



European Council
of
Civil Engineers

“nZEB”

nearly Zero Energy Buildings

ECONOMIC BASES and

Implementation into praxis in EU

ECCE-LISBON, Portugal, 2013
SC Knowledge and Technology
Prof, Dr. Tech. Asko Sarja

EPBD REQUIREMENTS

- The recast of the Energy Performance of Buildings Directive (EPBD), 2010/31/EU, introduced in Article 9, “nearly Zero-Energy Buildings” (nZEB) as a future requirement
 - to be implemented
 - from 2019 onwards for public buildings and
 - from 2021 onwards for all new buildings.
 - These requirements are valid also for major renovations



DEFINITION OF THE NZEB

In EPBD:

1. A nearly zero energy building is a “building that has a very high energy performance”.
2. The energy required should to a very significant extent be covered by energy from renewable sources, including renewable energy produced on-site or nearby.

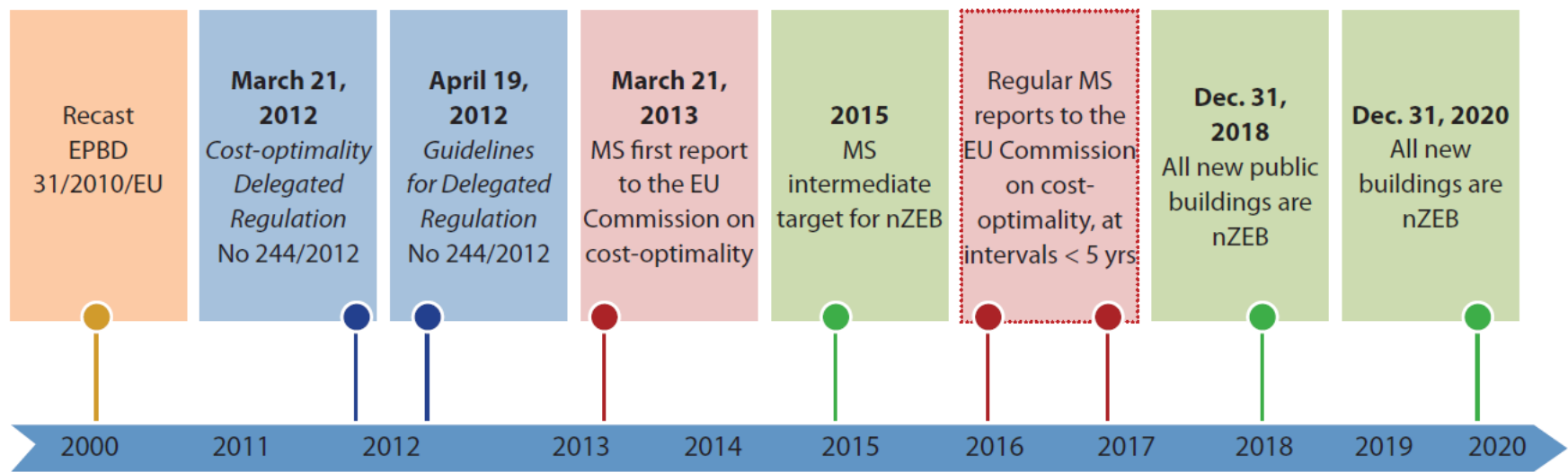


TECHNICAL CONCEPTS OF NZEB

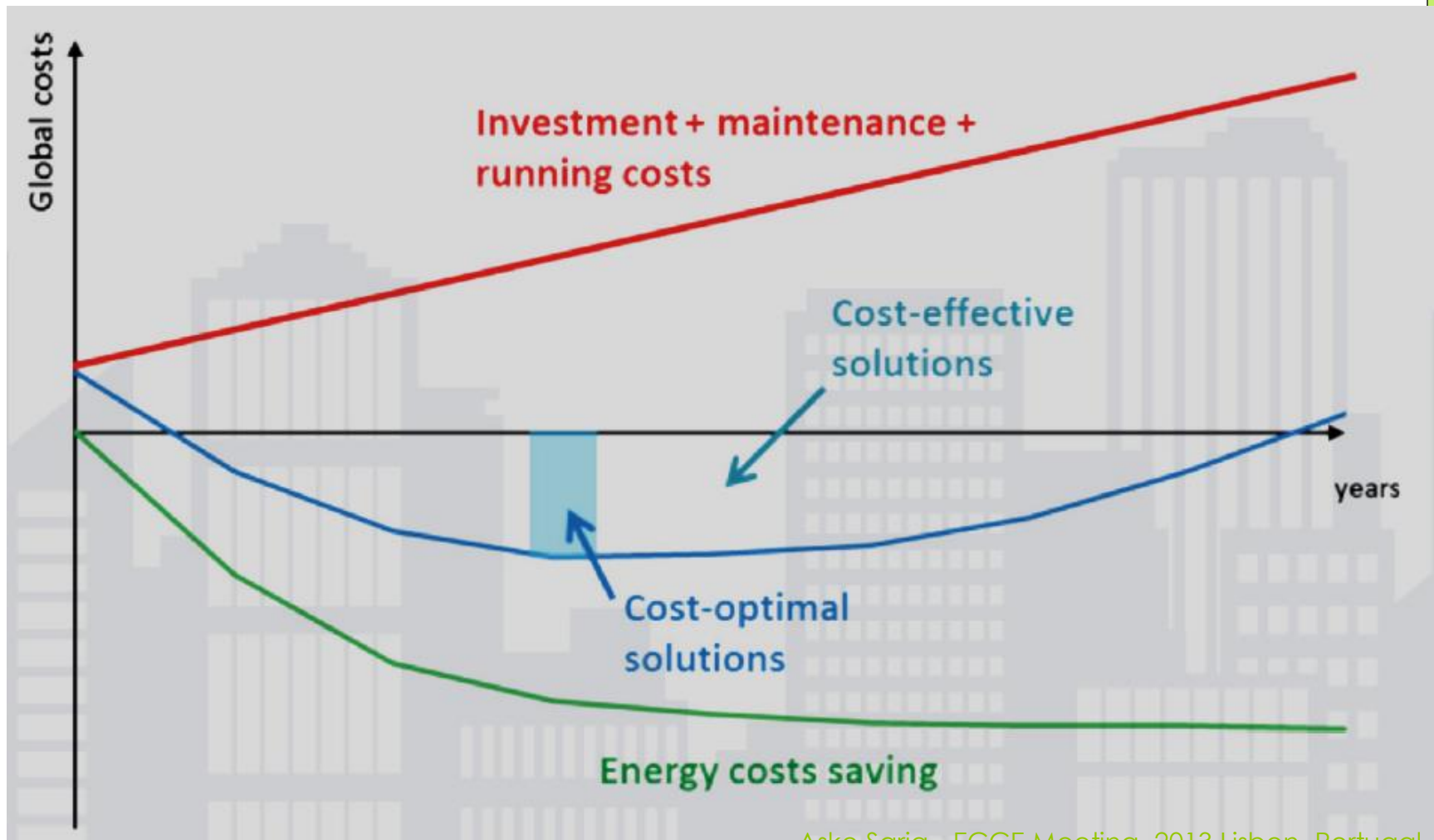
Typically, low-energy buildings will encompass

