targets for the building sector: 85% reduction
- Calculations for U-value for 4 cities (regions)

CONCLUSION - CONFIRMATION:

$U_{CO_2} \sim U_{econ.}$

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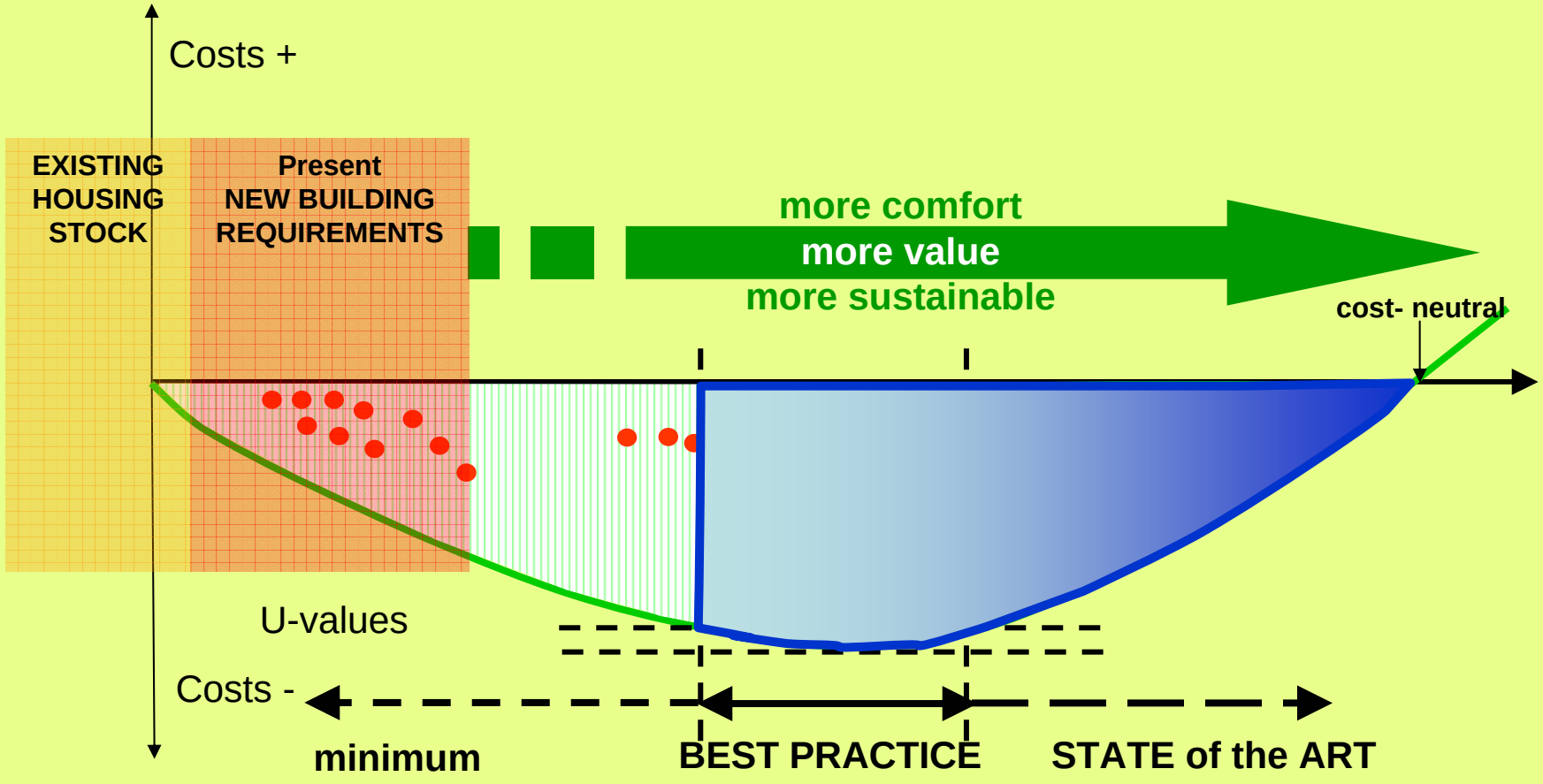
Moving right !



