Energy efficient buildings –

an opportunity or a burden for South East Europe?

Oliver Rapf
Executive Director

7th South East Europe Energy Dialogue ,
Thessaloniki, 19 – 20 June 2013

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Buildings Performance Institute Europe

www.bpie.eu

- Non-profit association based in Brussels, created in 2010
- Founders: ECF, ClimateWorks, eceee
- BPIE's mission is to improve the energy performance of buildings by:
  - Supporting the development of ambitious - yet pragmatic - buildings-related policies and programs at EU and member state level
  - Driving timely and efficient implementation by teaming-up with relevant stakeholders
  - Providing fact based analysis and knowledge, and sharing best practice globally through our network
- European center of Global Buildings Performance Network

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Global Buildings Performance Network

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The political context for energy and buildings

Flagship Initiative EUROPE 2020: A resource-efficient Europe

- **Low-carbon Economy 2050 Roadmap:**

GHG reduction vs. 1990	2005	2030	2050
Power	-7%	-54 to -68%	-93 to -99%
Industry	-20%	-34 to -40%	-83 to -87%
Transport	30%	+20 to -9%	-54 to -67%
Residential and services	-12%	-37 to -53%	-88 to-91%
Agriculture	-20%	-36 to -37%	-42 to -49%

- **Roadmap for a resource-efficient Europe 2050:** better construction and use of buildings - influence 42% of the final energy consumption, 35% of the CO_2 emissions, >50% of all extracted materials and 30% of water consumption.

- **Energy 2050 Roadmap:**

  "energy efficiency potential in new and existing buildings is key"

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The political context for energy and buildings:

EUROPE 2020 - the EU Commission Strategy:

A resource-efficient Europe.

Long-term framework for actions in many policy areas:

- ✓ 2011: Low-carbon Economy 2050 Roadmap
- ✓ 2011: Roadmap for a resource-efficient Europe 2050
- ✓ 2011: Energy 2050 Roadmap
- ✓ 2011: European Energy Efficiency Plan 2020

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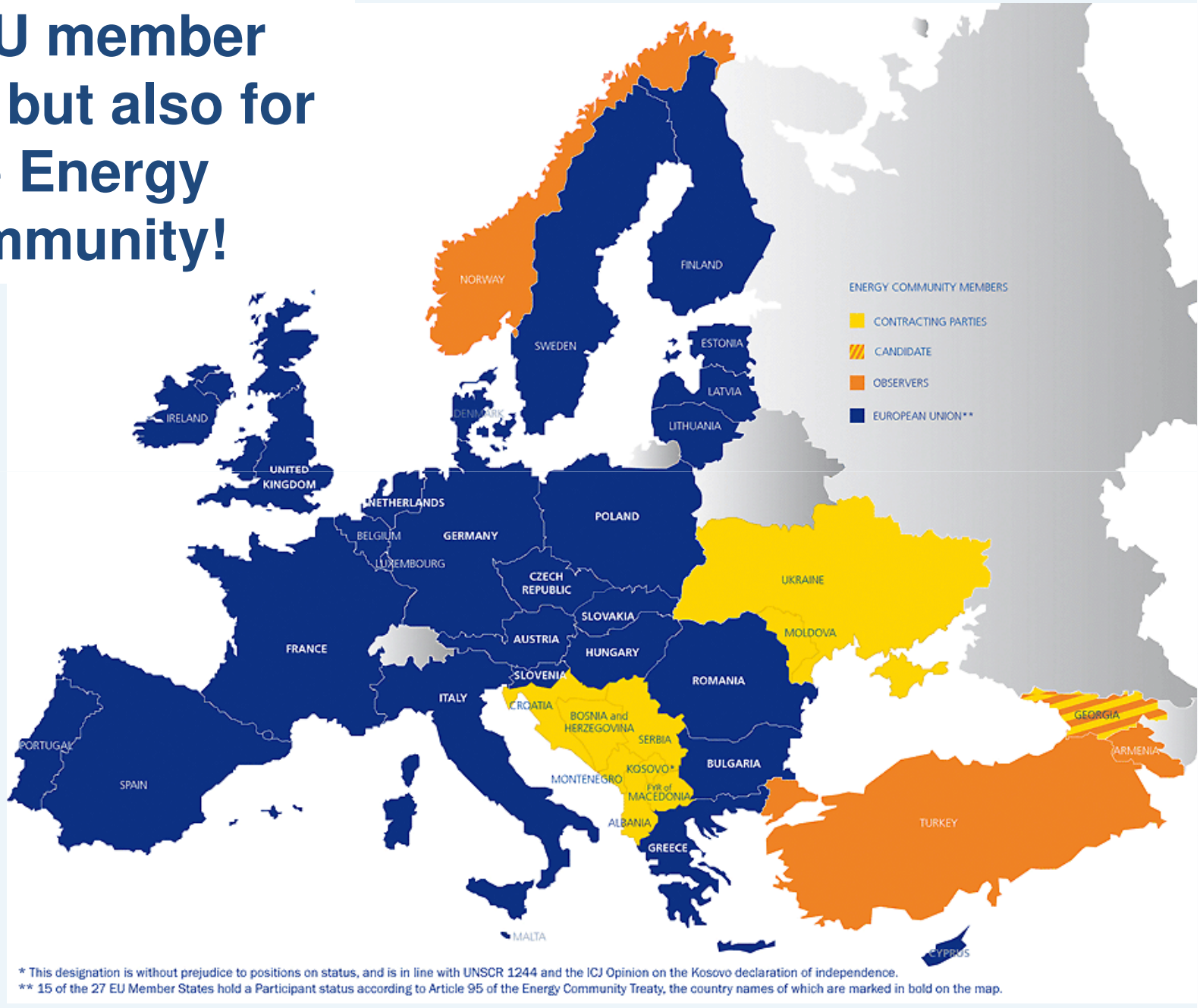
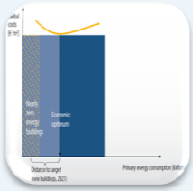
Not only relevant for EU member states, but also for the Energy Community!



* This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.
** 15 of the 27 EU Member States hold a Participant status according to Article 95 of the Energy Community Treaty, the country names of which are marked in bold on the map.

Energy Performance of Buildings Directive (recast)



Energy performance & Cost optimality

- MSs: Minimum energy performance requirements
- Cost-optimal methodology (common framework)
- Requirements for technical building systems

Existing Buildings

- All buildings undergoing major renovation should implement energy efficiency measures
- Minimum requirements for buildings & components

New Buildings = nZEB

- By 31 Dec. 2018 public admin. buildings
- By 31 Dec. 2020 all buildings
- National plans for nZEB

Energy Performance Certificates (EPC)

- Implement EPC schemes
- Recommendation for cost-optimal improvements
- Independent control systems

HVAC inspection

- Regular inspections (heating > 20kW, AC>12kW)
- Independent control systems

Financial incentives & Market barriers

- MSs: to prepare lists of measures and instruments

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Energy Efficiency Directive (2012)

Buildings related provisions:

- By April 2014, member states have to develop a long-term strategy for investments in the renovation of the national building stock, including policies and measures to stimulate cost-effective deep renovations
- Member states must renovate 3% of their central government buildings each year.

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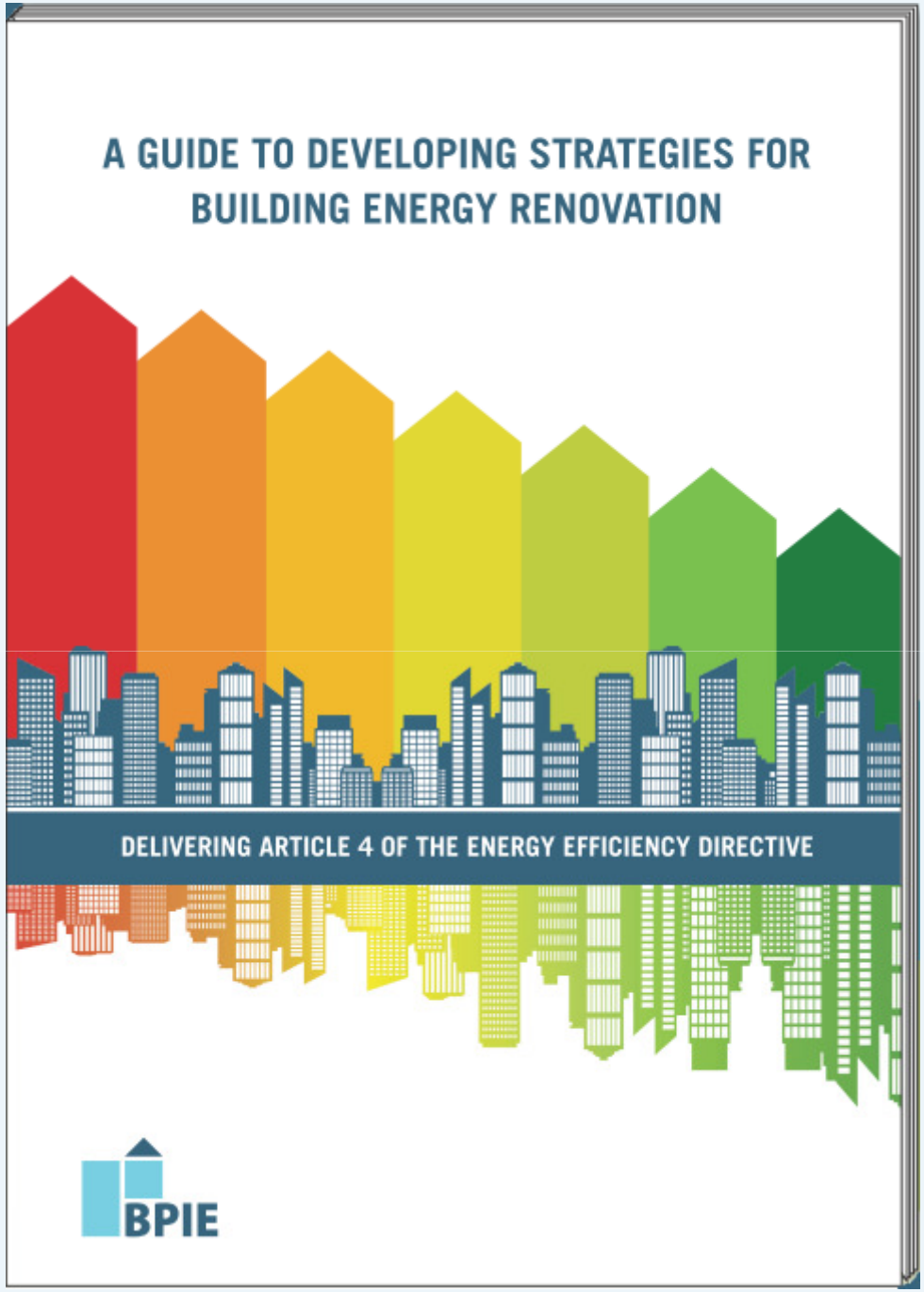

How to Design an Effective National Renovation Strategy…

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Renovation Delivers Multiple Benefits!

