Buildings 2020- a challenge and a big opportunity

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STRATEGIC GOALS

Global strategy:

- Buildings worldwide account for a surprisingly high share, about 40% of global energy consumption, the resulting carbon production being about 38 % of the total amount.
- These reductions are fundamental to support achieving the International Energy Agency's (IEA) target of a 77% reduction in the planet's carbon footprint against the 2050 baseline to reach stabilized CO_2 levels called for by the Intergovernmental Panel on Climate Change (IPCC)
- Large and attractive opportunities exist to reduce **buildings' energy use at lower costs and higher returns than other sectors**.

European strategy

- The EU`s SDS (**Sustainable Development Strategy**) for developing sustainable development **strategies at national and regional levels**.
- **Management of energy demand** is an important tool enabling the Union
  - **to influence the global energy market** and
  - for the **security of energy supply** in the medium and long term.
- EU has signed an international agreement on the commitment **to reduce, by 2020, overall greenhouse gas emissions by at least 20 %** below 1990 levels.

Directives and standards of EU

1. ***Directives on sustainability:*** related to construction assets, the construction activity itself or the construction product industry, in particular the Building Energy Performance.

2. Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings :

- For **new buildings** Member States shall ensure that:
- (a) by 31 December **2020**, all new buildings are **nearly zero-energy buildings (NZEB)**; and
- (b) after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy buildings
- In **major renovation**, the energy performance of the building or the renovated part thereof has to **meet minimum energy performance requirement**s in ***so far as this is technically, functionally and economically feasible***.