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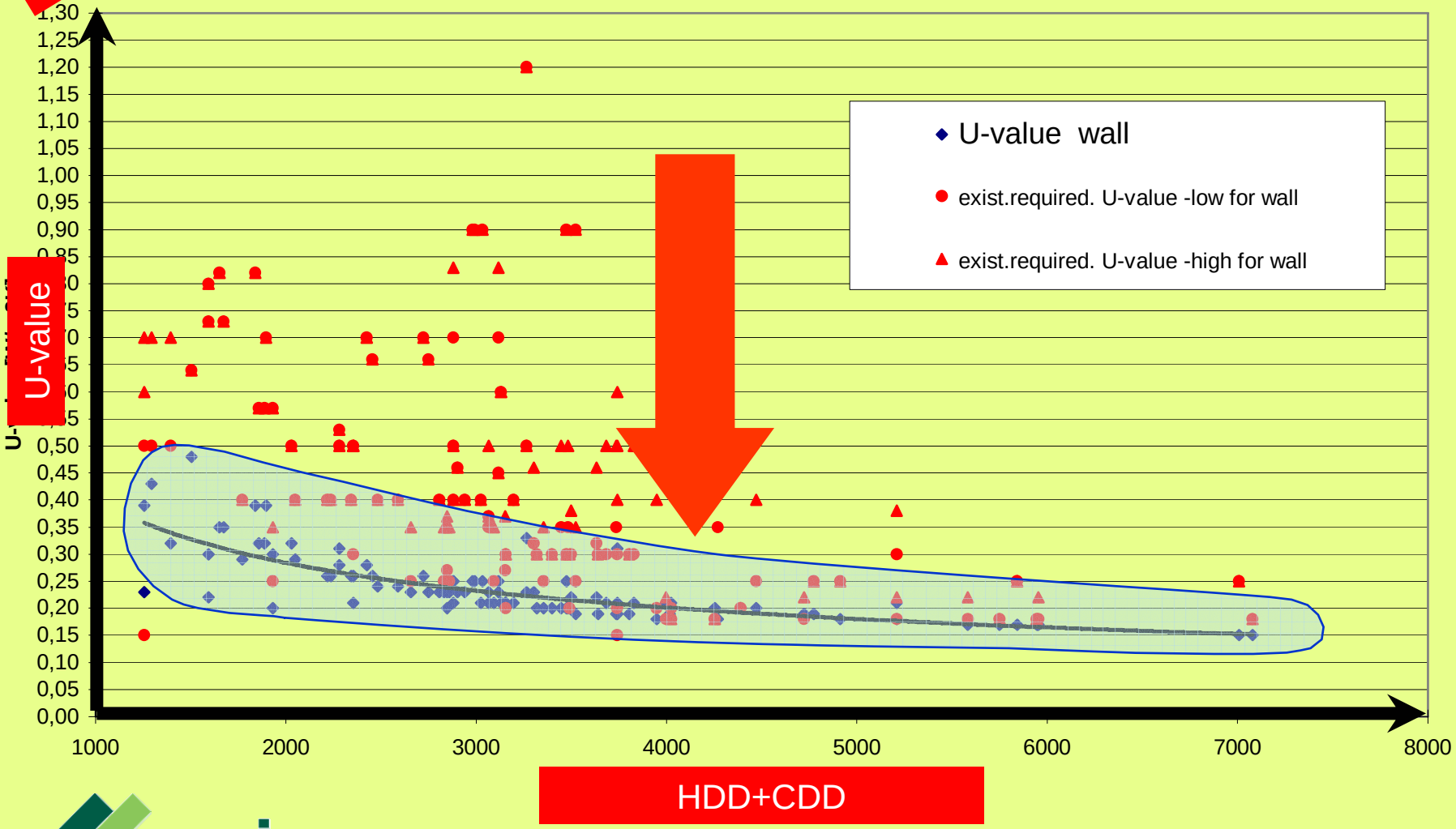
NEW: Eurima report Sept. 2007