MULTIPLE BENEFITS ACHIEVED THROUGH SUSTAINABLE ENERGY RENOVATION OF BUILDINGS

Economic
Energy Cost saving, Economic Stimulus, Impact on Gross Domestic Product, Property Values, Industrial Competitiveness, Impact on Public Finances, Reduced Energy Imports

Societal
Reduced Fuel Poverty, Improved Health, Increased Comfort and Productivity

Environmental
Carbon Saving, Reduced Air Pollution

Energy System
Energy Security, Avoided New Generation Capacity, System Benefits

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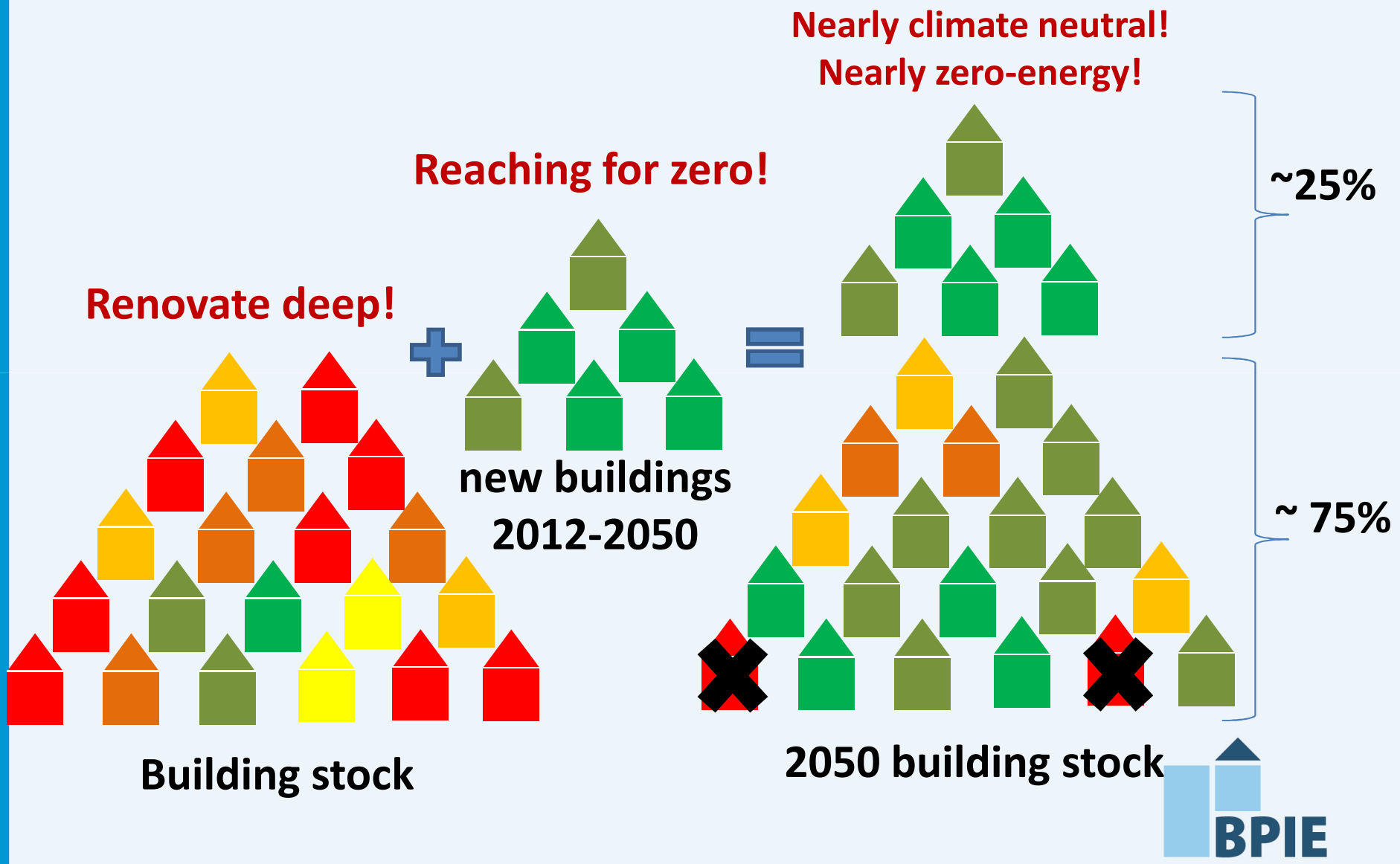
EU buildings by 2050: one aim, two big challenges!



nZEB: One EU requirement, 27 (28) national implementation rules

'nearly zero-energy building' […] has a **very high energy performance**. The **nearly zero or very low amount of energy required (for HVAC, DHW, aux. equip. and lighting)** should be covered to **a very significant extent by energy from renewable sources, including on-site or nearby RES.** (EPBD)

recast EPBD: Nearly Zero-Energy Buildings

- by 31 December 2020, all new buildings
- after 31 December 2018, new buildings occupied and owned by public authorities

- National definition for nZEB
- National plans for nZEB (including public buildings retrofit towards nZEB levels)
- Support measures & overcoming barriers

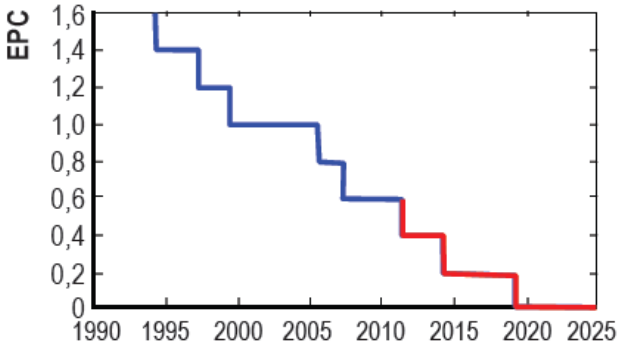
RES Directive Article 13.4: By 31 December 2014 the EU MSs have to introduce in building codes minimum requirements for RES for new buildings and renovation

Case Study
Nearly Zero Energy Buildings

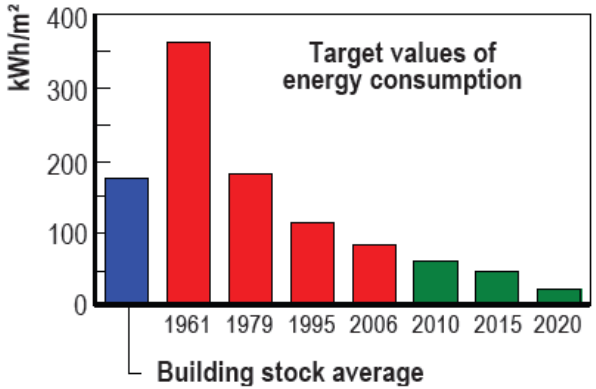
Source: Deutsche Energie-Agentur GmbH (dena)

Some countries started already: Roadmap towards nZEB

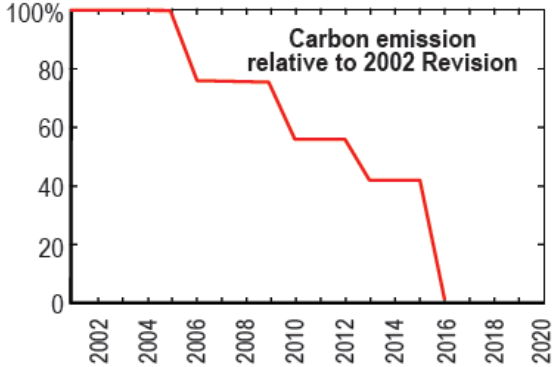
The Netherlands



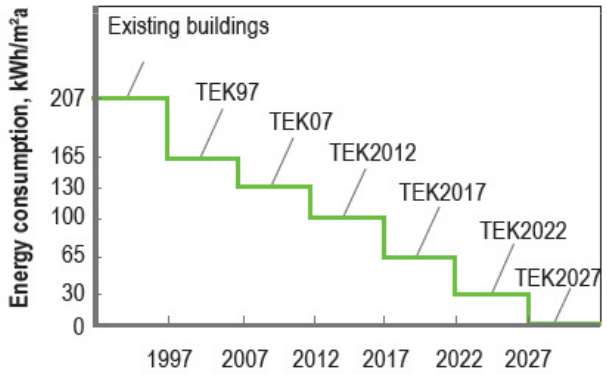
Denmark



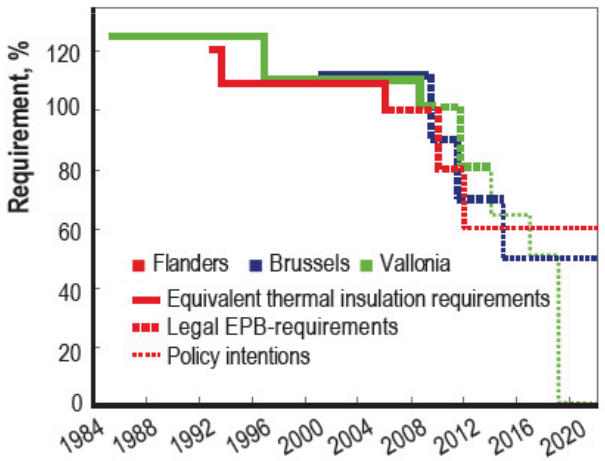
United Kingdom



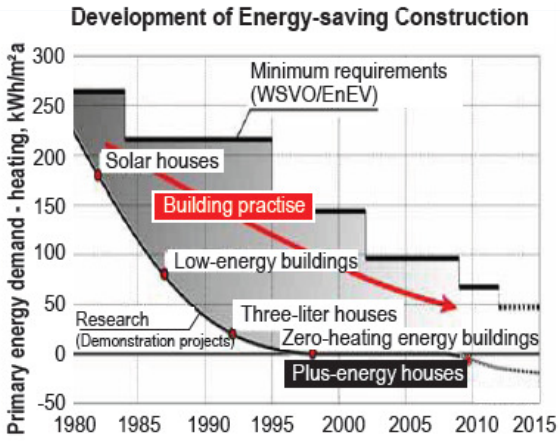
Norway



Belgium



Germany



Source: REHVA

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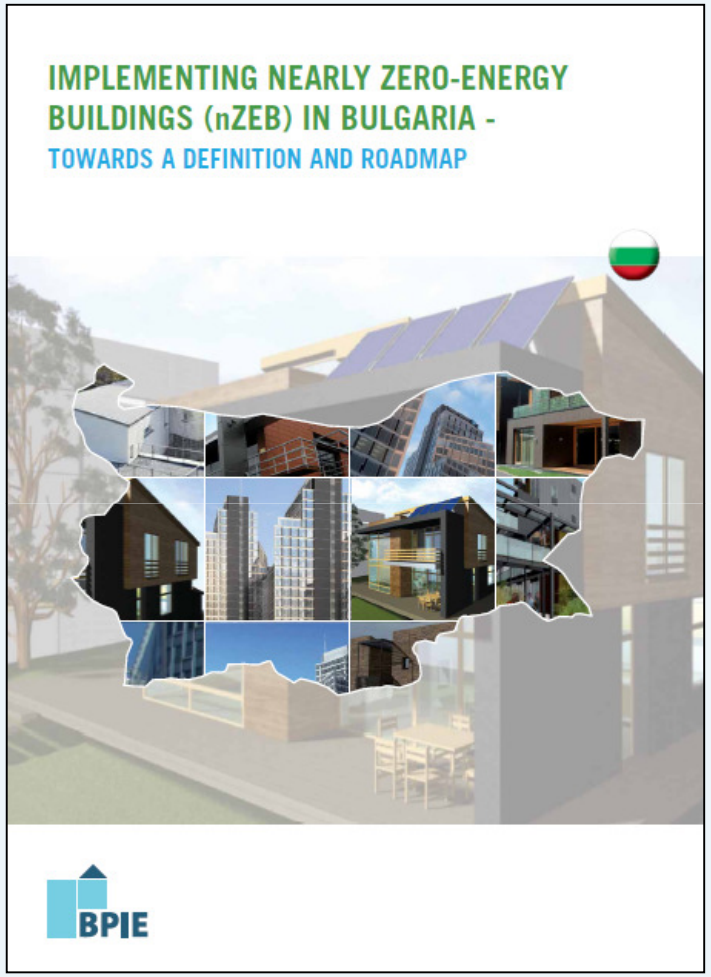
BPIE study for nZEB definitions and implementation roadmap in Bulgaria



Authors:
BPIE, Ecofys Germany, EnEffect Bulgaria

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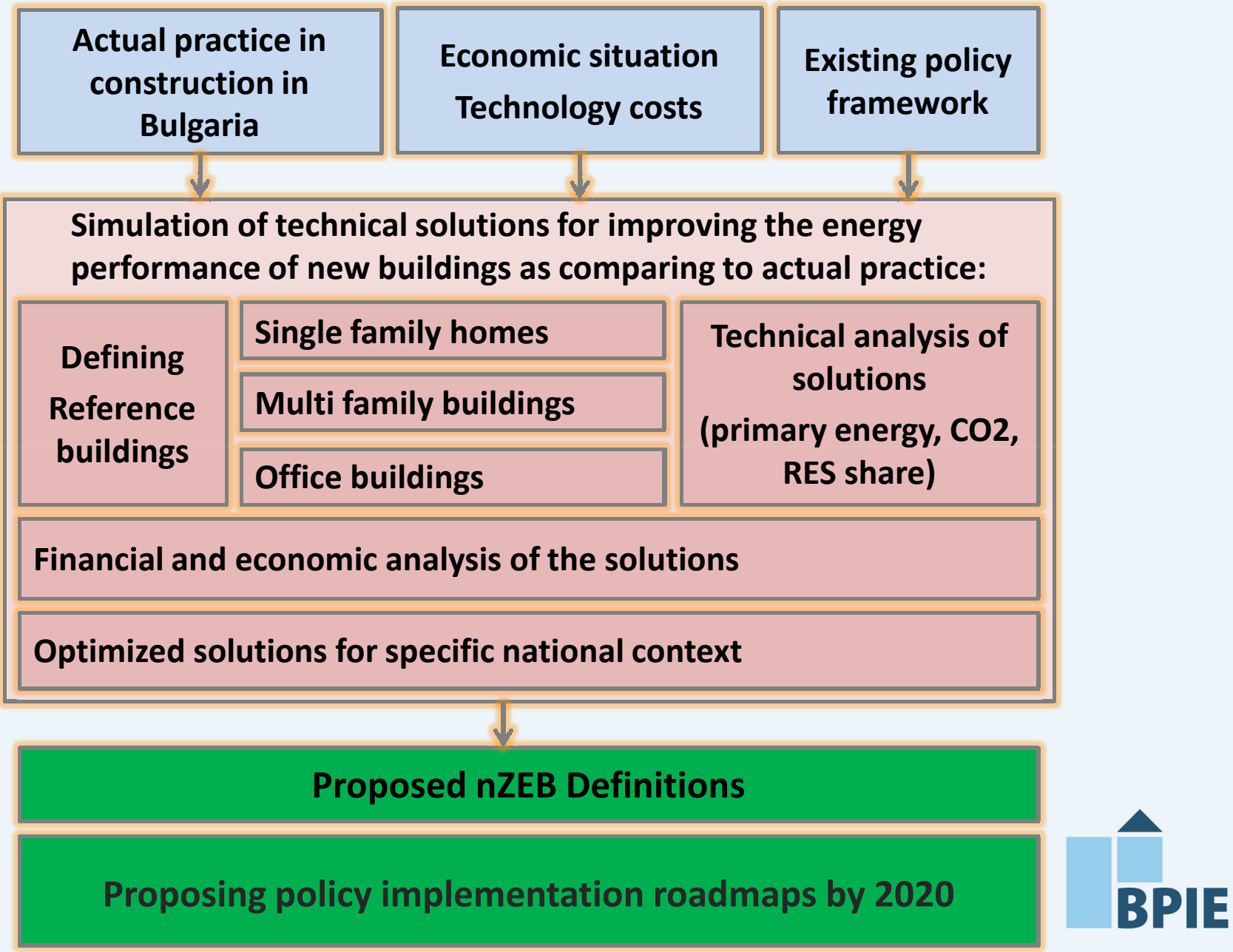
Structure of the study and methodological approach