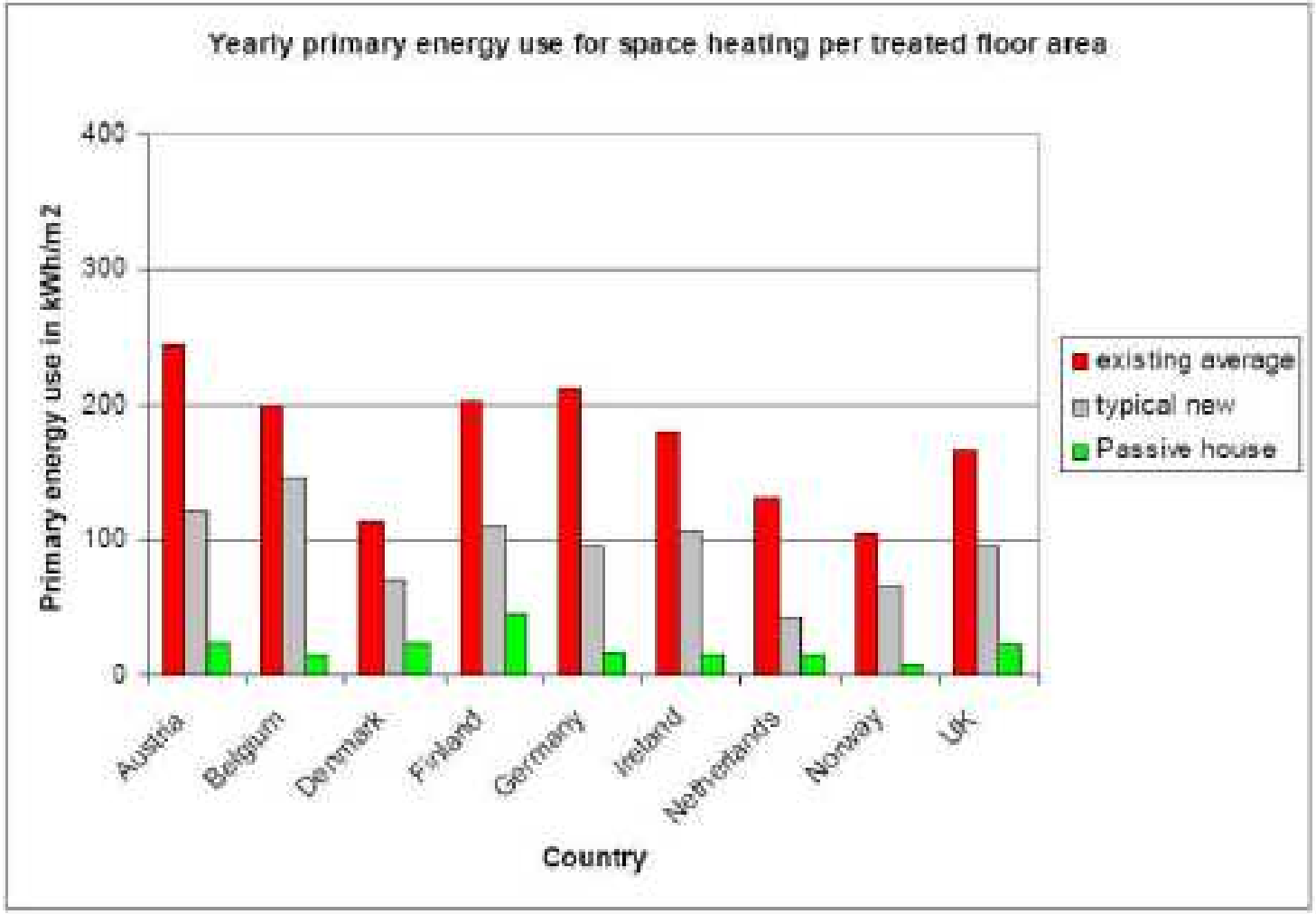


Figure 1 : Yearly primary space heating energy uses per dwelling, per existing, typical new and passive house[3]

Challenge and Opportunity

- **Knowledge**, models, building concepts and a thousends of passive buildings are **existing**
- The big change seems to be **possible**, but is very **challenging especially for SME:s** (Small and Medium Size Entrepeneurs)

CONCEPTS FOR ENERGY EFFICIENT BUILDINGS

1. *Low-energy House*

- A low-energy house is a building having a lower heating demand, with limit values differently defined in national standards.
- The buildings are distinguished by higher insulation of the building envelope, ventilation systems with heat recovery and windows and glass facades facing to the south to gain passive solar heat – where the climate so admits (Wirth, 2002).

2. Ultra House (Minimum Energy House)

- Ultra houses are distinguished by the same characteristics as low-energy houses but with additional focus on using building materials and components with better thermo technical qualities as lower U-values (Wirth, 2002).

3. Passive House

- "A passive house is a building, for which thermal comfort (ISO 7730) can be achieved solely by post heating or post cooling of the fresh air mass, which is required to fulfil sufficient indoor air quality conditions (DIN 1946)" (Feist, W., Passive House "A passive house is a building, for which thermal comfort (ISO 7730) can be achieved solely by post heating or post cooling of the fresh air mass, which is required to fulfil sufficient indoor air quality conditions (DIN 1946)" (Feist, W., 2006a) … "The house heats and cools itself, hence "passive"" (Passivhaus Institut). The concept of passive houses is defined by no need of supplement heating systems except the ventilation system. Up to a load of 10 W/m2 heating can be achieved by the ventilation system. Therefore houses classified as passive houses should not exceed a peak load of 10 W/m2 to be able to heat without any supplement systems (Feist, 1997).

4. Zero Energy House

- In general, zero-energy buildings are described as an energetically autonomous building, using solar energy and photovoltaic systems to generate energy, equipped with thermal storage systems.
- By producing as much energy as needed, the buildings are self-sufficient (Wirth, 2002)."Zero" stands for zero use of fossil fuels and the feasibility of this concept is being discussed heavily, followed by economically great costs for the technical equipment.

Types of energy effective houses

- **Nordic passive houses** > 60° northern latitudes
- **Central European passive houses** 40°-60° northern latitudes
- **Mediterranean passive houses** < 40° northern latitude