- ❖ a high level of insulation
- ❖ very energy efficient windows
- ❖ a high level of air tightness and
- ❖ mechanical ventilation with very efficient heat recovery
- ❖ architectural means and shadings to reduce cooling needs.

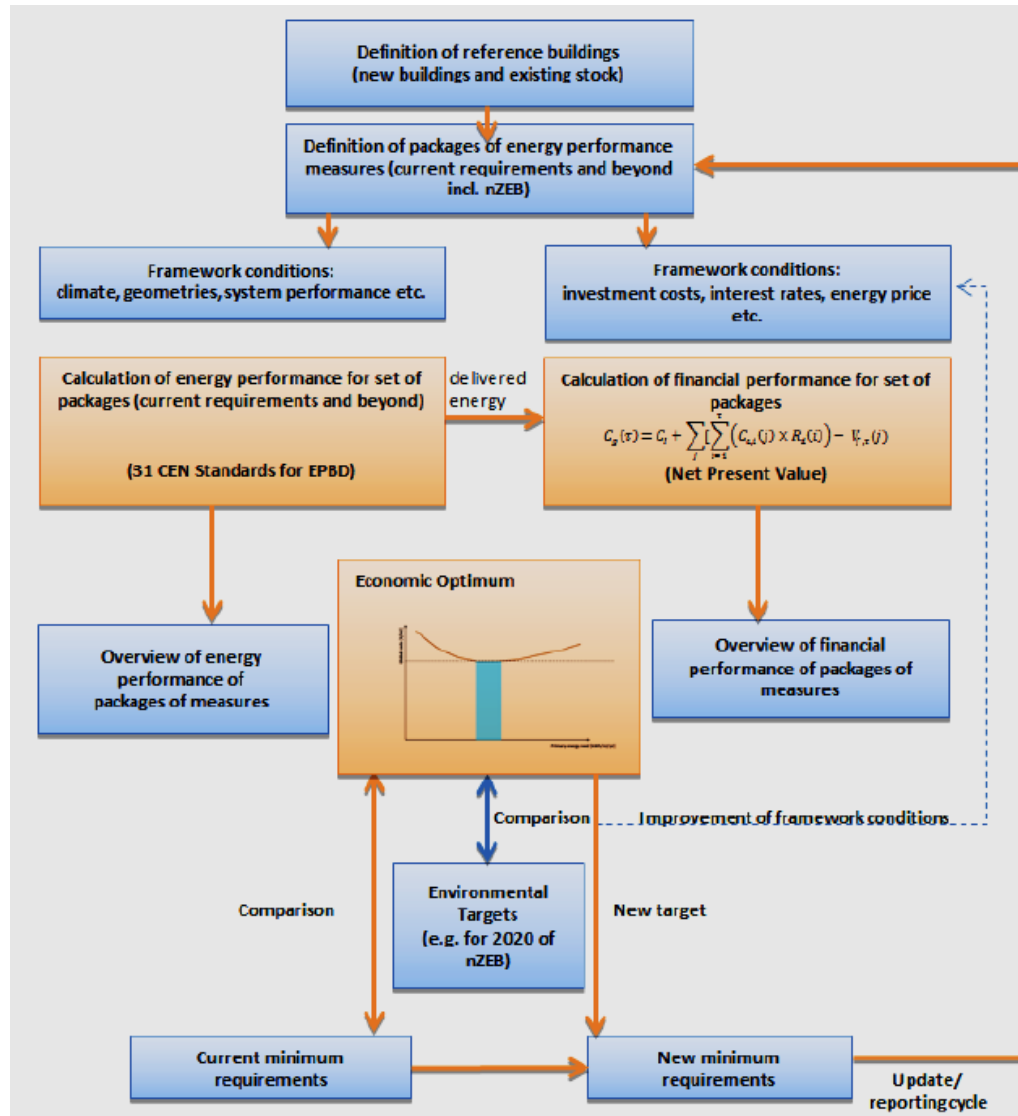
TIMELINE for IMPLEMENTING THE EPBD



RELATIONSHIP between ENERGY EFFICIENCY and COST OPTIMALITY



IMPLEMENTATION STEPS of COST-OPTIMAL METHODOLOGY



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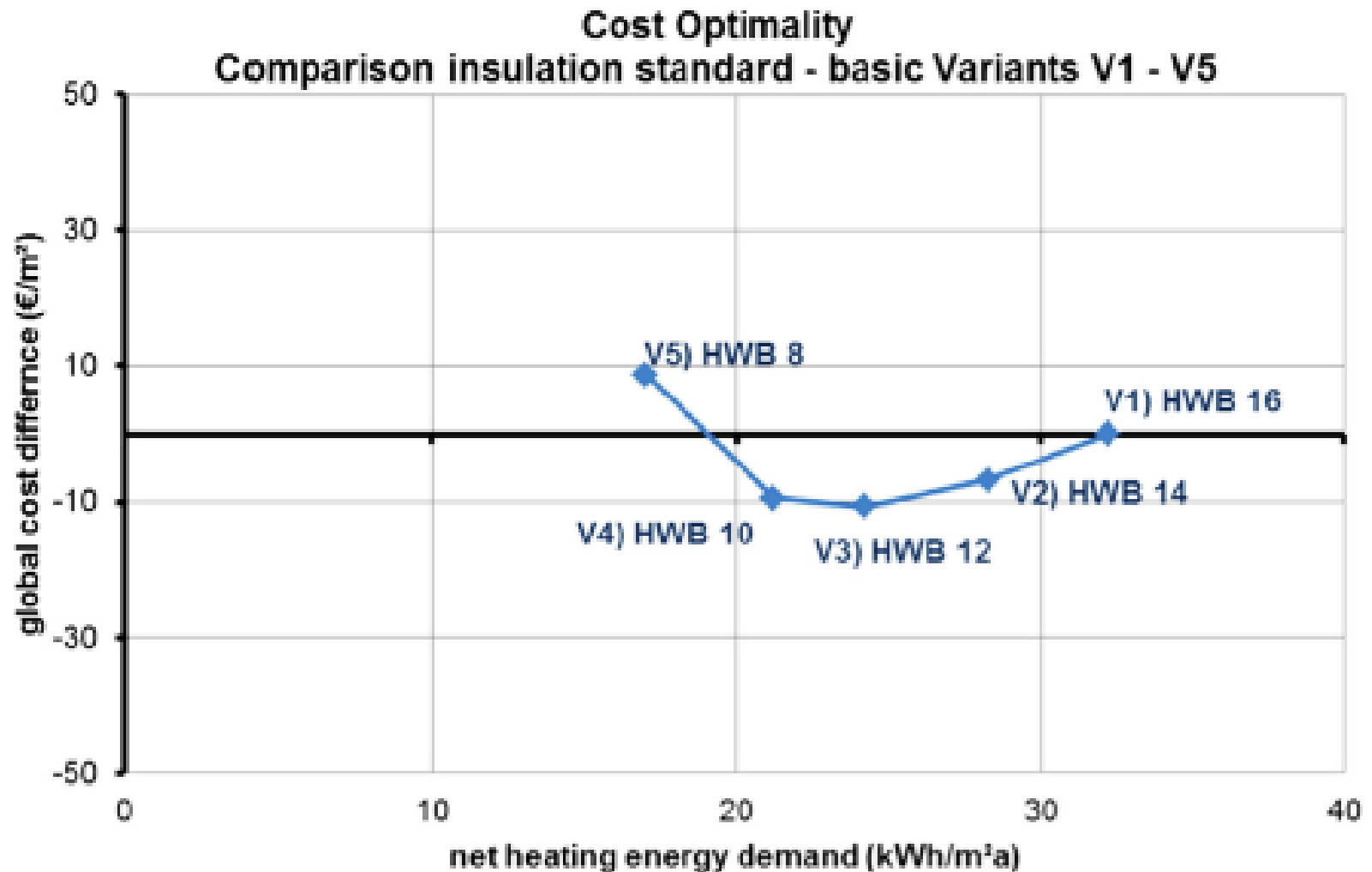
DISCOUNT RATES AND ENERGY PRICE SCENARIOS

Country	Parameter	Basic scenario	Sensitivity analysis
Austria	Discount rate	3.0 %/a (real)	1.0 %/a (real)
	Energy price development	2.8 %/a (real)	4 %/a (real)
Germany	Discount rate	3.0 %/a (real)	1.0 %/a (real)
	Energy price development	2.8 %/a (real)	4.3 %/a (real). 1.3% (real)
Poland	Discount rate	3.0 %/a (real)	5.0 %/a (real)
	Energy price development	6.0 %/a (real)	2.0 %/a (real)

ASSUMED SERVICE LIFE of BUILDING ELEMENTS

Parameter	Value for calculation
Insulation (thermal protection) Measures related to air tightness	50 years
Windows	35 years
Heating and ventilation distribution	35 years
Heat plant, central ventilation system	20 years
Heat pump, earth loop	50 years

