3encult

EFFICIENT ENERGY FOR EU CULTURAL HERITAGE

Historic buildings and city centres –

the potential impact of conservation compatible energy refurbishment on climate protection and living conditions

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Key question

Is it reasonable to invest – thoughts and money – in the energy refurbishment of historic buildings?

What is the potential impact in terms of

→ energy saving
→ CO_2 emission reduction
→ comfort
→ societal aspects

Definition

- Denmark
- Bologna

Denmark

- 9,000 buildings in Denmark are listed (as the best or most characteristic of their type and period)
- 300,000 buildings have been assessed to be worthy of preservation.

→ SAVE project: documentation of buildings built before 1940

Bologna

Urban Building Regulation distinguishes buildings of

- historic-architectural value
- modern architectural value
- historical documentary value
- modern documentary value

3616 buildings in city centre

→ 60% before 1919

→ 80% before 1945

Definition

→ Denmark
→ Bologna

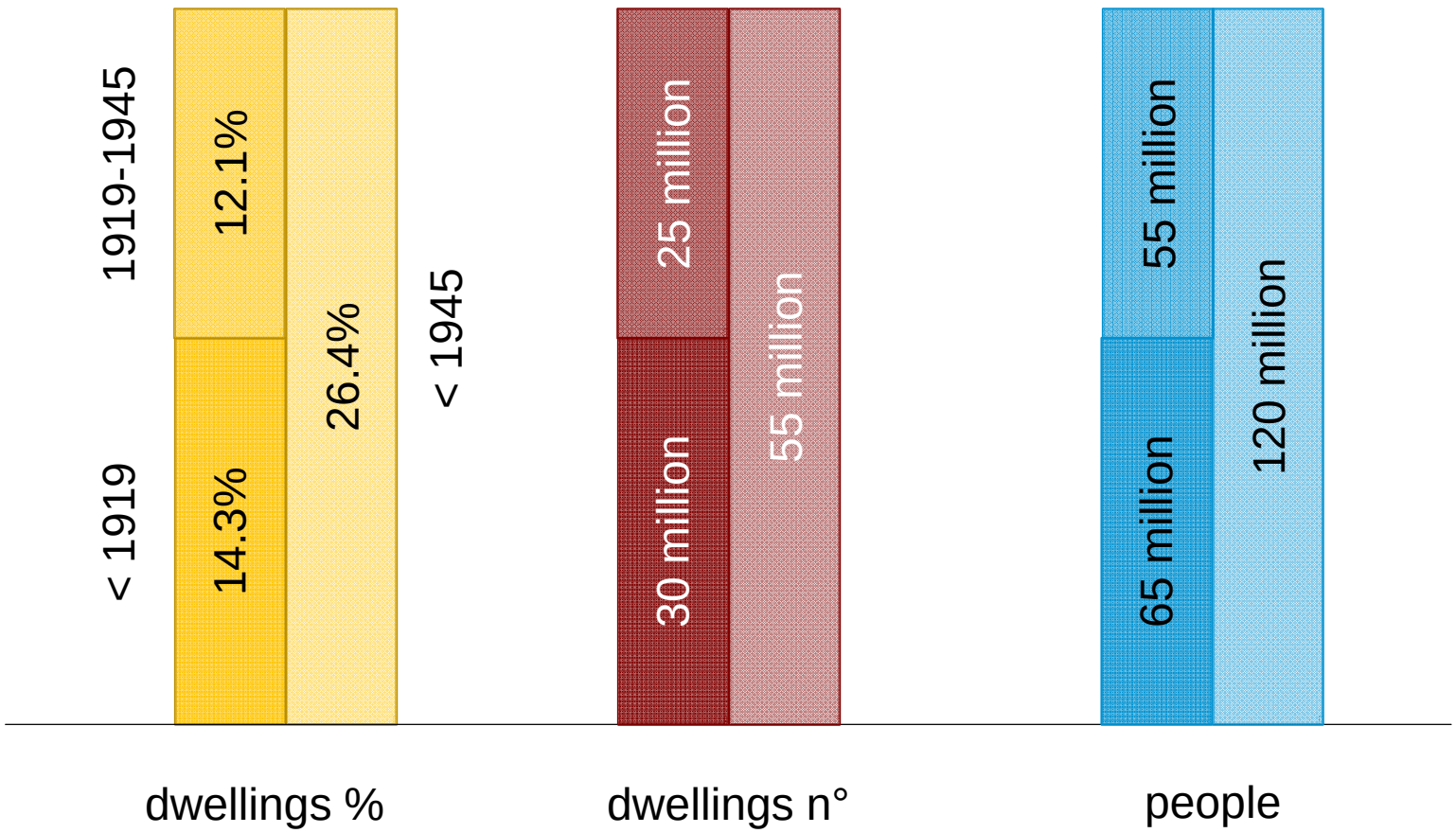
- Buildings dating before 1919

  Certainly the **big part of this building stock** makes part of the **cultural heritage** of European countries und gives **identity** to European cities, villages and public spaces.