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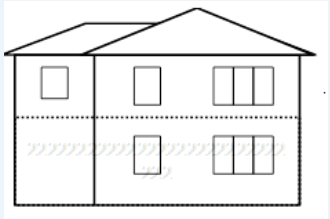
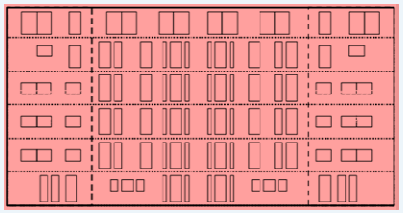
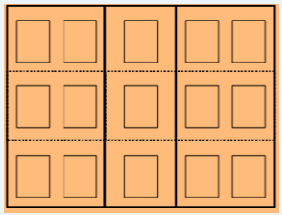
Reference buildings for new constructions in Bulgaria







Characteristics	Reference SFH	Reference MFH	Reference Office
Number of conditioned floors	2	6	3
Net floor area	127 m²	2870 m²	886 m²
Room height	2.65 m	2.73 m	3.00 m
U-walls	0.34 W/(m²K)	0.64 W/(m²K)	0.46 W/(m²K)
U-roof	0.27 W/(m²K)	0.30 W/(m²K)	0.32 W/(m²K)
U-floor	0.55 W/(m²K)	0.55 W/(m²K)	0.46 W/(m²K)
U-windows, frame fraction	1.70 W/(m²K); 21%	1.70 W/(m²K), 15%	1.70 W/(m²K), 15%
Window fraction (window/wall-ratio)	13% (only 5% on N & W facades)	23%	50%
Shading	None	None	Internal blinds, manual control
Heating system	Wood boiler (set point: 20°C) Heating efficiency: 0.82	District Heating (set point: 20°C) Heating efficiency: 0.99	Heat pump, fan coils (set point: 20°C) Heating efficiency: 3.3
DHW system	Combination of wood boiler and electric heater. DHW efficiency: 0.93 (40% Wood = 0.82, 60% electric heater = 1.00)	Same as for heating DHW efficiency: 0.99	Decentralised direct electric
Ventilation system	Natural/window ventilation (0.35 1/h)	Natural/window ventilation (0.5 1/h)	Mechanical ventilation 70% heat recovery
Cooling system	Split system (set point: 26°C) SEER: 3.2	None	Compression chillers, fan coils (set point: 24°C) SEER: 3.3
Internal gains	13.5 W/m²	20 W/m²	30 W/m²

Simulated nZEB variants and heating solutions

	Reference SFH	Reference MFH	Reference Office
V0	Reference	Reference	Reference
V1	Improved building shell	Improved building shell	Improved building shell + external shading
V2	Improved building shell + solar collectors	Mech. ventilation with heat recovery	Improved building shell + external shading + improved lighting
V3	Improved building shell + mech. ventilation with heat recovery	Improved building shell + mech. ventilation with heat recovery	Improved building shell + external shading + improved lighting + improved windows + improved heat recovery
V4	Nearly passive house standard	Improved building shell + mech. ventilation with heat recovery + solar collectors	
A	Air source heat pump	Air source heat pump	Central air/water heat pump
B	Ground collector brine heat pump	Ground collector brine heat pump	Central brine/water heat pump
C	Wood pellet boiler	Wood pellet boiler	Central wood pellet boiler
D	Gas condensing boiler	Gas condensing boiler	Central gas condensing boiler
E		District Heating	District heating

Additionally: with and without CO_2 compensation (by a rooftop PV system)

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Selected nZEB optimal solutions

	nZEB solution	Brief Description	Heating system	Additional annualised costs (Base year 2010) [€/m²yr]	Additional annualised costs comparing with average reference actual price [%]
SFH	V1A	Improved building shell	Air heat pump	**-7.73**	**-14.7%**
	V3B	Improved building shell + mech. ventilation with heat recovery	Brine heat pump	**-3.20**	**-6.1%**
	V3C		Bio Pellet	**-2.26**	**-4.4%**
MFH	V1C	Improved building shell	Bio Pellet	**0.53**	**1.15%**
	V3B	Improved building shell + mech. ventilation with heat recovery	Brine heat pump	**2.21**	**4.8%**
	V4C	Improved building shell + mech. ventilation with heat recovery + solar collectors	Bio Pellet	**2.01**	**4.4%**
Office	V2A	Improved building shell + external shading + improved lighting	Air heat pump	**4.24**	**12.15%**
	V2C		Bio Pellet	**9.47**	**27%**
	V3B	Improved building shell + external shading + improved lighting + improved windows + improved heat recovery	Brine heat pump	**9.22**	**26.3%**

Assumed present costs on the market: SFH: 450 Euro/m², MFH: 363 Euro/m² , Office: 275 Euro/m²
Assumed interest rate: 7.5%

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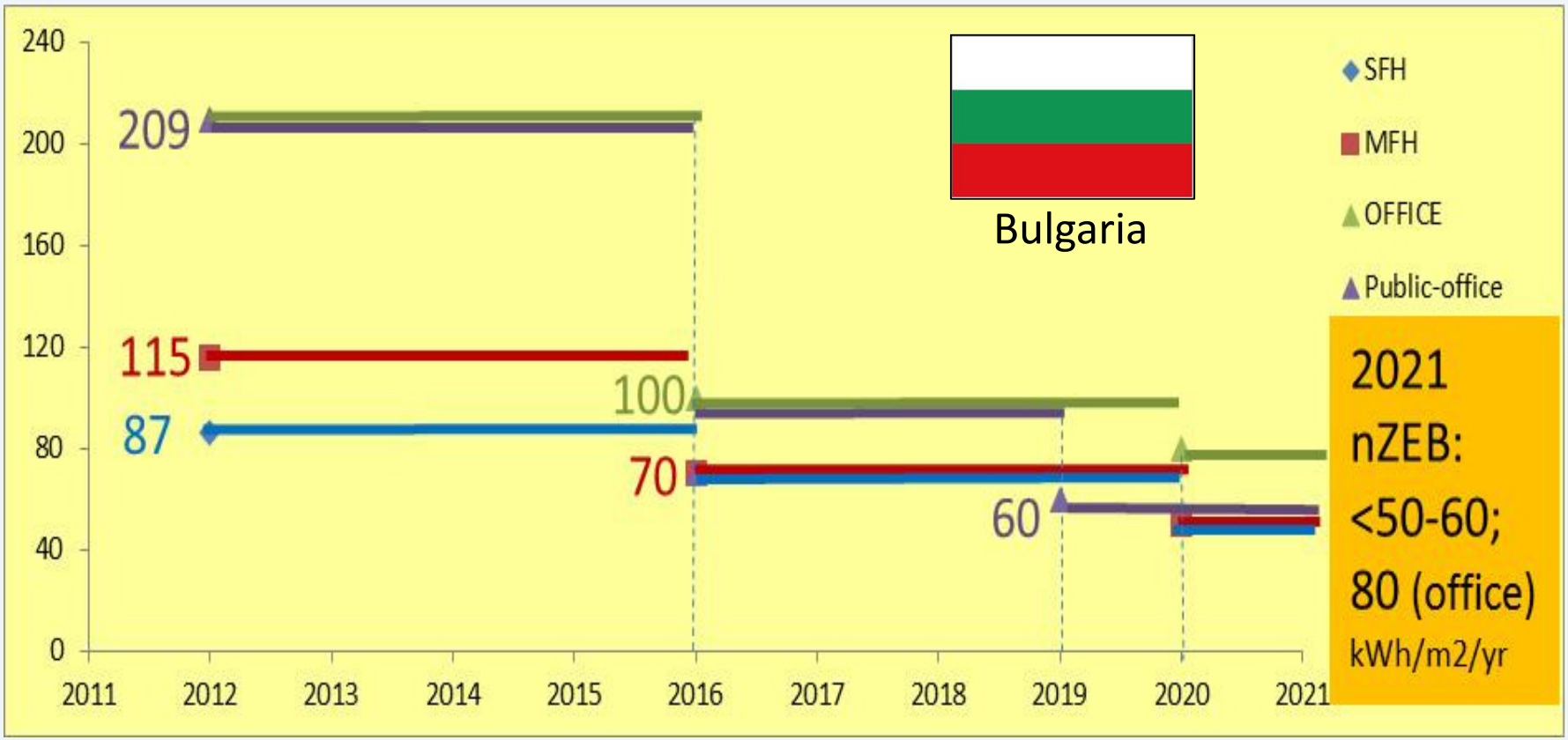
Proposed nZEB definitions - primary energy need (EPBD scope)



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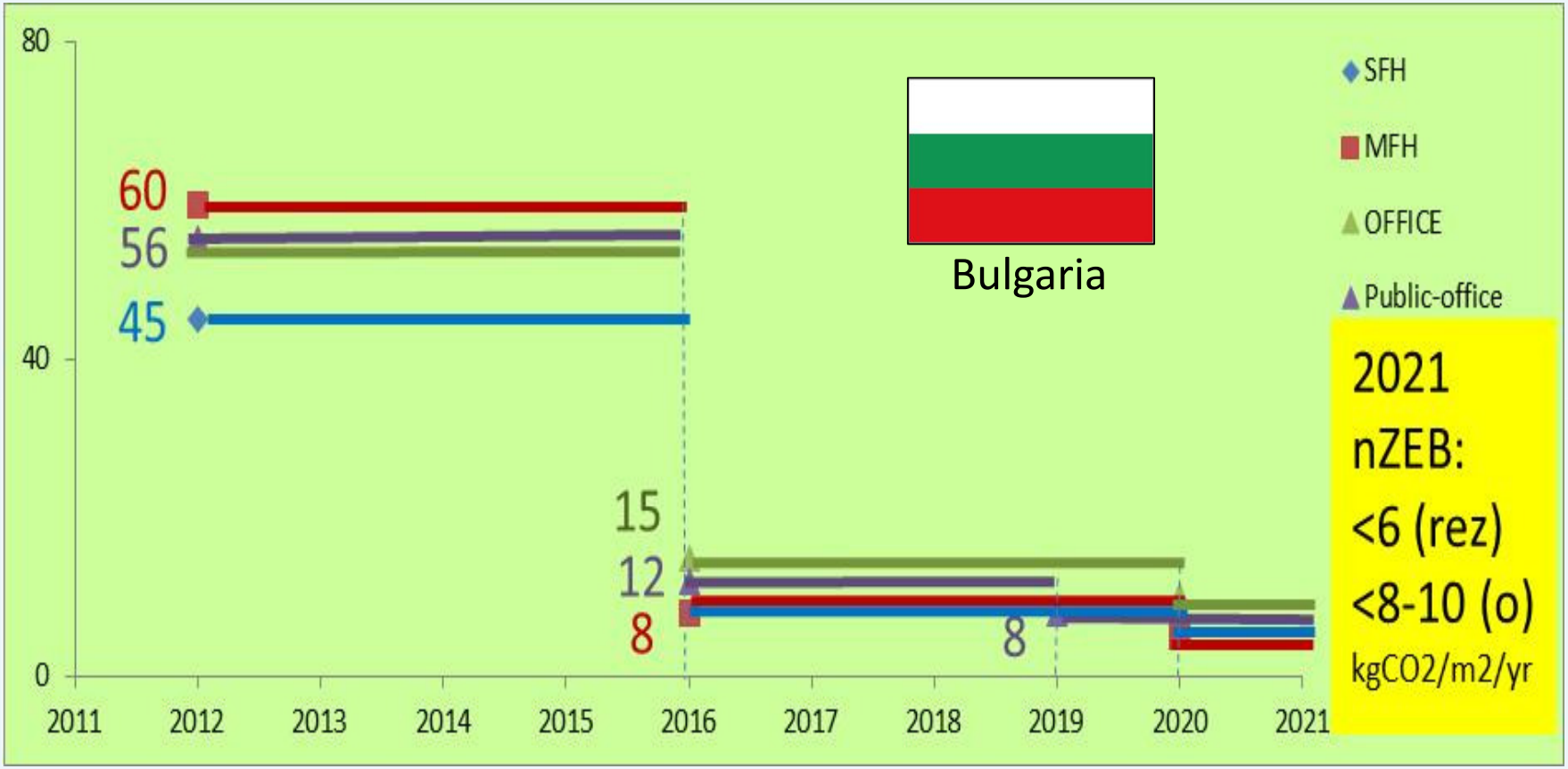
Proposed nZEB definitions - CO2 emissions in primary energy