An EXAMPLE of COST OPTIMAL CALCULATION

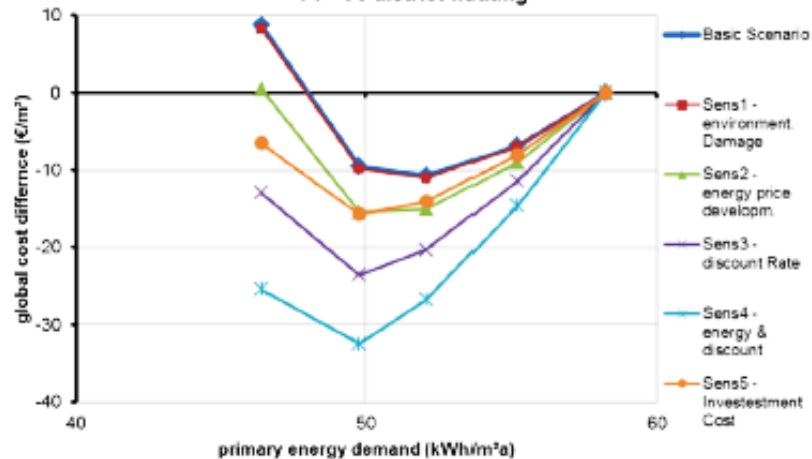


VARIATION of PARAMETERS in SENSITIVITY ANALYSIS

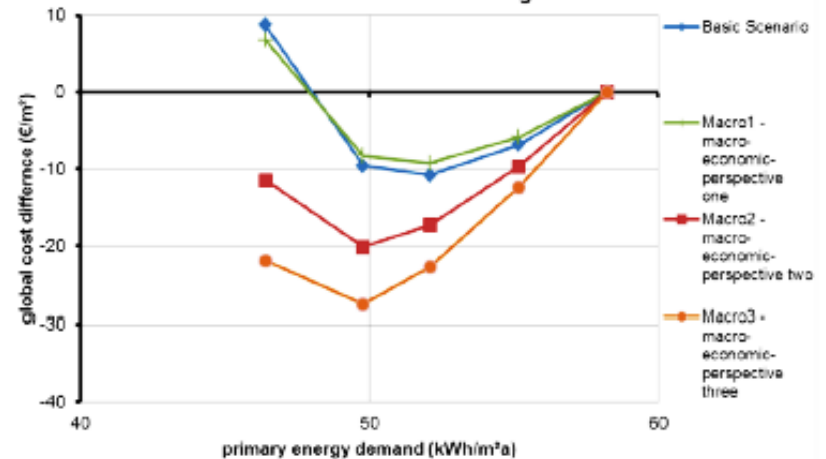
Parameter	Value for basic calculation	Value for sensitivity analysis
Sens1: Cost of environmental damage	0 EUR/tCO ₂	Carbon price according to recommended values by the C-O Regulation Annex II
Sens2: Energy price development	2.8 % p.a.	4 % p.a.
Sens3: Discount rate	3.0 % p.a.	1.0 % p.a.
Sens4: Discount rate and energy price development	3.0 % p.a. 2.8 % p.a.	1.0 % p.a. 4.0 % p.a.
Sens5: Investment cost		Reduction of difference costs between variants (due to regional cost differential)
Macro1: Macroeconomic-perspective 1	Discount rate 3.0% p.a. Energy price 2.8% p.a. VAT included No subsidies 0 EUR/tCO ₂	Discount rate 3.0% p.a. Energy price 2.8% p.a. No tax No subsidies Carbon price according to recommended values by the C-O Regulation Annex II
Macro2: Macroeconomic-perspective 2	Discount rate 3.0% p.a. Energy price 2.8% p.a. VAT included No subsidies 0 EUR/tCO ₂	Discount rate 1.0% p.a. Energy price 2.8% p.a. No tax No subsidies Carbon price according to recommended values by the C-O Regulation Annex II
Macro3: Macroeconomic-perspective 3	Discount rate 3.0% p.a. Energy price 2.8% p.a. VAT included No subsidies 0 EUR/tCO ₂	Discount rate 1.0% p.a. Energy price 4.0% p.a. No tax No subsidies Carbon price according to recommended values by the C-O Regulation Annex II

RESULTS of SENSITIVITY ANALYSIS

Cost Optimality - Sensitivity Analyses private perspective
V1 - V5 district heating



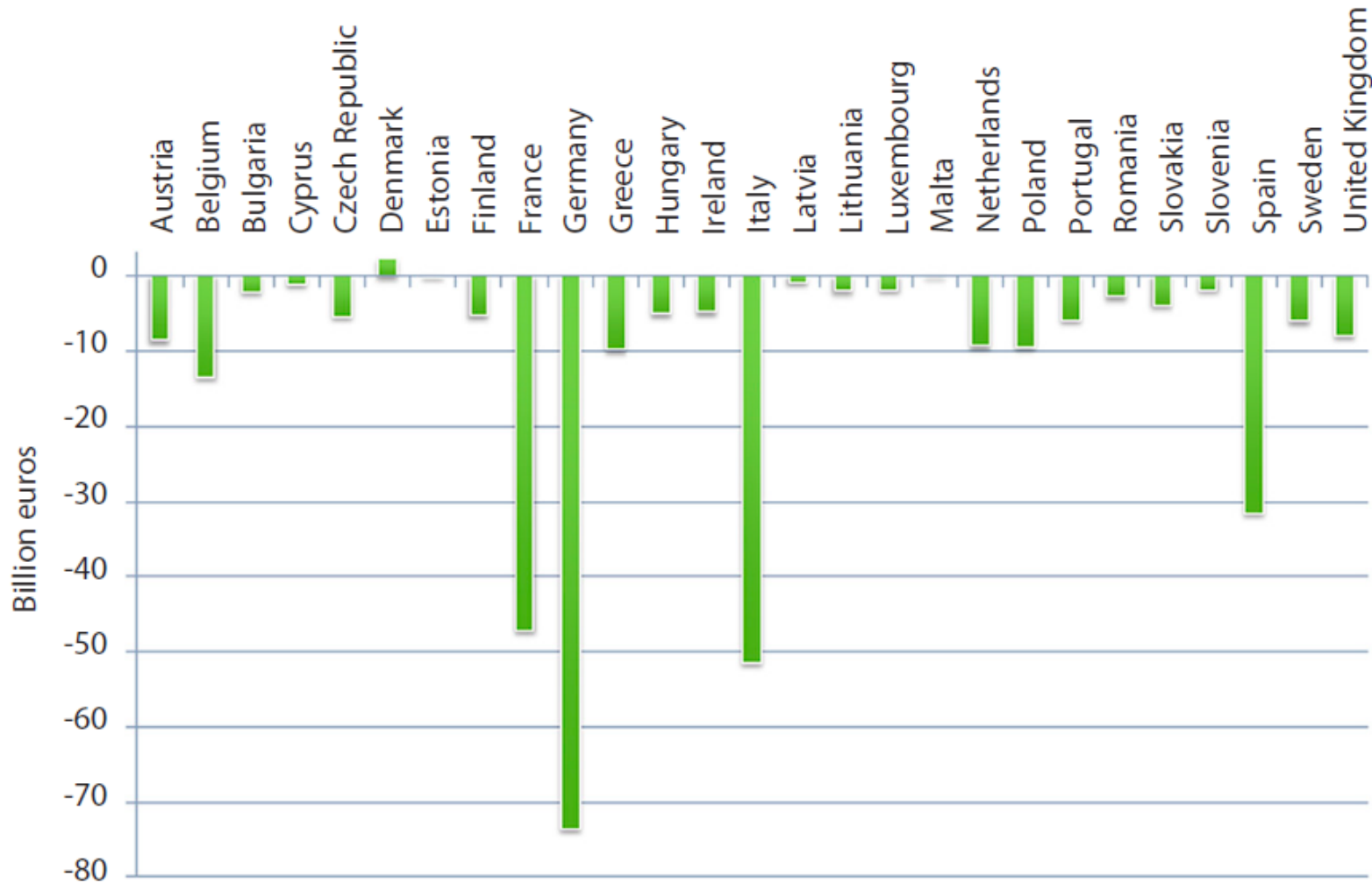
Cost Optimality - Sensitivity Analyses Macro-economic-view
V1 - V5 district heating