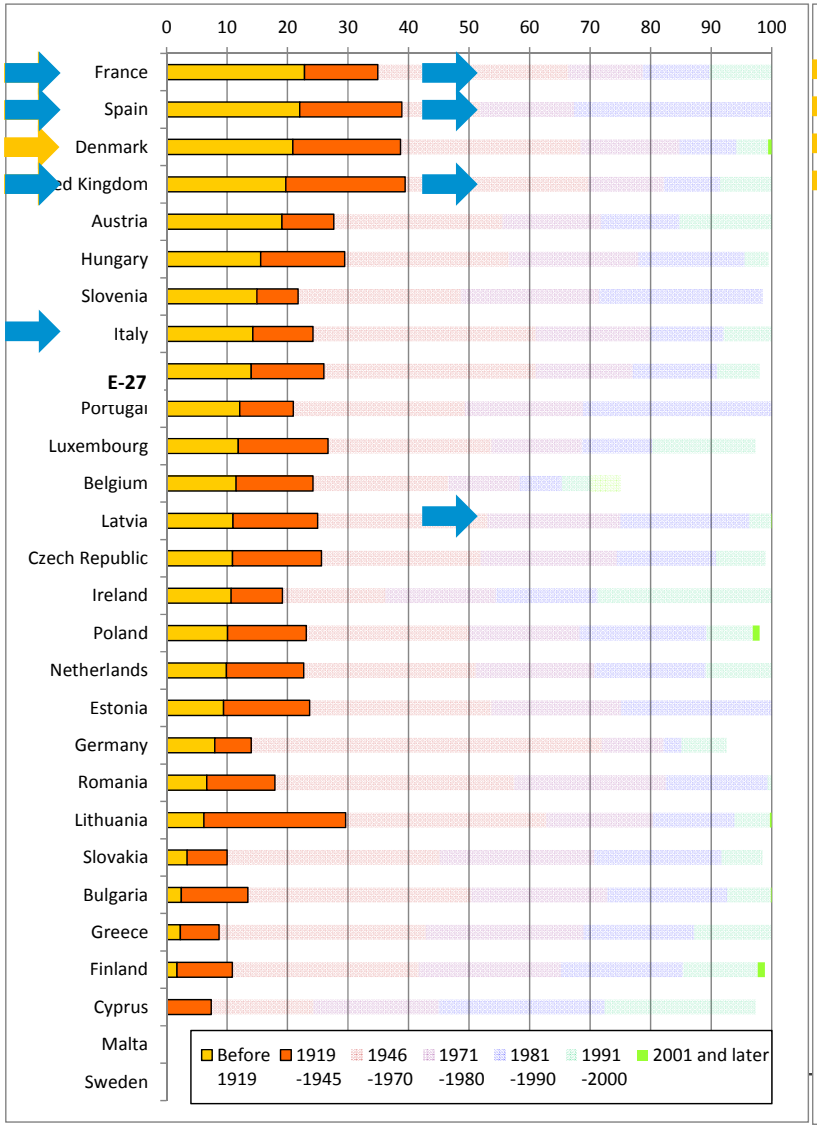
- Buildings built 1919 - 1945

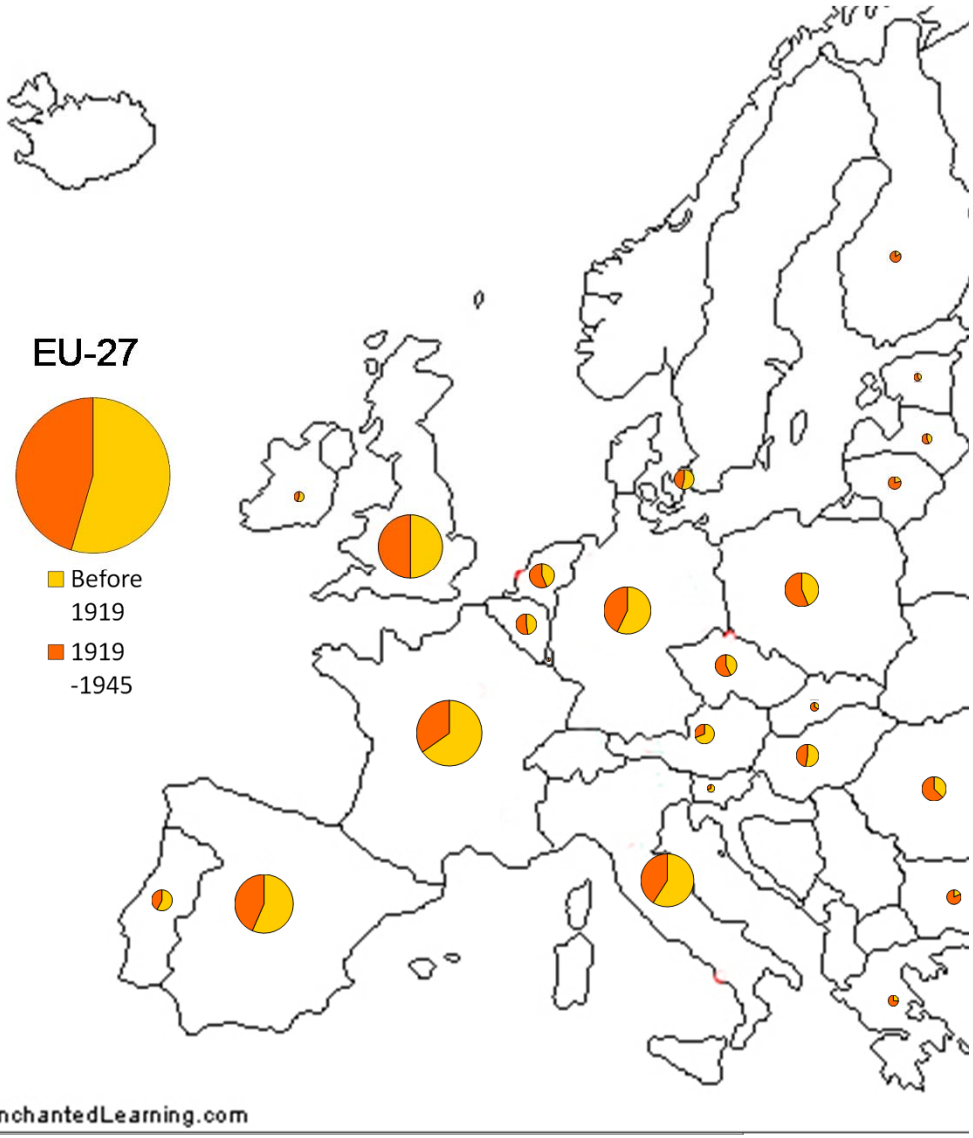
  Even if much less buildings from this latter epoch than from the building stock before 1919 are listed, they **form a part of the city-centre and cityscape** and retrofit interventions should take account of the **specific demands in terms of aspect preservation.**

Statistics


1919-1945
< 1919
12.1%
14.3%
26.4%
< 1945
25 million
30 million
55 million
55 million
65 million
120 million
dwellings %
dwellings n°
people