WEO 2006 - wall



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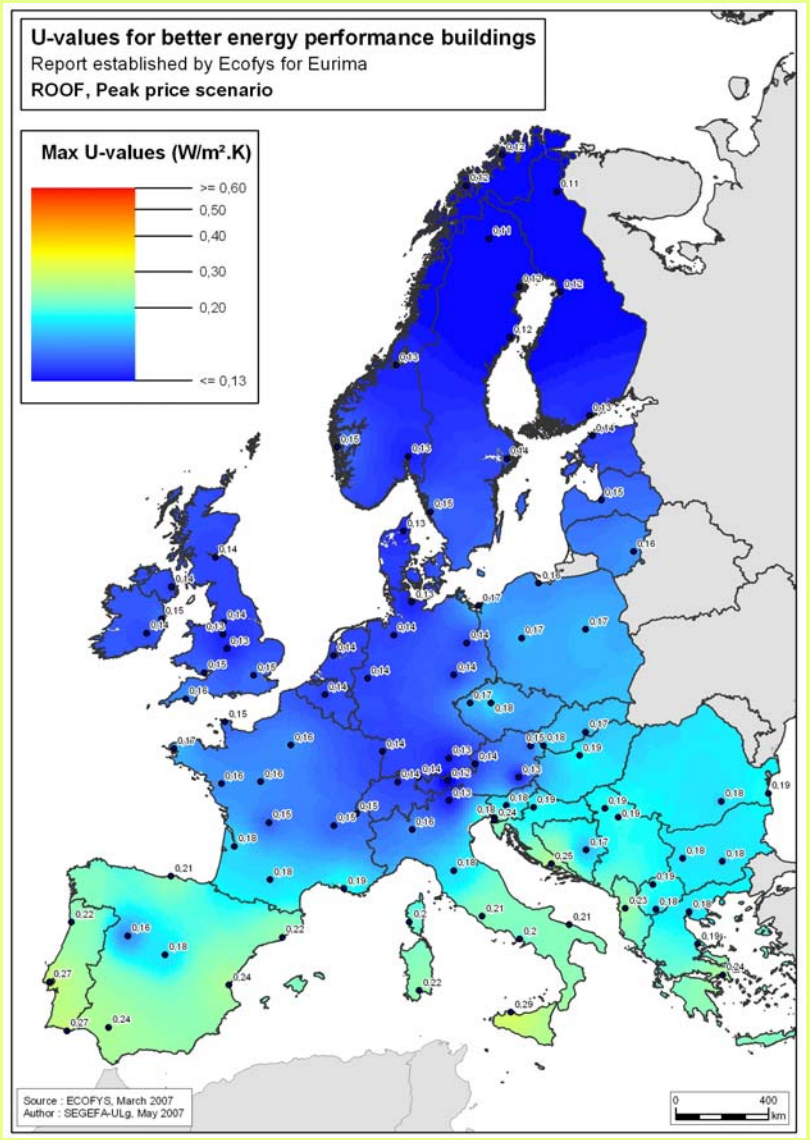
NEW: Eurima report Sept. 2007

Roof

esent U-values



U-values based on WEO2006 price

U-values based on peak-price

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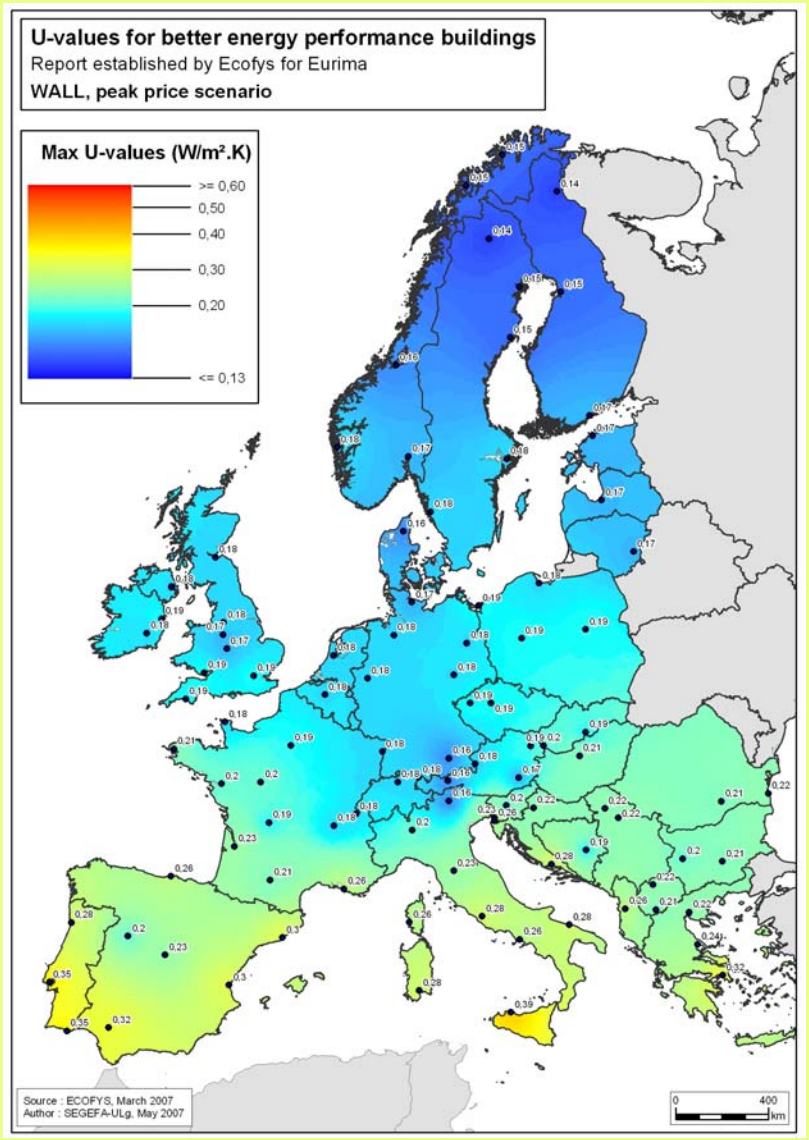
NEW: Eurima report Sept. 2007

wall

esent U-values



U-values based on WEO2006 price

U-values based on peak price

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Positioning of the project: BETTER BUILDINGS THROUGH EE