nZEB

IMPLEMENTING in RENOVATION

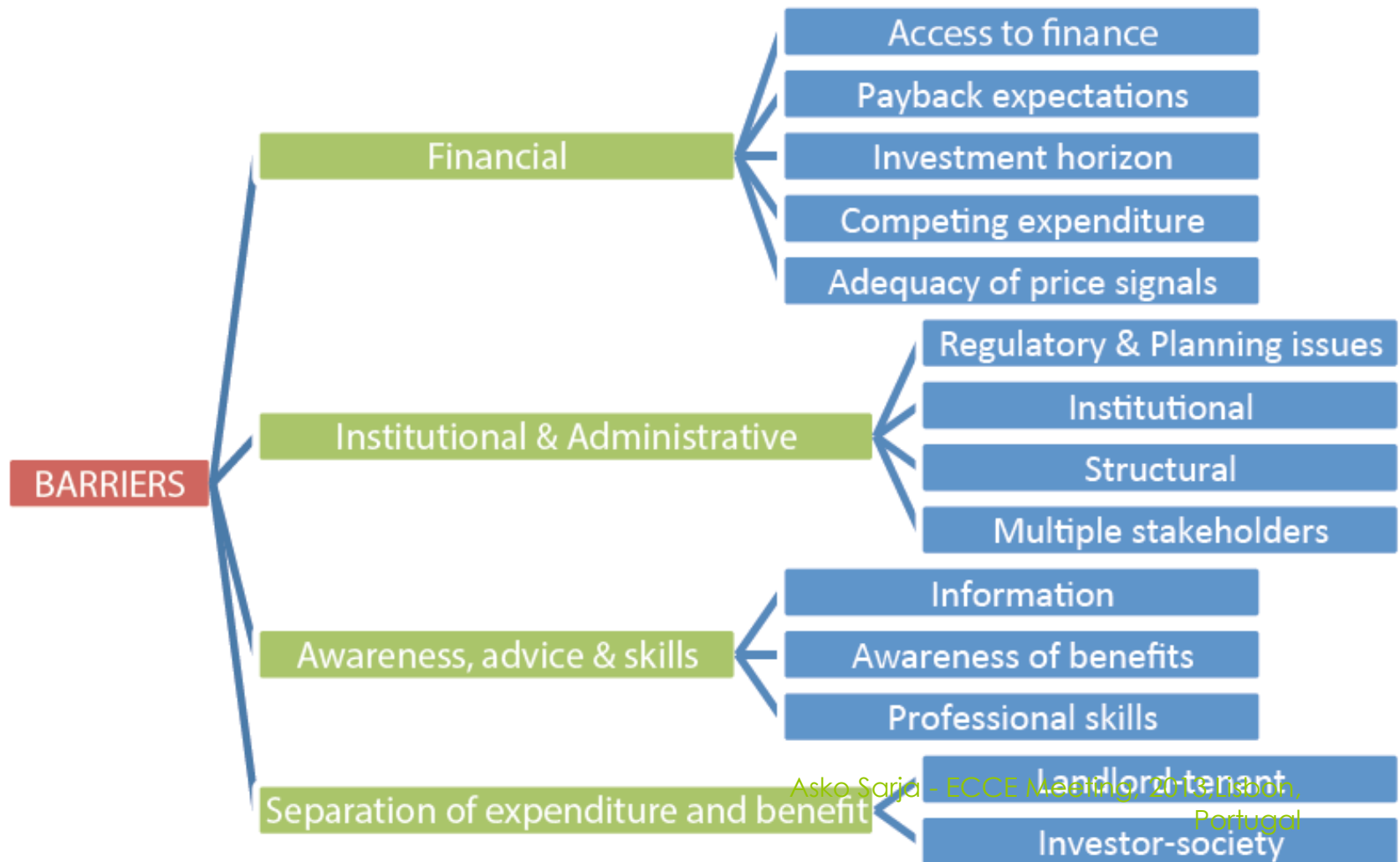
ENERGY COSTS of 25 EU countries (IEA Eurostat)