Variation


0
10
20
30
40
50
60
70
80
90
100
France
Spain
Denmark
ed Kingdom
Austria
Hungary
Slovenia
Italy
E-27
Portugal
Luxembourg
Belgium
Latvia
Czech Republic
Ireland
Poland
Netherlands
Estonia
Germany
Romania
Lithuania
Slovakia
Bulgaria
Greece
Finland
Cyprus
Malta
Sweden
Before 1919
1919 -1945
1946 -1970
1971 -1980
1981 -1990
1991 -2000
2001 and later


EU-27
Before 1919
1919 -1945
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Energy demand & CO_2 emissions

specific energy demand	170 kWh/m²a	European average [Balaras & al. 2007], [Uihlein & Eder 2010]
X	X	
dwellings‘ size	90 m²/dwelling	based on 50% of stock [UNECE 2004 consistent with [Balaras & al. 2007]
X	X	
n° of dwellings	55.9 million dwellings	
=	=	
energy demand	**855 TWh/a**	
energy demand	855 TWh/a	
X	X	
specific emissions	0.28 kg/kWh	For EU-27 in 2000 [Uihlein & Eder 2010]
=	=	
CO_2 emissions	**240 Mt/a**	**~5% EU-27 emissions in 1990**

Examples for reduction in energy demand

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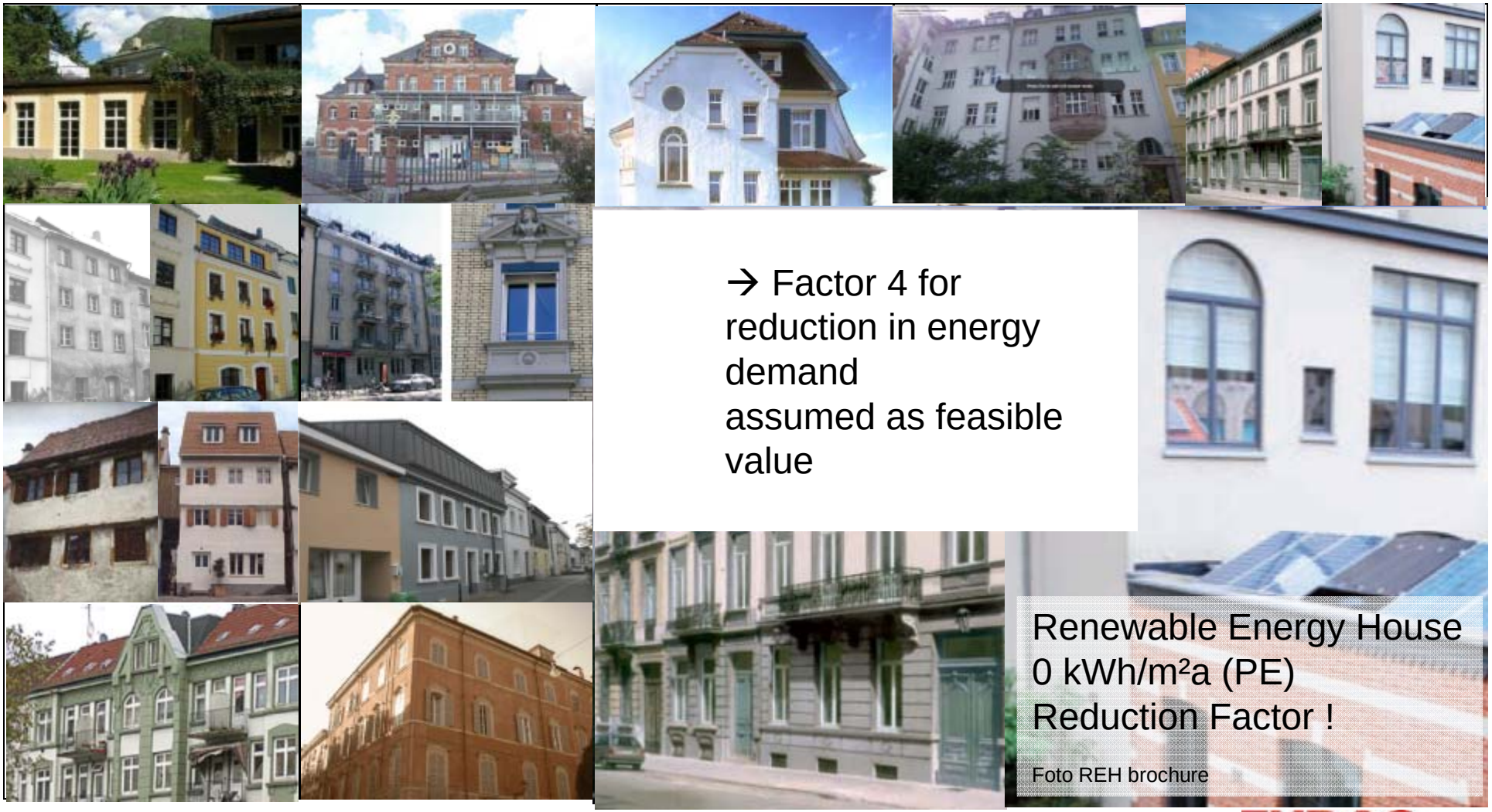