MARKET PENETRATION OF PASSIVE HOUSES IN SOME EURPEAN COUNTERIES
In the years 2005 and 2007

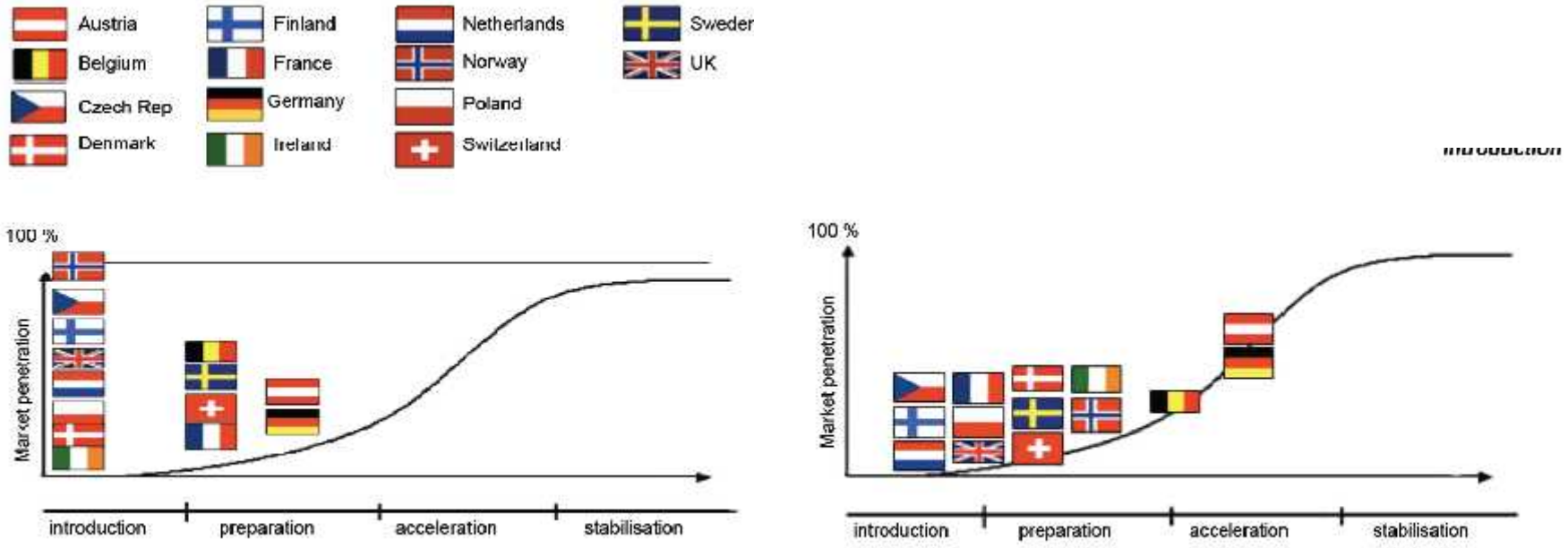


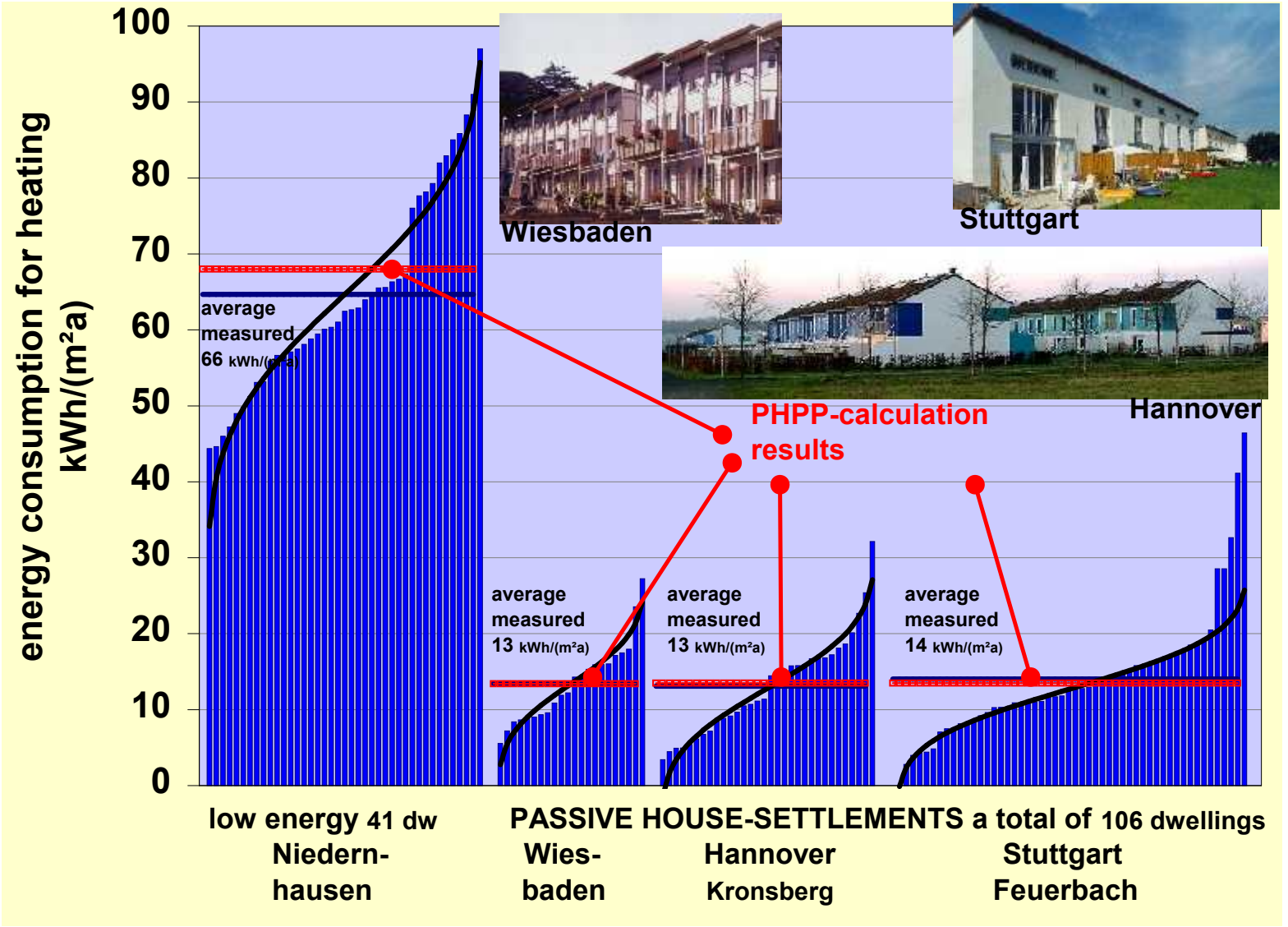
Figure 1: Market Penetration Passive Houses in 2005 (Elswijk & Kaan, 2008)

Figure 2: Market Penetration Passive Houses in 2007 (Elswijk & Kaan, 2008)

Lif Cycle Costs of Standard and Passive houses

		France	Germany	Italy	Spain Granada	Spain Seville	UK
Extra Capital Costs (€/m²)		**103**	**94**	**60**	**24,1**	**20,5**	**73**
Extra Capital Costs (%)		**9%**	**6,71%**	**5%**	**3,35%**	**2,85%**	**5,54%**
Total Energy Savings (kWh/m²/year)		55	75,0	86,0	65,5	37,6	39,7
Total Energy Savings (%)		45%	50,0%	65,4%	57,3%	40,7%	26,4%