■ Balance of trade (energy component)

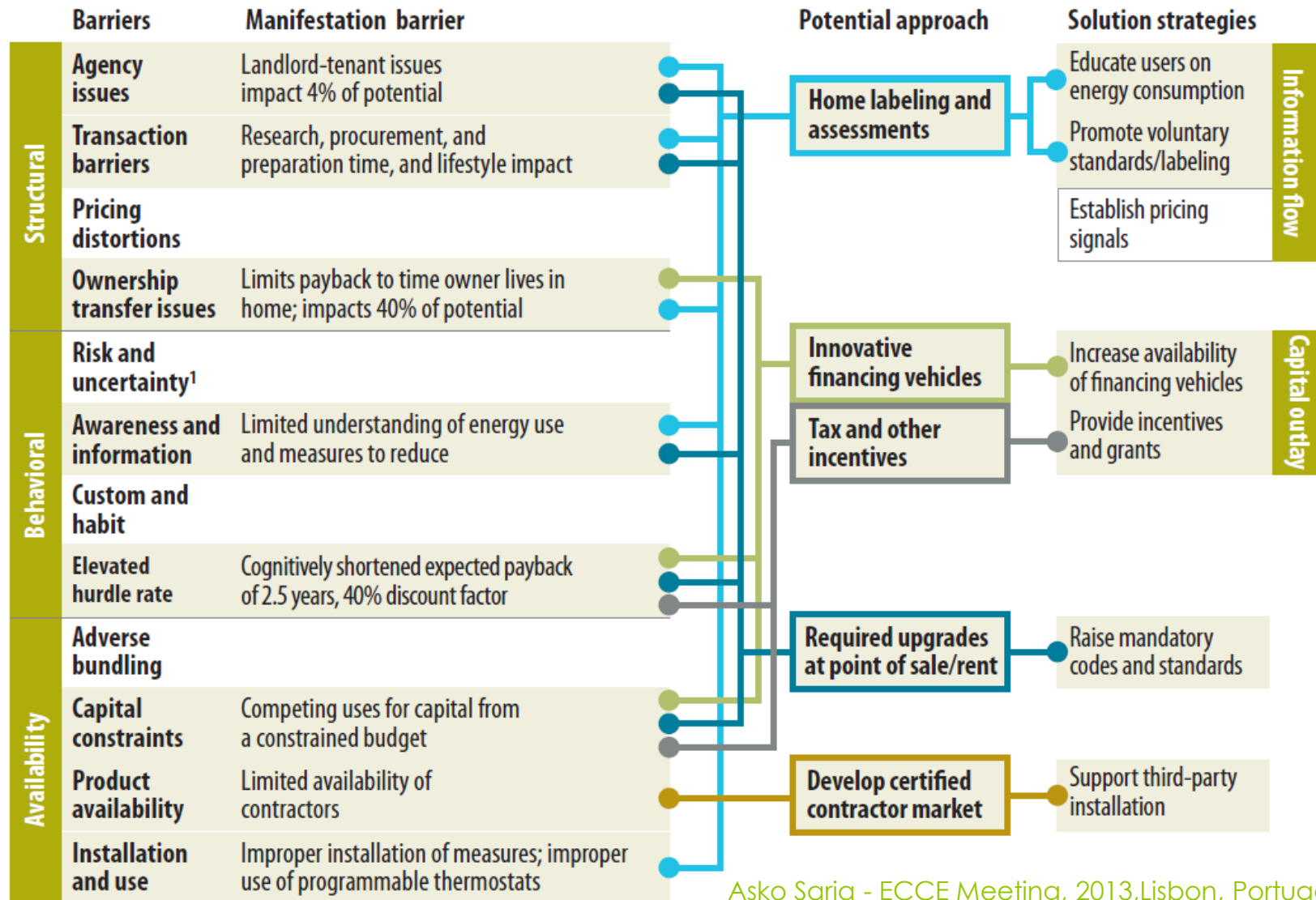
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BARRIERS for renovation into nZEB