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	Final specific demand [kWh/m²/yr]	Without CO_2 compensation				With CO_2 compensation (by additional PV)			
		Primary energy demand [kWh/m2/yr]	CO_2 emissions [kgCO_2/m²/yr]	Renewable share [%]	Total additional annualised costs [Euro/m2/yr]	Primary energy demand [kWh/m2/yr]	CO_2 emissions [kgCO_2/m2/yr]	Renewable share [%]	Total additional annualised costs [Euro/m2/yr]
V0-Reference	169.9	86.4	45.1	90%	0	n.a	n.a.	n.a.	0
V1 - Air heat pump	25.5	51.1	6.4	35%	-11.23	0	0	135%	-7.73
V1 - Brine heat pump	21.2	42.5	5.4	35%	-6.37	0	0	135%	-3.46
V1 - Bioboiler	91	21.9	0.5	99%	-4.28	11.6	0	104%	-3.57
V1 - Gas boiler	91	102	18.5	1%	-5.58	36.4	10.2	37%	-1.07
V2 - Air heat pump	19.4	39	4.9	35%	-9.78	0	0	135%	-7.11
V2 - Brine heat pump	15	29.9	3.8	35%	-4.95	0	0	135%	-2.9
V2 - Bioboiler	71	16.6	0.3	99%	-3.93	6.3	0	106%	-3.22
V2 - Gas boiler	71	79.4	14.4	1%	-5.23	26.1	7.7	38%	-1.57
V3 - Air heat pump	20.8	41.8	5.3	35%	-8.78	0	0	135%	-5.92
V3 - Brine heat pump	18.1	36.4	4.6	35%	-5.69	0	0	135%	-3.2
V3 - Bioboiler	72.1	18.8	0.6	98%	-2.96	8.5	0	105%	-2.26
V3 - Gas boiler	72.1	81.6	14.7	1%	-4.27	15.9	6.4	47%	0.23
V4 - Air heat pump	15.6	31	3.9	35%	-7.12	0	0	135%	-4.99
V4 - Brine heat pump	13.5	27.1	3.4	35%	-4.85	0	0	135%	-2.99
V4 - Bioboiler	49.4	13.2	0.5	98%	-2.75	2.9	0	108%	-2.04
V4 - Gas boiler	49.4	55.9	10.1	1%	-3.51	-9.7	1.8	68%	1
	<40	<40	<4	>50	<5	<40	<4	>50	<5
	40<x<60	40<x< 70	4<x<7	30>x<50	5<x<10	40<x<70	4<x>7	30>x<50	5< x<10
	>60	>70	>7	<30	>10	>70	>7	<30	>10

Example Bulgaria: simulation results for single family home

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Conclusions

- Energy efficient buildings are not just a dream in Brussels, they can be a reality in all European countries.
- Smart policies to overcome the many barriers need to be tailor-made and effective with a variety of target groups.
- Increasing energy efficiency will have many positive effects for society and economy.
- Need for a reliable and continuous data collection.
- Public funding alone will not be sufficient to finance the deep renovation of buildings - Financing tools that unlock private capital and institutional investors capital.
- Training & education to improve the skills in the construction industry and in other related sectors.
- Creating a market for energy efficiency is important, by removing market barriers and administrative bottlenecks.

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Thank you for your attention!

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Wednesday, June 26th, 14.30 – 18.00
Brussels, Committee of the Regions

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http://eusew.eu/energy-days/high-level-policy-conference

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Proposed nZEB definitions – Renewable energy share [%]

	2015/ 2016	2019	2020/ 2021
Single Family Buildings	>20		>40
Multi Family Buildings	>20		>40
Office Buildings	>20		>40
Public Office Buildings	>20	>50	

RES share may be adjusted at regional level, according to the local potential.

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Estimated macro-economic benefits between 2020-2050

Indicator	Effect
CO_2 emissions savings in 2050	4.7-5.3 Mio t CO2
Cumulative energy savings in 2050	15.3 -17 TWh
Additional annual investments	38 - 69 Mio Euro
Additional new jobs	649 - 1180 Full time employees

Proposed nZEB implementation roadmap by 2020

Policy process	• Strategies and planning, milestones, monitoring & evaluation, public consultation
Building codes	• Gradual improvement for meeting proposed targets
Energy certification	• Adjust for more visibility of nZEB. Better control & national database
Enforcement and compliance	• Stricter enforcement/compliance on energy performance of buildings
Reinforce existing /New Policies	• Light support schemes (especially for compensating the high upfront capital for RES) • Better integrate buildings and DH and community policies (minimise the costs) • Support development of supply chain industry (maximise economic benefits) • Stricter public procurement for buildings (public sector) • Remove market barriers
Capacity building	• Reinforce responsibilities. More and targeted info and advice points
Workforce skills	• Basic and long-life educational and training programs for workforce. Need for improving the actual practice in design and construction.
Information and awareness	• More info and guidance, • Support market champions promoting low-energy buildings
Demo projects	• nZEB demo-projects for all building types
Research	• Support research on new technologies and techniques

Our mission is to significantly reduce greenhouse gas emissions associated with building energy use by

Transforming

Policies and markets

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Global Buildings Performance Network

Global Center

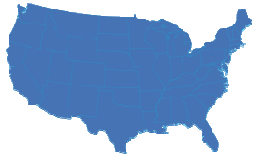
Conducting cross-cutting research and analysis

Connecting regional institutions, and share the best thinking building energy and GHG policy.

Communicating progress toward achieving the GHG abatement potential of the building sector

Harvesting best practices policies in building energy efficiency and performance.

Advancing policies and programs that promote low carbon, energy & efficient buildings.



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Europe's buildings today

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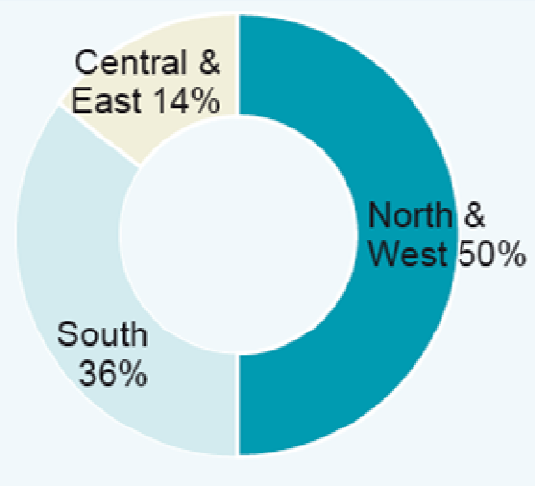
Total floor area of buildings

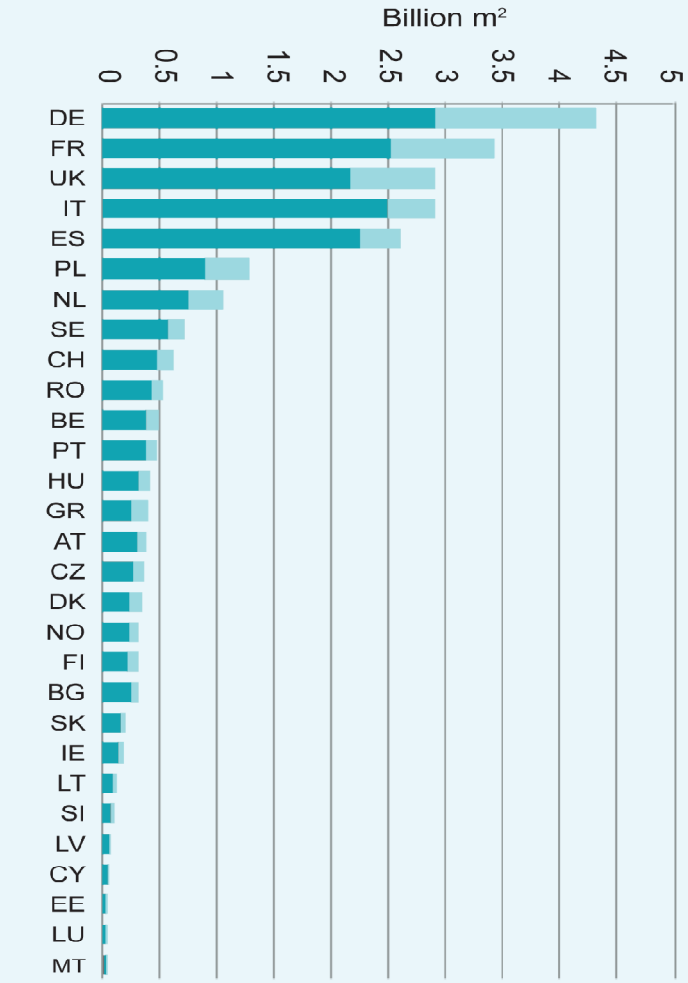
Total useful floor area:

- 24 billion m^2 for EU 27
- 25 billion m^2 with Norway and Switzerland added.

The 5 most populated countries (DE, FR, UK, IT and ES) account for 65% of total floor space.



Floor space distribution per region



Floor space distribution per country

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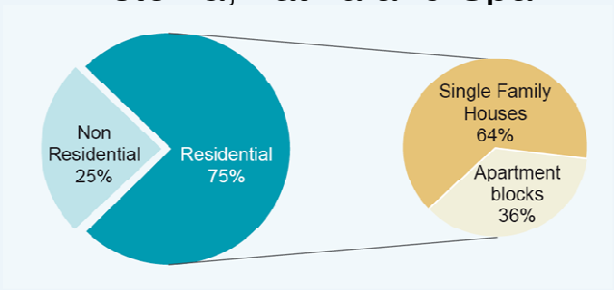
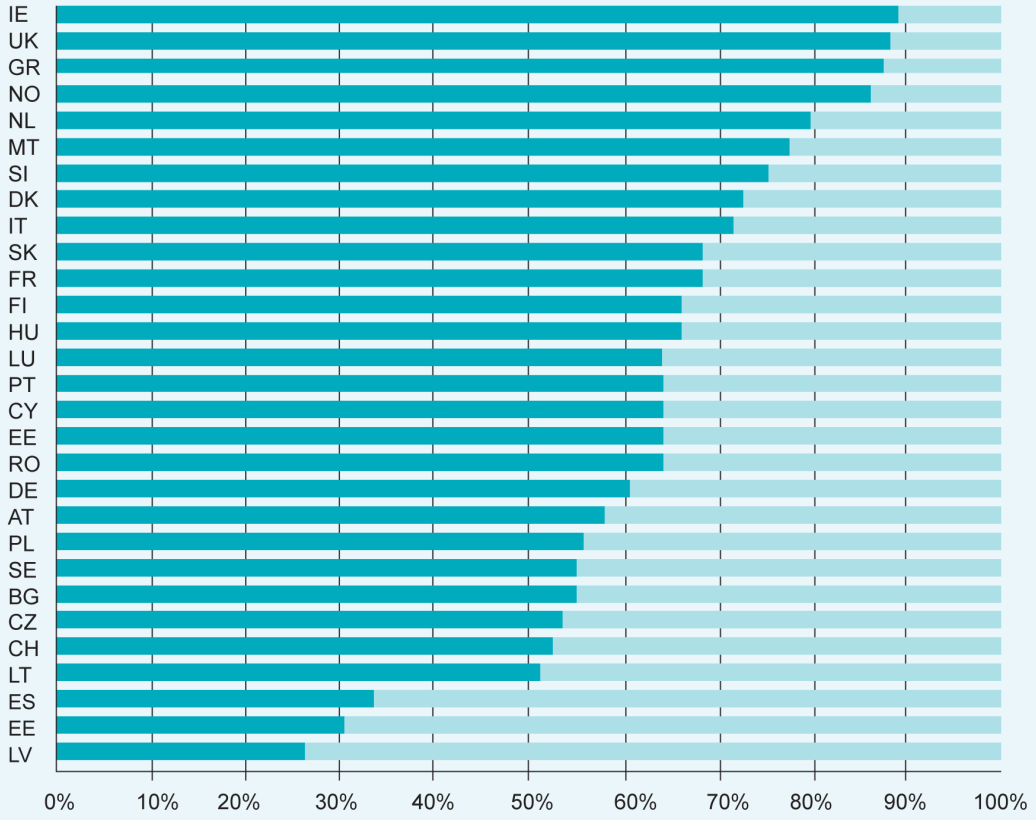
Residential floor area distribution