Extra Costs per saved kWh/m²/year		1,87	1,25	0,70	0,37	0,55	1,84
LCC 10 years€	Standard	143.731	184.716	193.817	101.828	98.385	108.337
	Passive	152.621	190.104	190.437	95.676	96.100	111.988
LCC 20 years€	Standard	160.343	204.942	221.148	117.928	108.689	117.875
	Passive	160.552	200.579	198.458	103.647	102.290	117.256
Cost-Benefit Ratio, 10 years		**-0,72**	**-0,48**	**0,39**	**2,13**	**0,93**	**-0,65**
Cost-Benefit Ratio, 20 years		**0,02**	**0,39**	**2,63**	**4,94**	**2,60**	**0,11**
Discounted Payback Period (years)		**19.5**	**19**	**8**	**4**	**5**	**19**

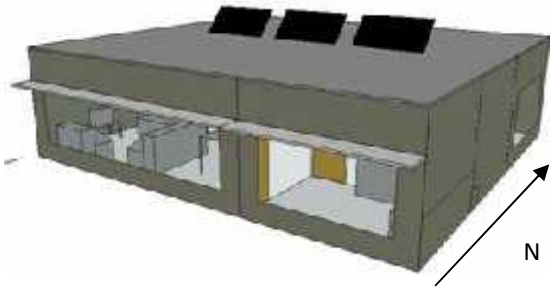
Excellent agreement with building measurements