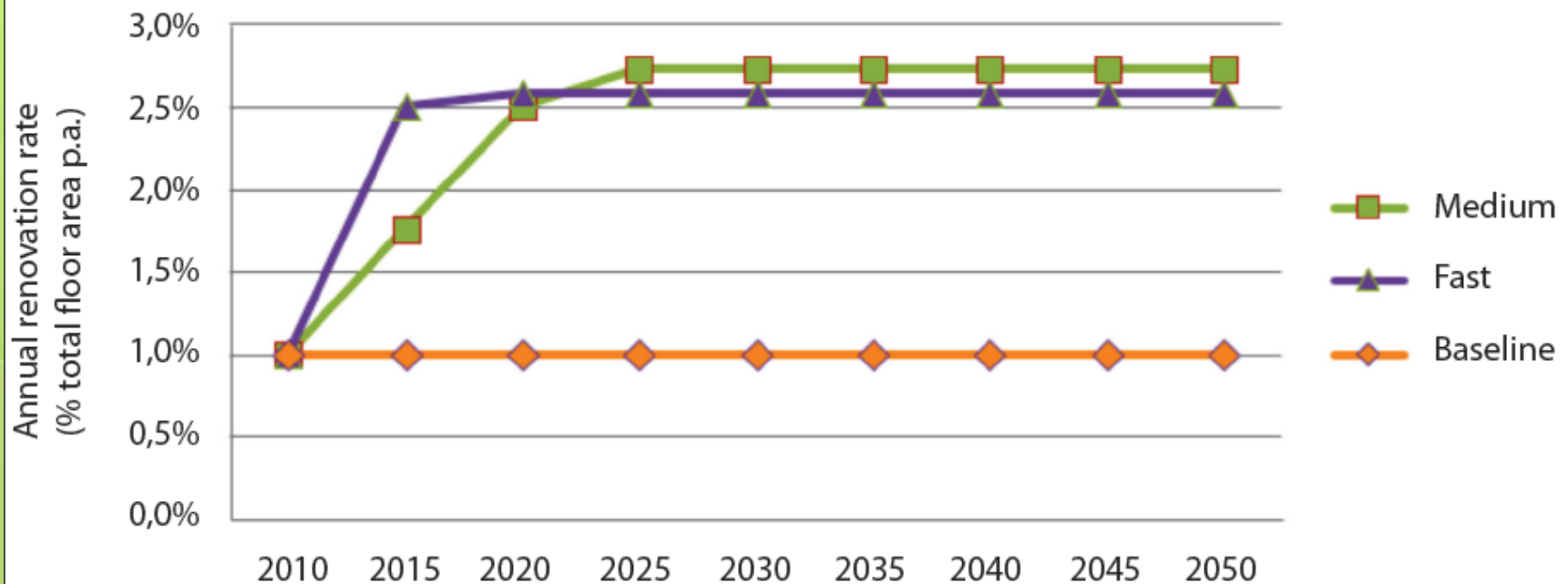


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HOLISTIC POLICY RESPONSE to BARRIERS



REQUIRED RENOVATION RATE of the building stock in EU in order to achieve 90% reduction of CO₂ production between the years 2020-2050



INDICATIVE TIMELINE for RENOVATION SATRATEGY DEVELOPMENT

Month	1	2	3	4	5	6	7	8	9	10	11	12	year2+
PHASE 1 - Identify key stakeholders & information sources													
PHASE 2 - Technical and economic appraisal													
PHASE 3 - Policy appraisal													
PHASE 4 - Drafting & consultation													
PHASE 5a - Finalisation & publication													
PHASE 5b - Delivery													Ongoing thereafter

REFERENCE to RENOVATION STRATEGY



Buildings Performance Institute Europe (BPiE)

Rue de la Science 23

1040 Brussels

Belgium

www.bpie.eu

www.buildingsdata.eu

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CURRENT STATE

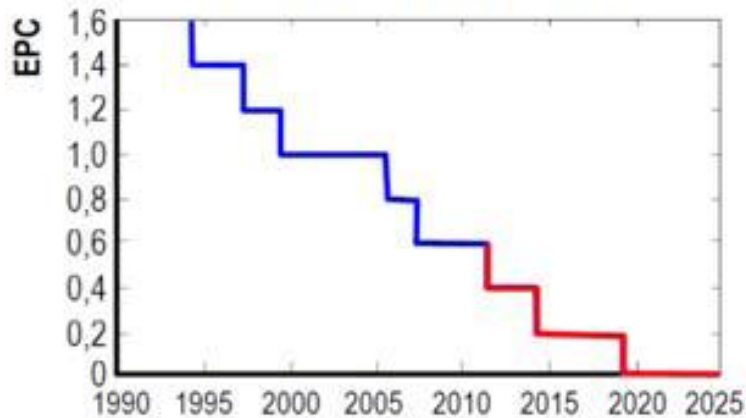
In IMPLEMENTING the EPBD 2010/32 into PRAXIS

CURRENT STATE of nZEB STANDARDS

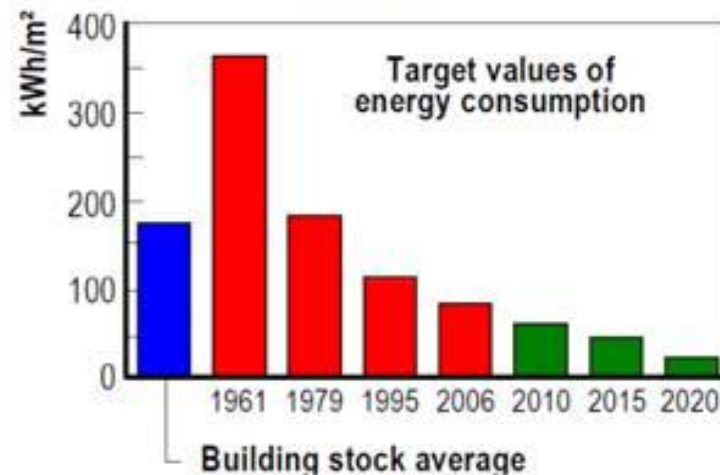
- More than half of the Member States do not have an official definition for nZEB.
- Member States have already set up long-term strategies and targets for achieving nZEB standards for new houses.