- Wide range of floor area contributions from single and multi family houses
- Proportion of floor areas for **single family houses** is highest in Greece, Ireland, Norway and the UK
- Proportion of floor areas for **apartments** is highest in Estonia, Latvia and Spain



Floor areas share for the covered countries



Floor area share for residential buildings

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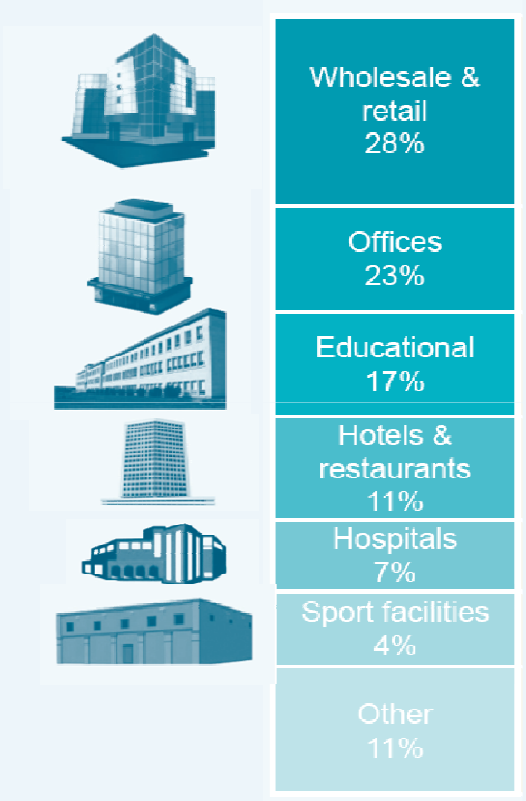
Non-residential floor area distribution

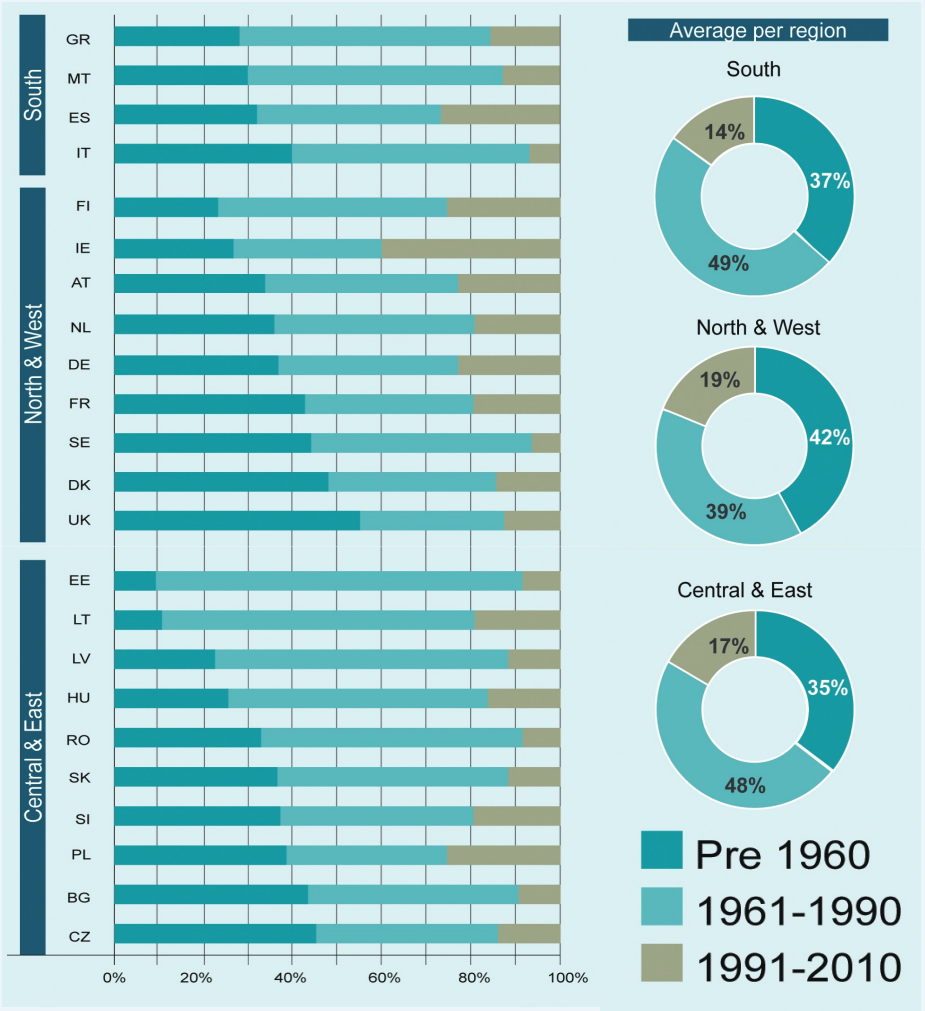
- Wholesale & retail buildings heating and cooling conditions may differ substantially from other categories due to large areas of wholesale buildings often being used only for storage purposes.
- Offices and educational buildings together account for 40% of the entire non-residential floor space. These buildings have similar heating and cooling conditions to residential buildings (although they are of shorter use)
- Hospitals (7% of total non-residential floor space) have continuous usage patterns, where energy demand can vary substantially depending on the services provided (from consultation rooms to surgery rooms).



Non-residential buildings by floor area

Residential age profile

- Variations in the age profile between the 3 regions are relatively small. Nonetheless, older buildings (before 1960) have the biggest share in the North & West region
- It is evident that all countries experienced a large boom in construction between 1961 and 1990 (with a few exceptions, the housing stock more than doubled in this period)
- Countries with the biggest share of recently constructed buildings (1990-2010) appear to be Ireland, Spain, Poland and Finland.
- Countries with the biggest share of residential stock dating from 1961 to 1990 seem to be Estonia, Hungary, Latvia and Finland.



Age profile of residential floor space

EE: Data only from 1951 onwards.
IT: Data excludes heritage buildings before 1950.
LT: Data only from 1941 onwards.
ES: Data excludes secondary houses
SE: Data only from 1921

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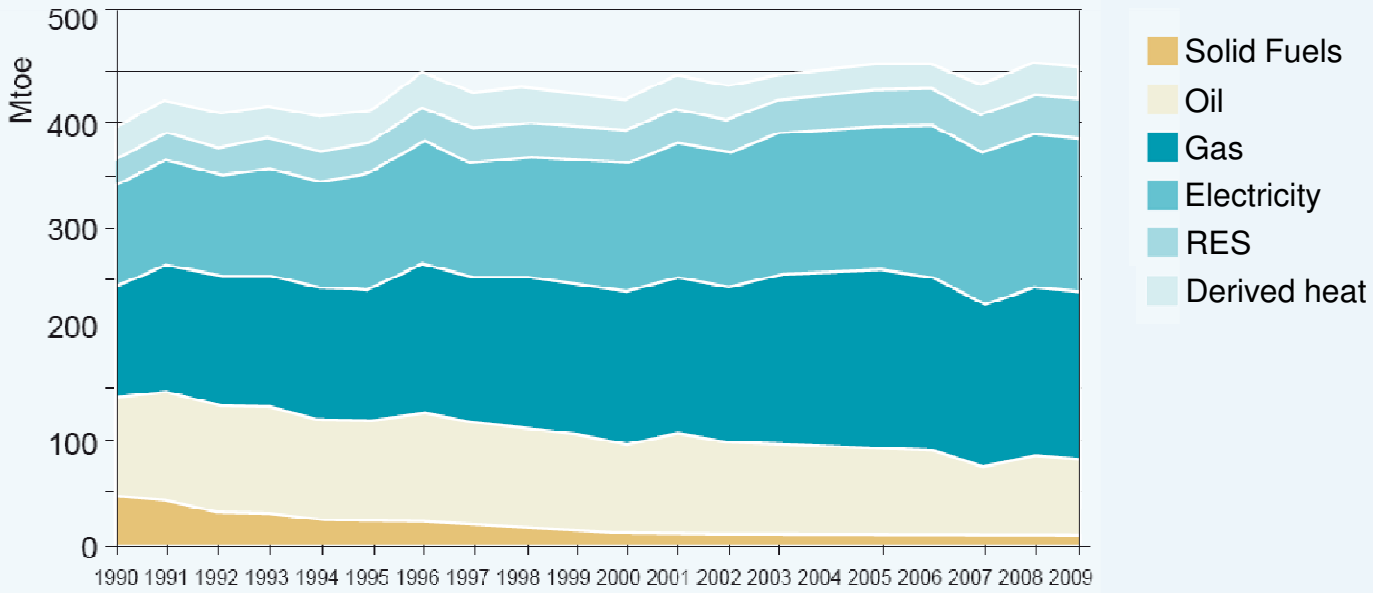
Final energy consumption in buildings

The final energy consumption has had a 50% increase in electricity and gas use and a decrease in use of oil and solid fuels by 27% and 75%, respectively.
Overall, the energy use in buildings has a rising trend with an increase from around 400 Mtoe to 450 Mtoe over the last 20 years. This is likely to continue if insufficient action is taken to improve the performance buildings.

Historical final energy consumption in the building sector since 1990 for the EU27, Switzerland and Norway



Source: Eurostat

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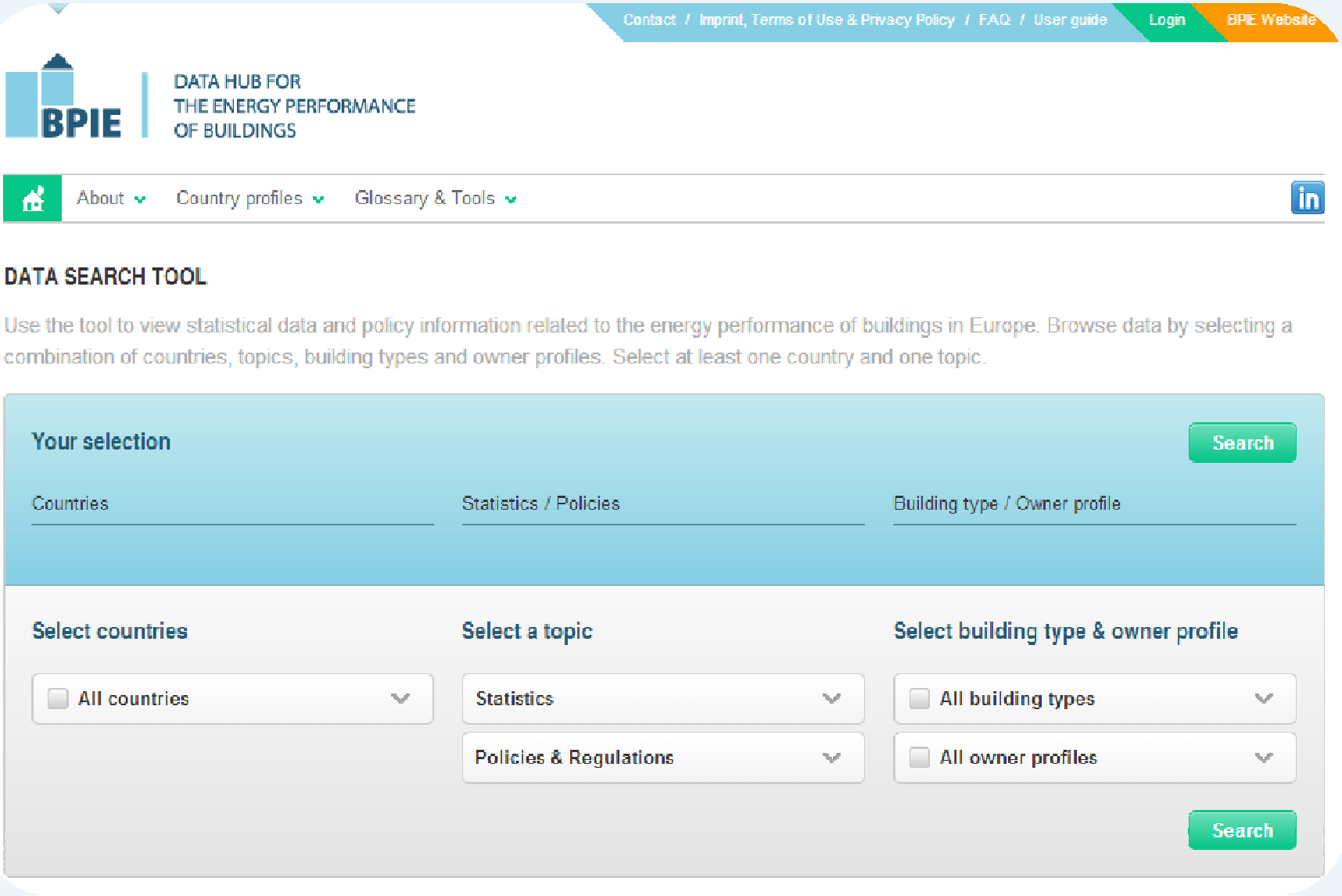
www.buildingsdata.eu