Passivhaus Portugal – the house

- The starting point:
  - Single floor 2 bedrooms house, total treated floor area of 110 m^2 complying with the national Building Regulation 2006 (RCCTE, DL 80/2006)
  - Location: Lisbon
  - Orientation: Mainly South
- Focus on portuguese climate, constructions standards and technical and economical framework:
  - Simple prototype (can be easily enlarged to offer more rooms and/or floor area) to allow architects the freedom to design the house
  - No mechanical ventilation system and air tightness of 0.8 ach at 50 Pa
  - Thermal solar system is compulsory for DHW and is proposed to be enlarged to supply part of heating
  - The extra costs of the proposed Passivhaus for Portugal is 57 €/m2 (7.25%) with a payback period of 12 years

Low energy housing near Lisbon, Portugal



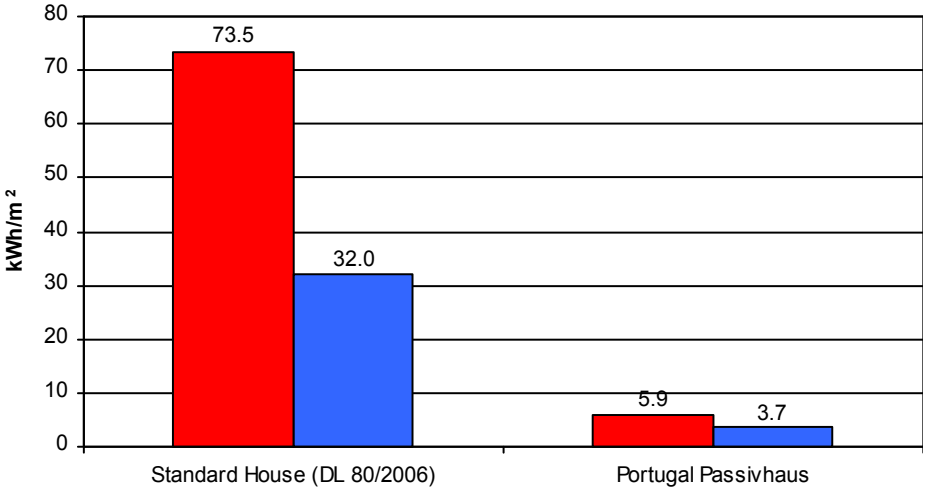
SE view of proposed *Passivhaus* with Thermal Solar Panels on roof

Passivhaus Portugal – Energy Performance

- The annual heating energy demand of the *Passivhaus* proposed for Portugal has been estimated as 16.9 kWh/m^2.year, of which 11 kWh/m^2.year are supplied by the solar system (in this analysis priority of the solar system is given to heating and the solar fraction for domestic hot water is 48%)
- The annual cooling energy demand is 3.7 kWh/m^2.year
- The sum of net heating and cooling demand is 9.6 kWh/m^2.year

- According to the thermal regulation, the limits of heating and cooling for this house built in Lisbon, are 73.5 and 32 kWh/m2.year, respectively
- The proposal would achieve the following labels in Portuguese labelling scheme:
  - **A** without contribution from the Thermal Solar System
  - **A+** (maximum) with the Thermal Solar System)

Predicted annual **heating demand (red) and cooling demand (blue)** for **Standard House and *Passivhaus* in Lisbon**



Nordic Passive Houses in Finland

Added costs in comparison to standard house:

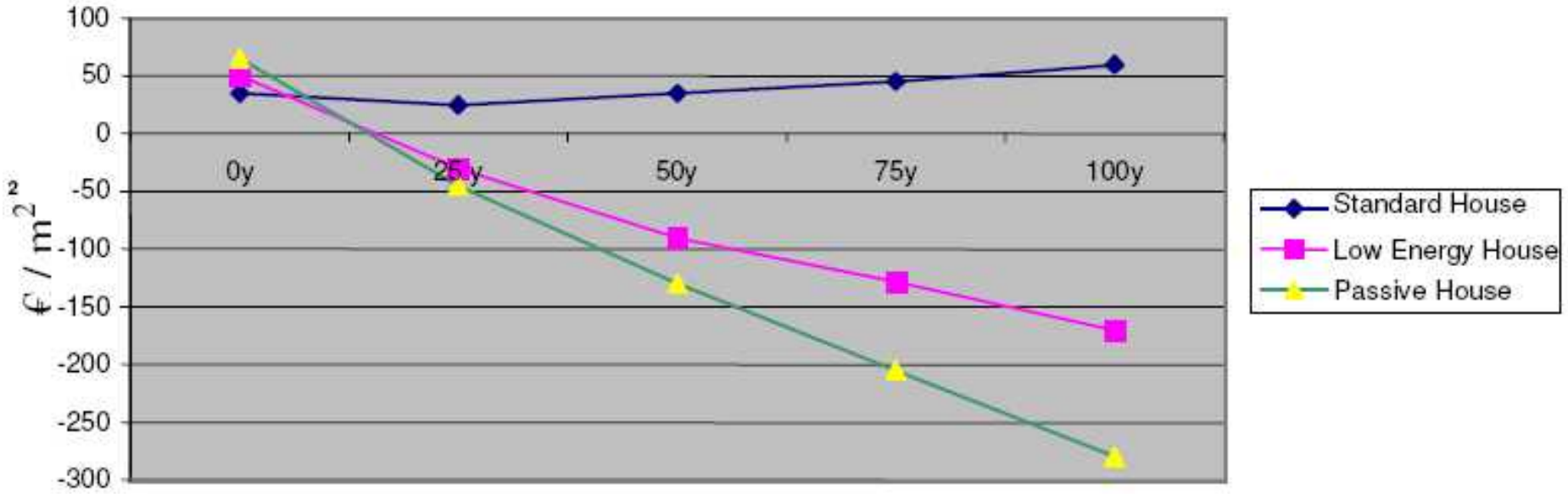
- 0-2 % in multistorey buildings
- 3-5 % in one family houses

Payback time: 0-6 years (with energy prices in 2011)

Optimised building concept

Graphic illustration of the differential cash flow of the alternative building concepts

(standards and prices in 2002)



TRANSFORMATION OF MARKETS

Transformation of business models to quickly change in existing as well as new buildings is a **big opportunity for**

- **drastic modernization of the building sector** and
- for **changing the entire paradigm of building**.

All building sector stakeholders need to **adopt a sense of urgency and a new mindset in which building energy is a top priority**

- **businesses will succeed** if they align with a sector transformation, adopting advanced technologies and business models.

Policy-makers need to introduce **strong regulatory frameworks** that **support the market transformation**.

Some barriers in implementing NZEB (Nearly Zero Energy Buildings)

- In the **energy renovation investment costs are often high and the payback time is long**
- **Developers** would **need a short payback time** of energy investment in order to have benefit of the renovation
- **For long term owners the payback time of 10-15 (or 20) years is OK**. This makes also energy renovation possible, if some **state support** is available
- In **new buildings** the **additional cost of passive house level buildings is quite low: 0-7 %, and the estimated payback time is about 5-15 years** (with current energy price **less**)
- **Lack of knowledge and skills** on zero energy building technology is **a high barrier especially in SME:s**, including all partners:
  - Clients, Architects, Structural Designers, Building Service designers, Contractors, propery managers etc

A huge Gap between:

the agreed goals 2020

and

the current state & slow trend of development

***The* current development *is* not sufficient**

***for fullfilling the requirements of** DIRECTIVE 2010/31/EU in 2020*

- ***How can the needed rapid change be concretised?***
- ***How can the development be accelerated?***
- ***How can ECCE contribute the change?***

Demands of ECCE Members for Actions

- Primary interest is on the **information and publishing of results and experiences of NZEB** (Nearly Zero Energy Building)
  - Model building concepts (new and renovation)
  - Measurement results of the technical performance
  - Economic analysis
  - Experiences in operation and asset management
- **Knowledge transfer** between ECCE Members and from sources outside of ECCE

Proposed Action

ECCE SC Knowledge and Technology wants to carry out in 2011 the following action:

Establish a mutual "ECCE Society of Zero Energy Buildings 2020"

- for **interactive working between ECCE professionals** , including all partners of the building, renovation and facility management process
- Guiding for **optimised life cycle economy of Nearly Zero Energy Buildings (NZEB)**
- Applying most modern IT technology of **social networks in Internet**
- **Actors** will be the **professionals of ECCE Member Organisations**

Structure of the Network