Roadmap of some countries towards nearly zero energy buildings

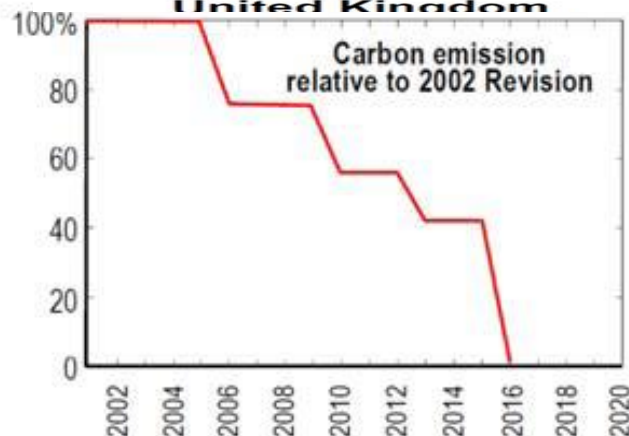
The Netherlands



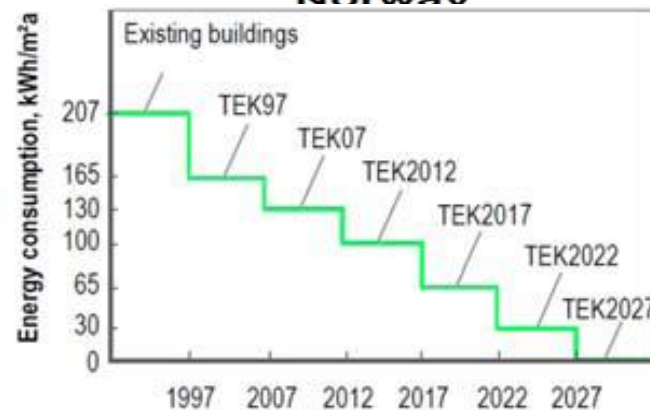
Denmark



United Kingdom



Norway



ENERGY DELIVERY OF NZEB

- The minimum share of renewables to cover the remaining nearly zero or very low energy demand of the nZEB
 - in order to be consistent with EU energy and climate targets
- might be chosen in the range of 50%-90%

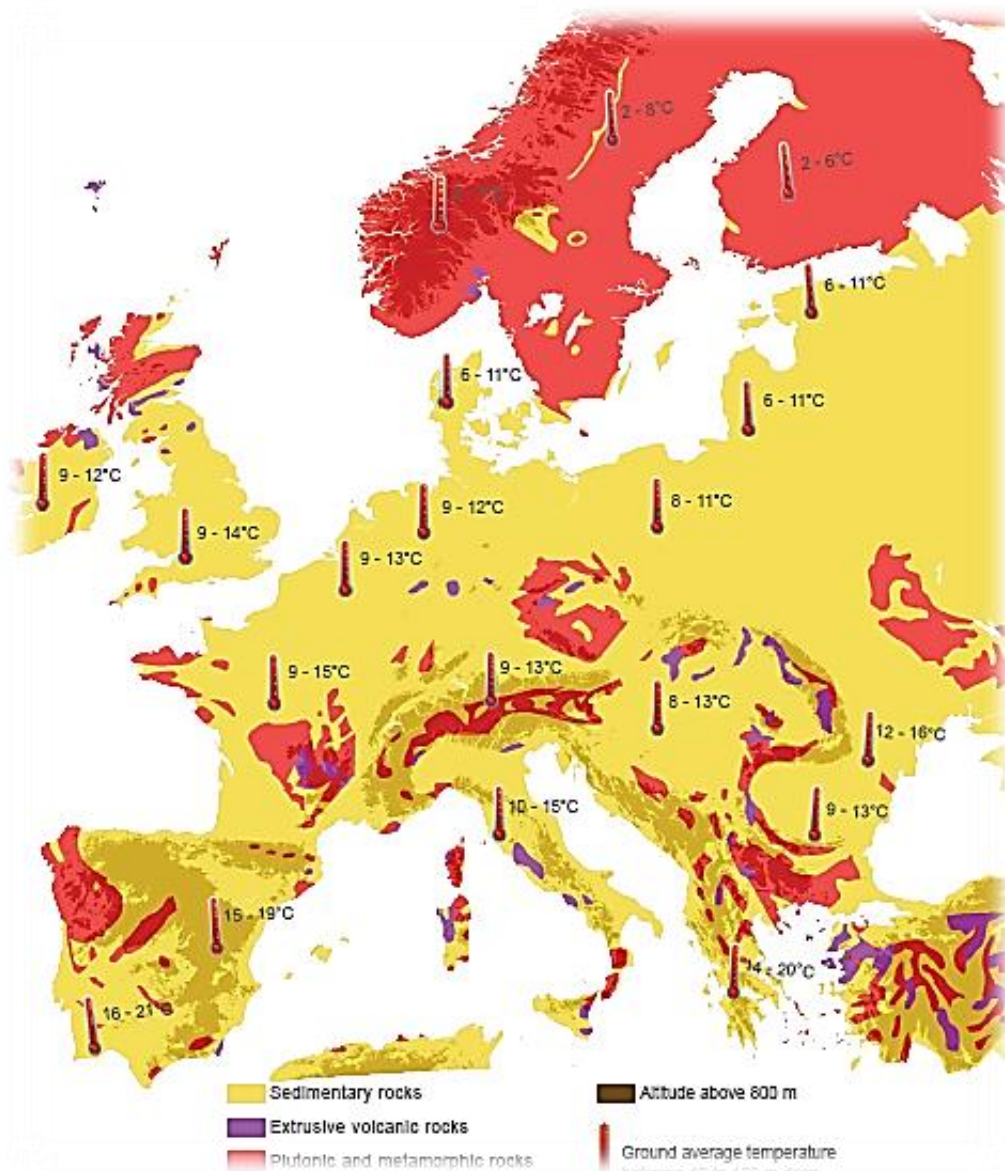
RENEWABLE AND CO2-FREE ENERGY

- **Most common types of local renewable energy sources are:**
 - **Geothermal energy: Earth heat pumps**
 - **Air heat energy: air heat pumps and exhaust air heat pumps**
 - **Solar energy: Solar panels and electric solar cells**
 - **Wind energy**
- **The selection in each case is depending on the geografic location (North, Central, South) and on the lifetime economy of the heating system**

Geothermal energy

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6/4/2013



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Reference

http://ec.europa.eu/energy/intelligent/index_en.html