EU policies addressing the energy performance of buildings

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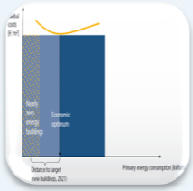
Energy Performance of Buildings Directive (recast)



Energy performance & Cost optimality

- MSs: Minimum energy performance requirements
- Cost-optimal methodology (common framework)
- Requirements for technical building systems

Existing Buildings

- All buildings undergoing major renovation should implement energy efficiency measures
- Minimum requirements for buildings & components

New Buildings = nZEB

- By 31 Dec. 2018 public admin. buildings
- By 31 Dec. 2020 all buildings
- National plans for nZEB

Energy Performance Certificates (EPC)

- Implement EPC schemes
- Recommendation for cost-optimal improvements
- Independent control systems

HVAC inspection

- Regular inspections (heating > 20kW, AC>12kW)
- Independent control systems

Financial incentives & Market barriers

- MSs: to prepare lists of measures and instruments

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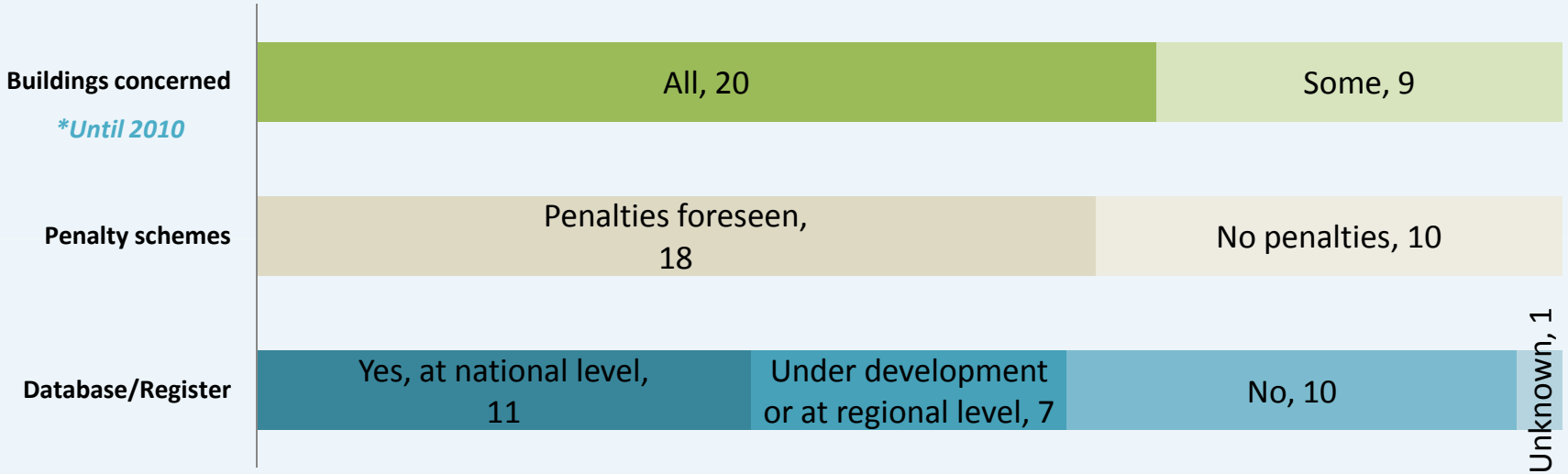
EPC schemes

Implementation status



Countries concerned: EU27, CH, NO

Existing EPC registers/databases have proven to be extremely useful in monitoring and analysing the opportunities for energy performance improvement.

In the longer term, they will also prove invaluable in assessing trends in energy performance.

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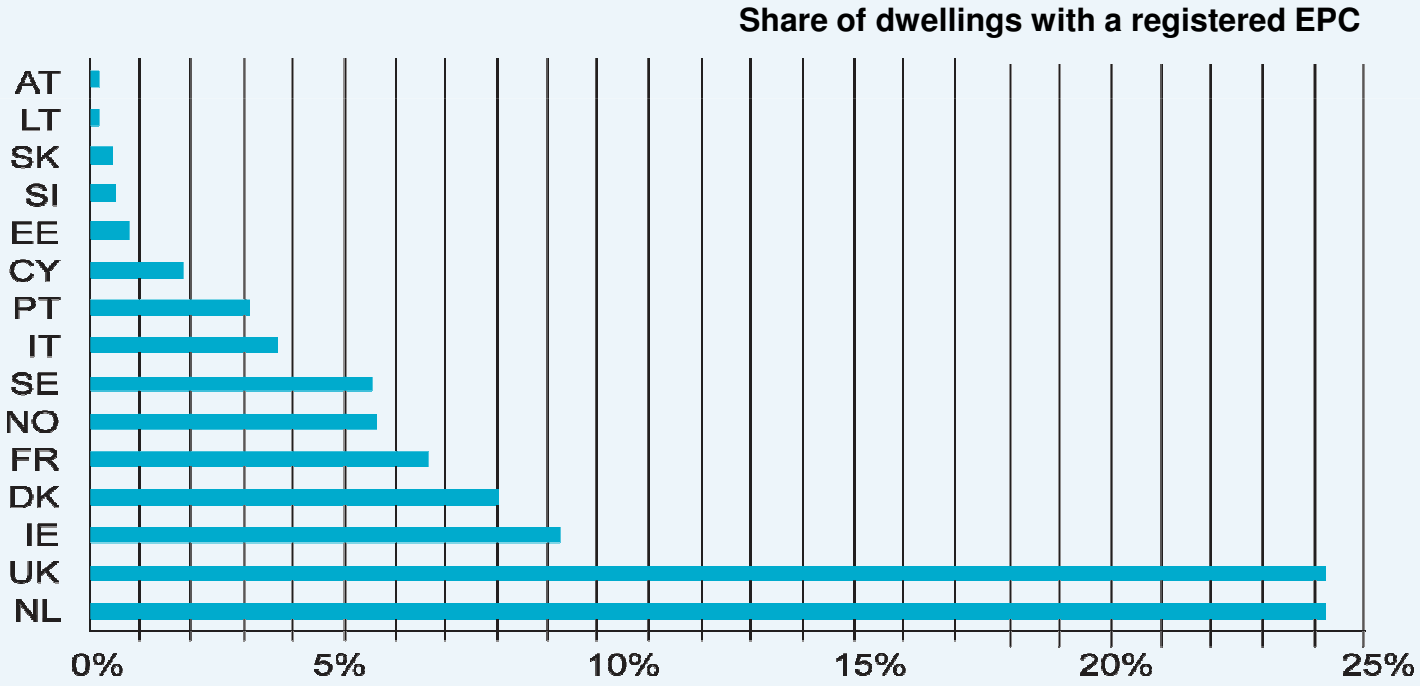
EPBD implementation

Residential EPCs

Although the certification schemes have been working for only a couple of years, the proportion of dwellings not yet certified remain above 90% for all countries with the exception of The Netherlands and the United Kingdom.



Financial instruments for EE in buildings

	Grants, Subsidies, Funds	Loans	Tax Incentives, Levies Etc	Obligations, white certificates	Audits	3rd Party finace, ESCOs	Other
AT	All		Households			Existing bldgs	
BE	All		Households & Business	Flanders region			
BG	Existing bldgs	Residential and Public bldgs	Class A or B new build				
CR	All	Public bldgs				Existing residential bldgs	
CY	All						
DK	Existing bldgs						
ES	Residential	Residential					
FI	All		Households		Existing non-residential		
FR	All	All	Households & Business	Existing buildings	Private sector		Feed-in tariff; training scheme
DE	All	Residential				Public buildings	Feed-in tariff
GR	Existing bldgs		Private sector				
HU	Existing bldgs		Planned				
IE	Residential		Business	Imminent			
Italy	Existing bldgs	Existing bldgs	Households & Business	All		Yes	Feed-in tariff
LT	Existing bldgs						household renewable grants
LI	All						
LU	All	New homes					
MT	All						
NL	Residential	New private non-residential	Private sector				All
NO	All					All	
PL	Public sector	Existing bldgs		Planned			
PT	All		All				
RO	Residential bldgs						
SK	Existing bldgs	Existing bldgs					
SL	Private residential and Public non-residential	Private homes				Public residential	
ES	All	All	Households			Public sector	
SE	All		Households & Business				Technology procurement
CH	All		Households & Business				
UK	Existing bldgs	Residential	Households & Business	Residential		Public sector	Feed-in tariff

Summary of the financial programmes for buildings efficiency in Europe 2010/2011

- About 333 financial schemes have been screened through the BPIE survey using several databases (among them MURE, IEA and input from each MS)
- Wide range of identified financial instruments, from grants to VAT reduction applied to all building typologies.
- Financial support varies considerably from around €1M/a to in excess of €1b/a. Larger programmes tend to be support for improvements of social housing.
- Many schemes targeting specific technologies, such as insulation, boiler replacement, renewables, and also new passive buildings.
- Various forms of loans and taxes are usually available both for individuals as well as businesses
- Less popular schemes: audits, third party financing and energy supplier obligations/white certificate schemes (this could become mandatory across all EU MSs if the current proposal in the draft Energy Efficiency Directive is approved)

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Impact Evaluation for financial programmes

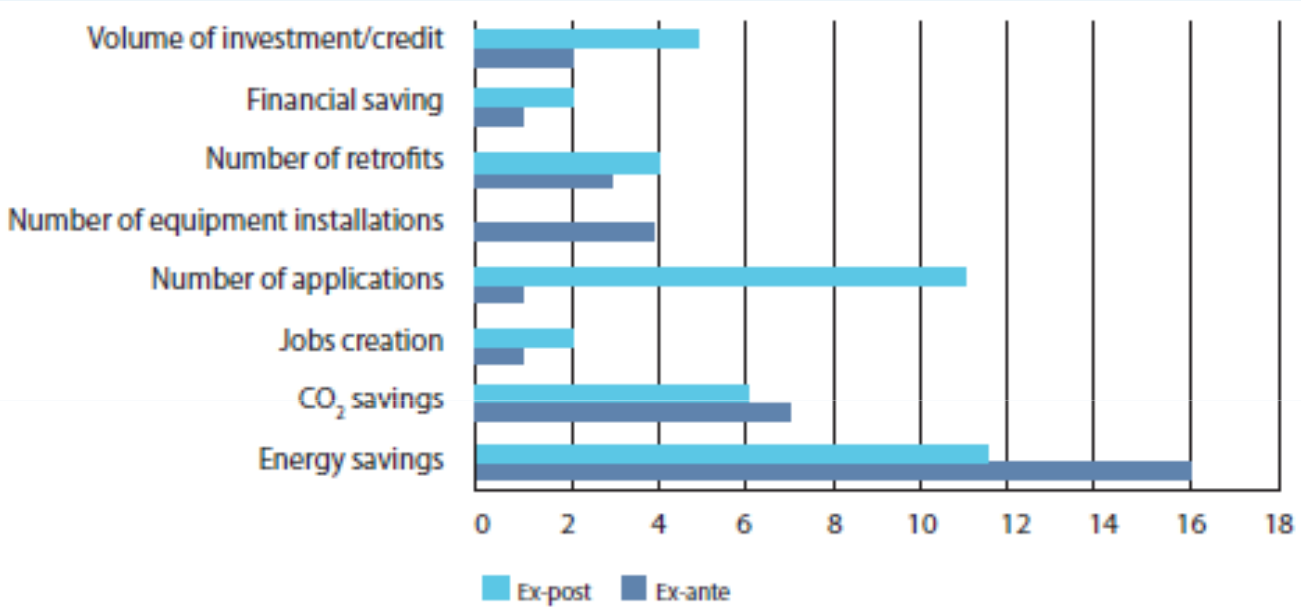
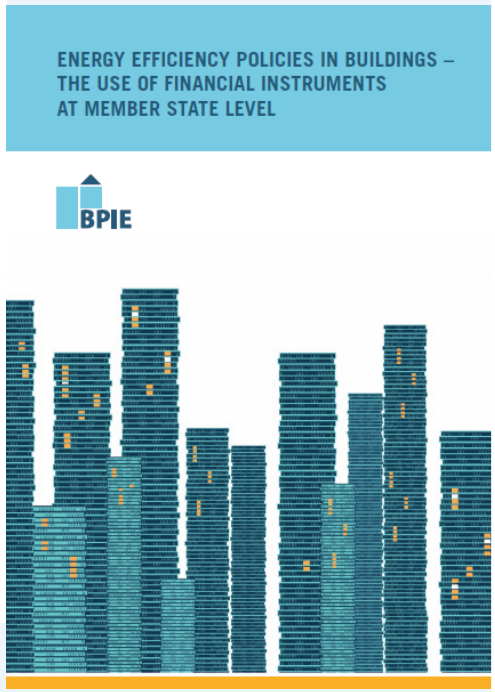


Figure 17 – Number of programmes that reported ex-ante and/or ex-post impacts by different key performance indicators



Source: BPIE survey

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EPBD – Effective implementation?