→ Factor 4 for reduction in energy demand
assumed as feasible value

Renewable Energy House
0 kWh/m²a (PE)
Reduction Factor !

Foto REH brochure

EURAC research

Energy & CO_2

- energy saving – factor 4

  - 640 TWh/a (Europe)
  - 11’500 kWh/a (dwelling)

- CO_2 emission reduction
  → reduction of 180 Mt/a (Factor4 applied also here),

  i.e. 3.6% of EU-27 1990 emissions

  depends very much on energy source, can also be higher!

Comfort

- Higher (possible) air temperature
- Higher surrounding surface temperature

  → lower air temperature with same comfort
- Less air draught

  → neither actual outdoor air entering through windows

  → nor cold air streams under cold windows
- Better air quality (CO_2 level, odours, particles …)

Societal aspects

- Reduce energy bills → **avoid fuel poverty**
- Support with use & maintenance of historic building their **long term preservation**
- Sustain identification of inhabitants with their **heritage as common value**
- Keep/re-establish city centres as high quality, **attractive living areas**
- Avoid need for new infrastructure and soil
- Maintain our cities attractive for high level tourism

Conclusion

- energy saving – factor 4

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  - 11’500 kWh/a (dwelling)

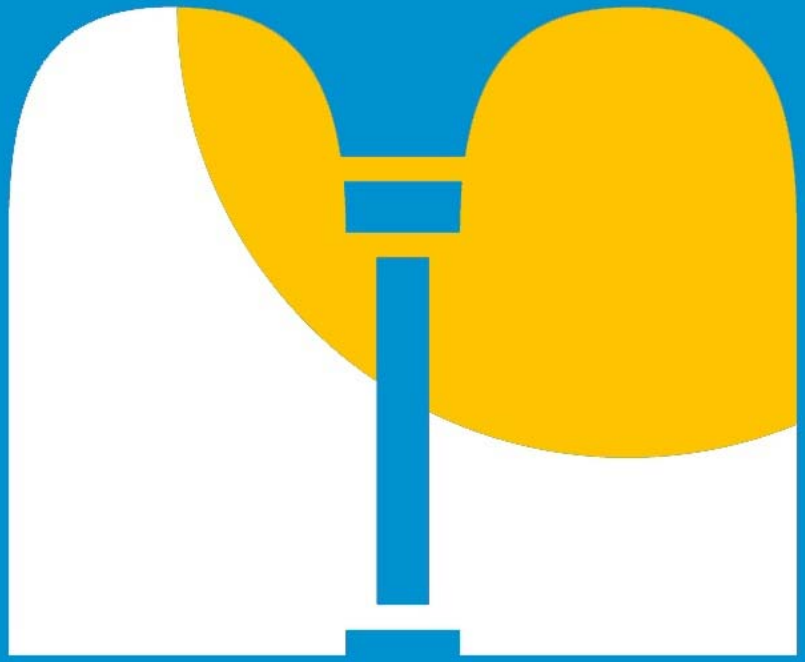
- CO_2 emission reduction
  → reduction of 180 Mt/a (Factor4 applied also here),

  i.e. 3.6% of EU-27 1990 emissions

  depends very much on energy source, can also be higher!

- comfort
  → higher surrounding temperatures and less draughts

- societal aspects
  → lower energy costs, more attractive historic city centres



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