- Support for building energy efficiency improvements
- Lack of understanding of what policies can deliver
- Quick scan to address this gap
- Analyses of national and regional initiatives
- Development of policy packages for every situation

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Quick-Scan of Building Energy Efficiency Programmes

1. Selection of Best Practices
2. Description and Classification (fact sheets)
3. Strengths & Weaknesses of Instruments
4. Definition of Prototype Instruments
5. Barriers & Instruments of Sectors
6. Policy Packages, per Building Sector & Tenure

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EU Roadmap Model

Best Practices Selection

Strengths & Weaknesses of Instruments

Description & Classification of Best Practices

Analysis of Barriers per Building Sector & Tenure

Prototype Instruments

Policy Packages per Building Sector & Tenure

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Prototype Instruments

Regulatory	• Regulatory benefits for above-standard energy performance • Mandatory environmental performance evaluation with minimum requirement • Above-standard requirements for government buildings • Energy upgrading requirements when renovating a building
Economic	• Preferential loans for significant (above-standard) energy performance improvements • Tax credits for installing energy-saving products
Communicative	• Building energy performance audits • Demonstration projects • Voluntary energy conservation agreements
Organisational	• Independent energy audits with organisational support • Professional management for multi-family housing • Independent verification of sustainable building investments • Energy service contracts

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Example: Barriers & Instruments
Existing Residential Buildings, Owner-occupied

Key barriers	Promising instruments
• Lack of upfront money • Lack of professional advice/ limited offers / complicated procedure • Lack of specific knowledge/ knowledge of alternatives • Lack of obligations	• Preferential loans (perhaps in combination with the EPBD energy certificates) • Tax credits for installing energy-saving products • Energy performance advice • Organisational support like Chance Energiepass • Partner Programme • Homeowner associations • Demonstration projects • Energy regulations for the existing stock

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Policy Packages

- Final outcome of the quick-scan
- Combination of instruments
  - typically regulatory or economic & communicative or organisational
- On European scale – localisation needed
- Issues:
  - What are key barriers for the sector and tenure?
  - What instruments can work together to address a specific setting?

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Policy Packages
Existing Residential Buildings

Owner-occupied	• Preferential loans for significant energy performance improvements combined with energy audits with organisational support • Energy upgrading requirements combined with energy audits with organisational support
Private rental	• Tax credits for installing energy-saving products (for landlords) combined with energy audits with organisational support • Energy upgrading requirements combined with energy audits with organisational support
Social rental	• Energy upgrading requirements combined with energy audits with organisational support

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Policy Packages
Existing Commercial & Public Buildings

Commercial buildings	
Owner-occupied	• Tax credits for installing energy-saving products combined with energy conservation agreements • Energy upgrading requirements
Private rental	• Tax credits for installing energy-saving products combined with energy conservation agreements • Energy upgrading requirements
Public buildings	
	• Above-standard requirements for government buildings, combined with energy performance contracting

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Conclusions

Key observations

- Much more can be done
- Good programme principles identified, for all sectors & tenure situations
- Regional differences not as important as tenure
- Usually more barriers present, but only one addressed

Key results

- Prototype instruments and policy packages useful to analyse and develop European & local policies
- Organisational support deserves more attention
- Combination of instruments required, including up-front money (loans)

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Recommendations

For Projects

- Perform good barrier & instrument analysis
- Combine instruments (financial / legal with organisational / communicative)
- Access national or European financing (Structural funds - JESSICA)

For Europe

- To ensure that local parties put programmes in place
- Support national & local parties
- Require a good barrier & instrument analysis
- Follow-up with sector-specific regulation

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Sector-Specific Recommendations

- Existing residential buildings:
  - Extend EPBD to cover renovation of components
  - Extend EPBD to cover follow-up of audits
  - Promote organisational support schemes
- New residential & commercial buildings:
  - Set minimum and high performance levels
  - Promote incentives for above-standard buildings
- Existing commercial buildings:
  - Promote Energy upgrading requirements
- Public buildings:
  - Promote above-standard requirements

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