- 14 Member States informed EC about nZEB plans (EC report was due end 2012)
- 5 Member States informed EC about list of measures & instruments to support the objectives of the Directive (deadline was June 2011)
- 9 Member States have reported their approach to applying the cost-optimal methodology to define minimum performance standards for buildings (deadline was March 2013)
- DG Energy taking legal action:
  - Infringement procedures concerning EPBD 2010 ongoing against 24 member states
  - In 2012, legal action in European Court of Justice against Italy and Spain regarding EPBD 2002

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Energy Efficiency Directive (2012)

Buildings related provisions:

- By April 2014, member states have to develop a long-term strategy for investments in the renovation of the national building stock, including policies and measures to stimulate cost-effective deep renovations
- Member states must renovate 3% of their central government buildings each year.

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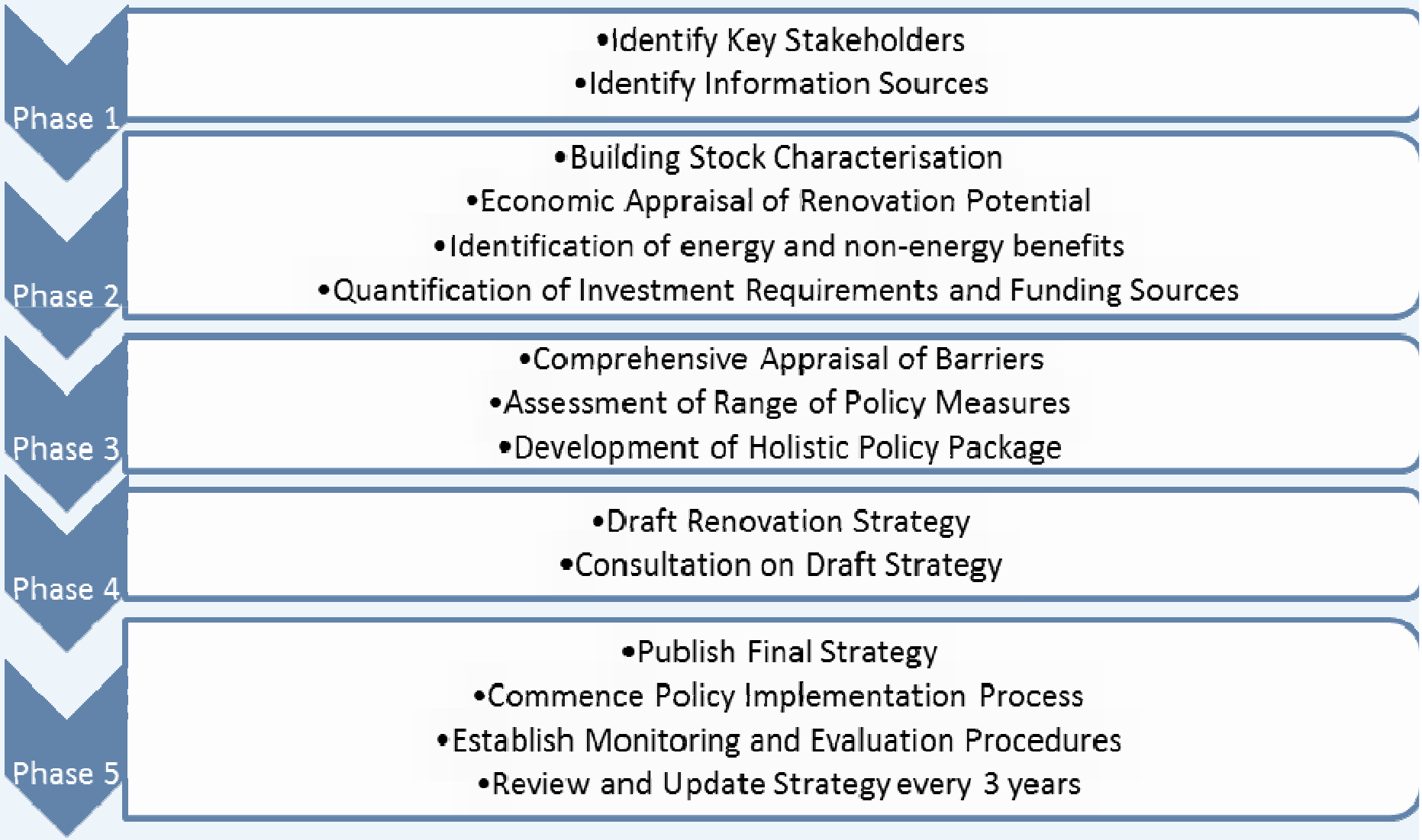
Strategy Development Process



Renovating with a purpose – Defining a roadmap towards 2050

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Model basic assumptions

Practical limit by 2050:

- Demolition rate considered (0,2% / yr.)
- Recent renovations excluded (only few, up to 1%)
- New buildings between 2011-2020 considered (0,5% / yr.)
- Additional adjustment

Building stock energy performance:

- By age bands
- By building types
- Residential; old buildings to be renovated first
- Non-residential

Cost assumptions:

- Discount rates: societal (3%), private (10%), public sector (5%)
- Learning curves
- Energy prices: Eurostat, PRIMES forecasts

Decarbonisation of the power sector- 2 pathways:

- BaU (approx. 0,5% / yr.)
- As requested by the Low-carbon economy Roadmap 2050 (approx. 5% p.a. for electricity and 2% for other fuels)

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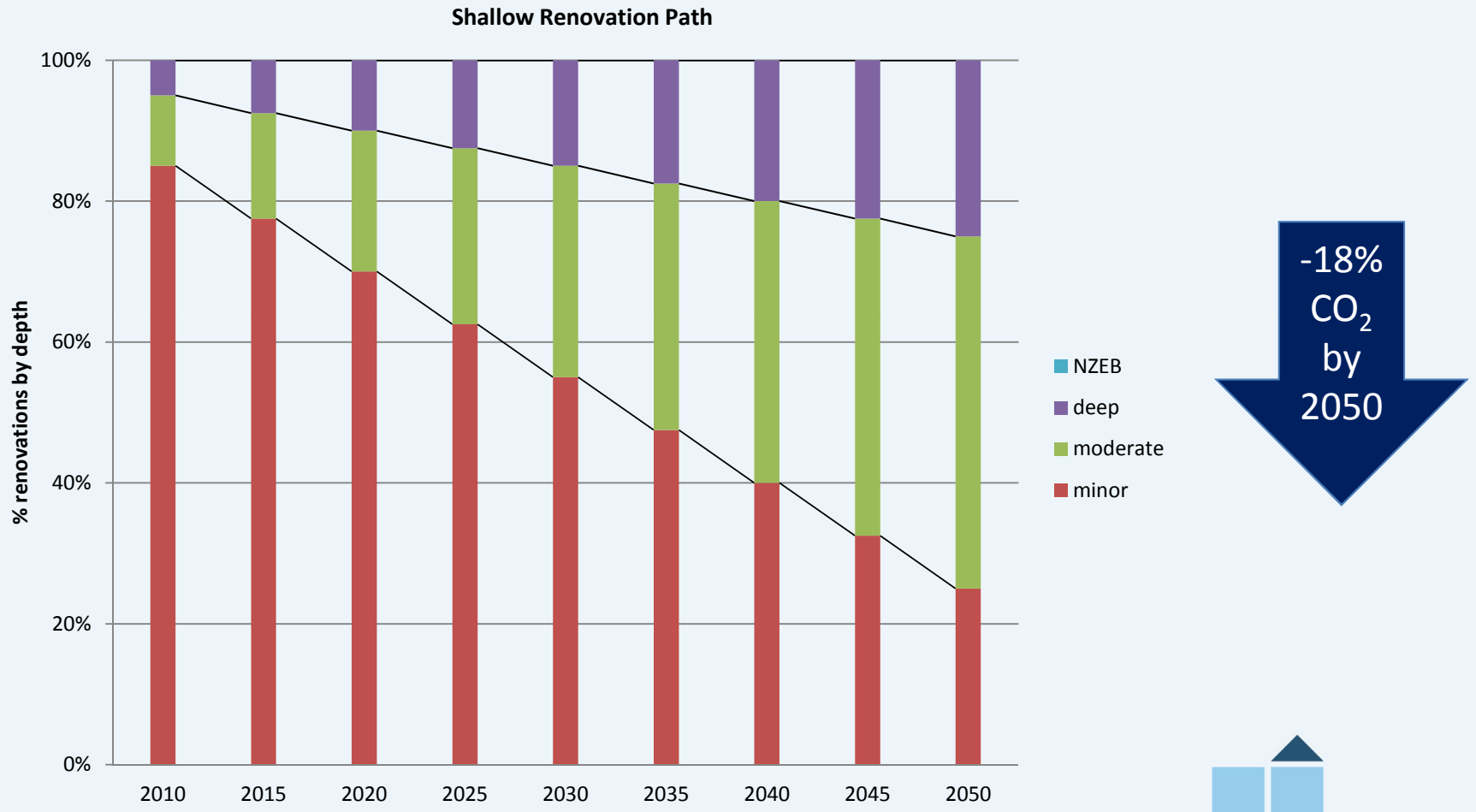
Renovation depths



-18% CO_2 by 2050

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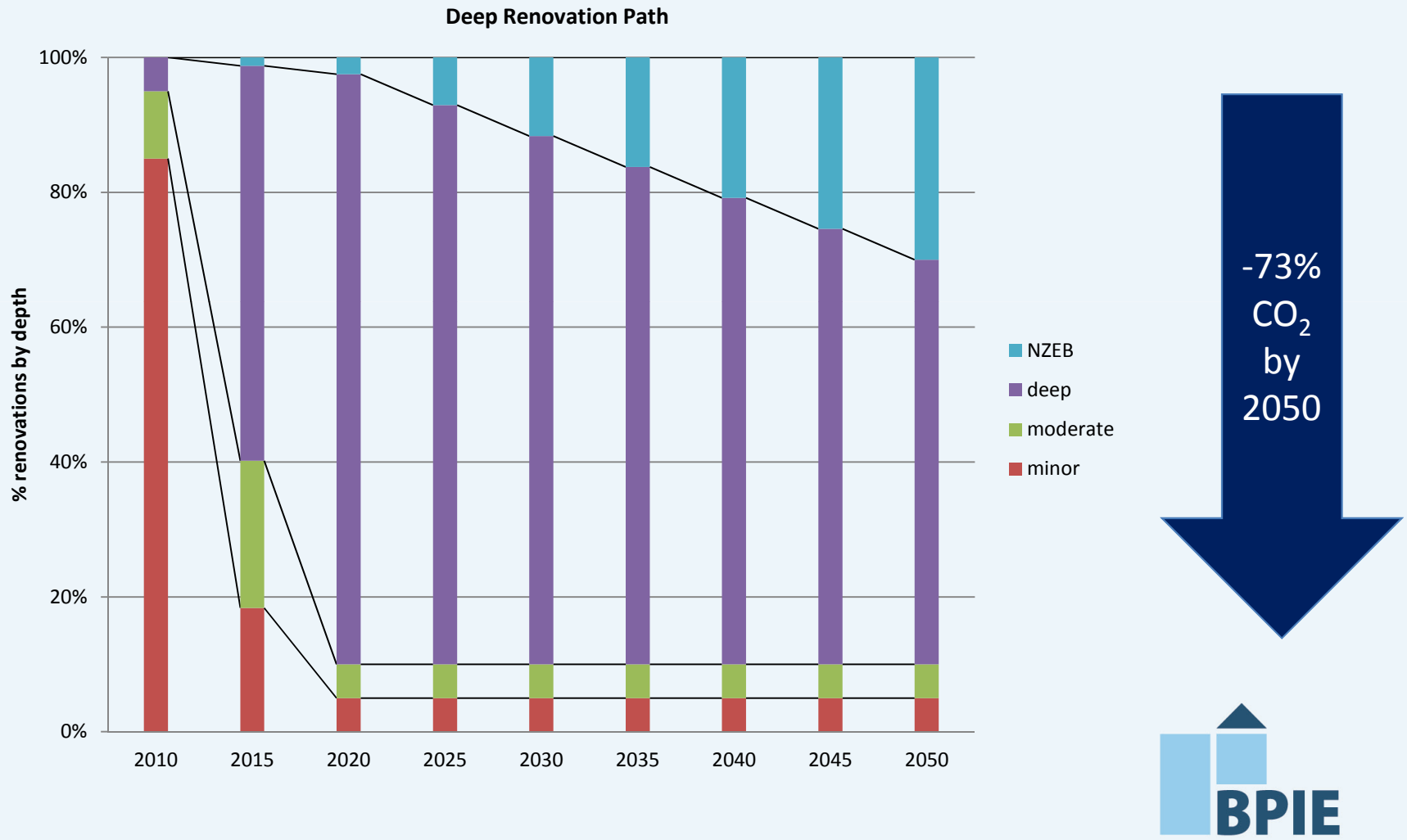
Renovation depths



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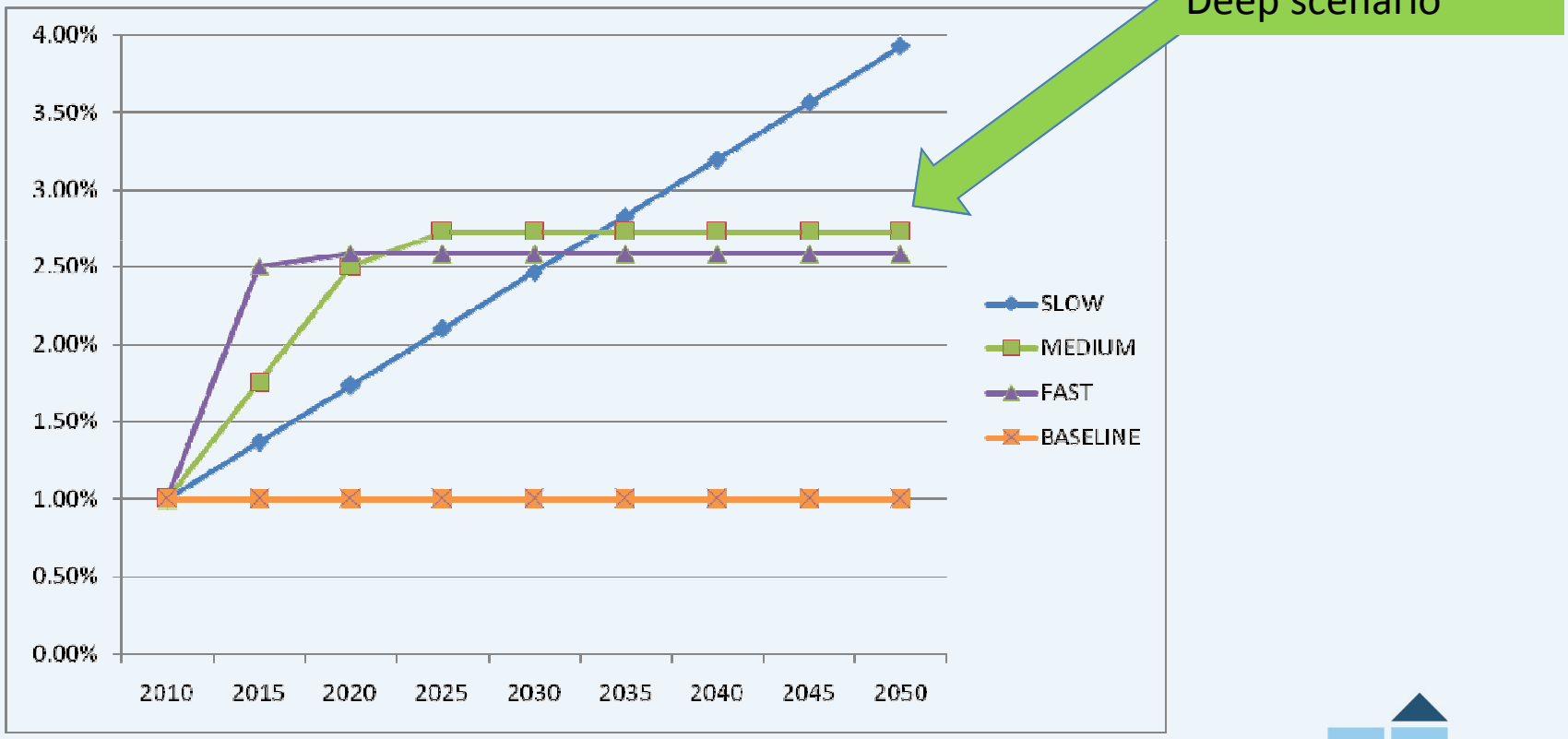
Renovation speeds

Renovation rates profiles considered over time



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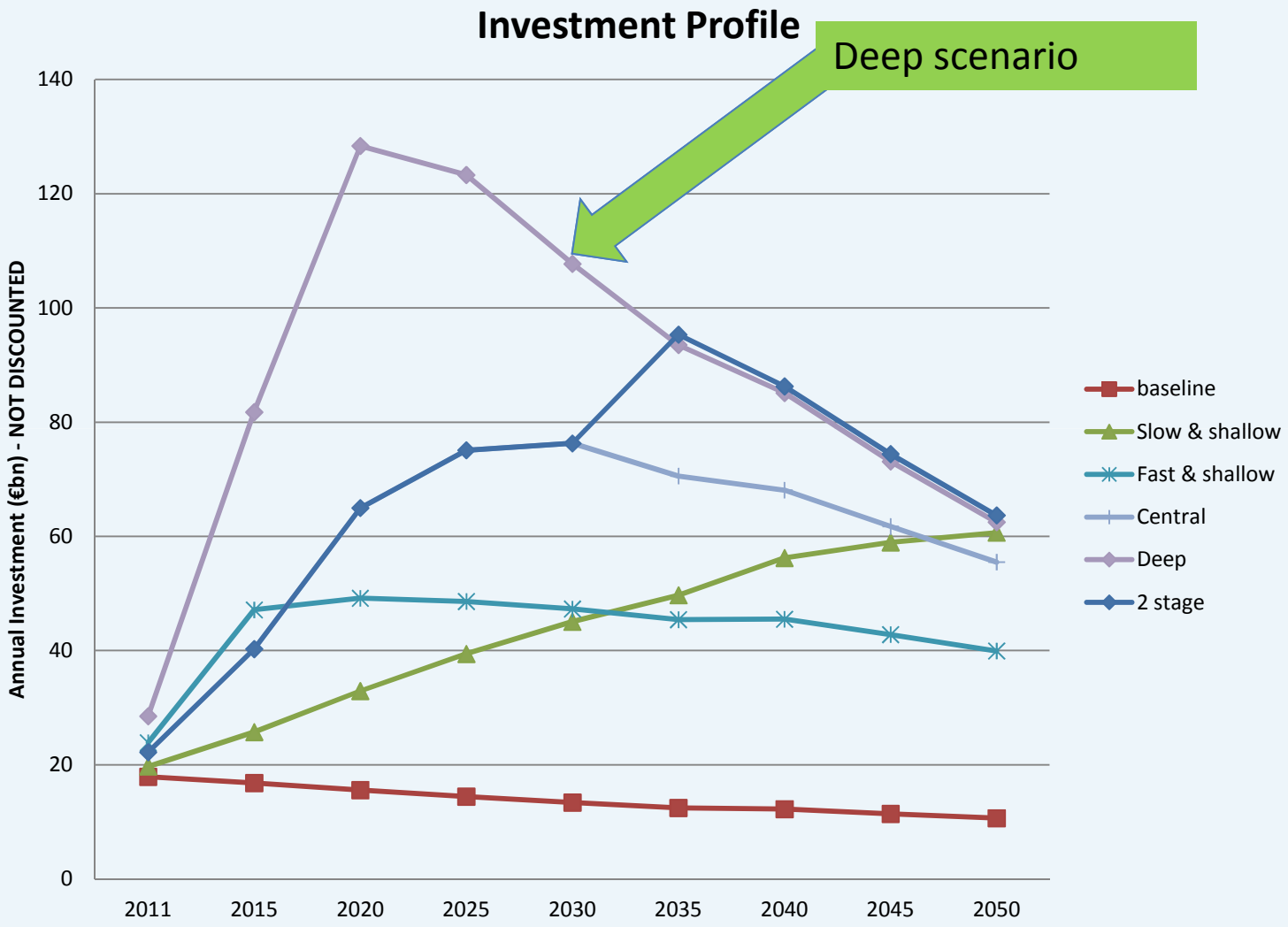
Europe's buildings under the microscope
A country-by-country review of the energy performance of buildings

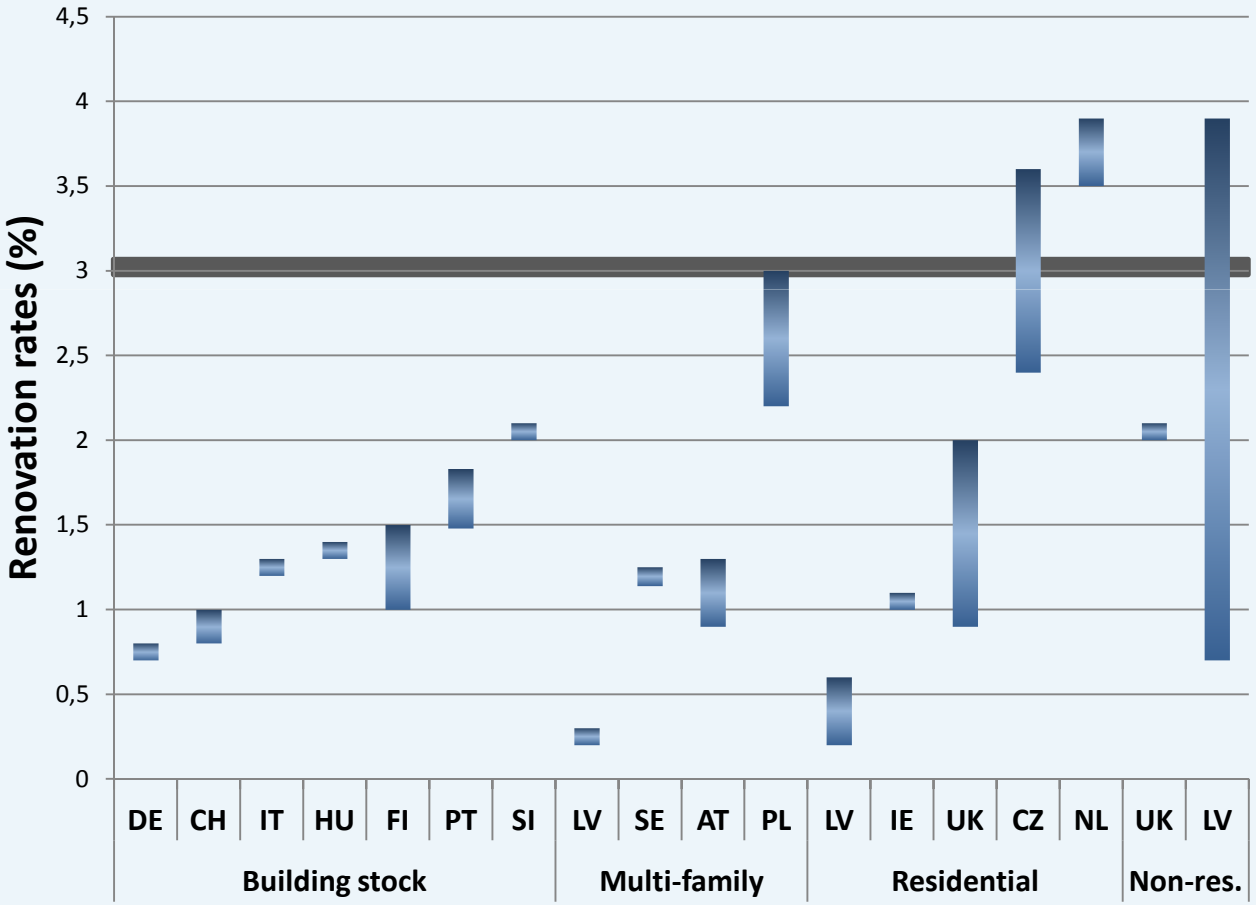


BPIE

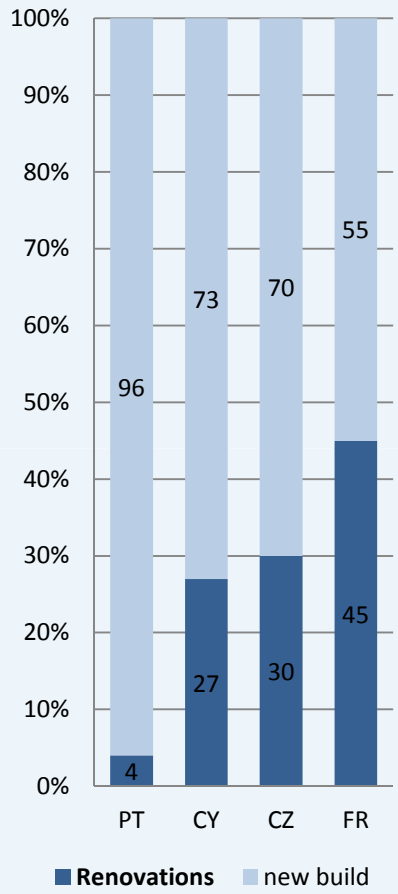
REALITY CHECK!

Europe's buildings under the microscope
A country-by-country review of the energy performance of buildings

Annual renovation rates



Construction activity



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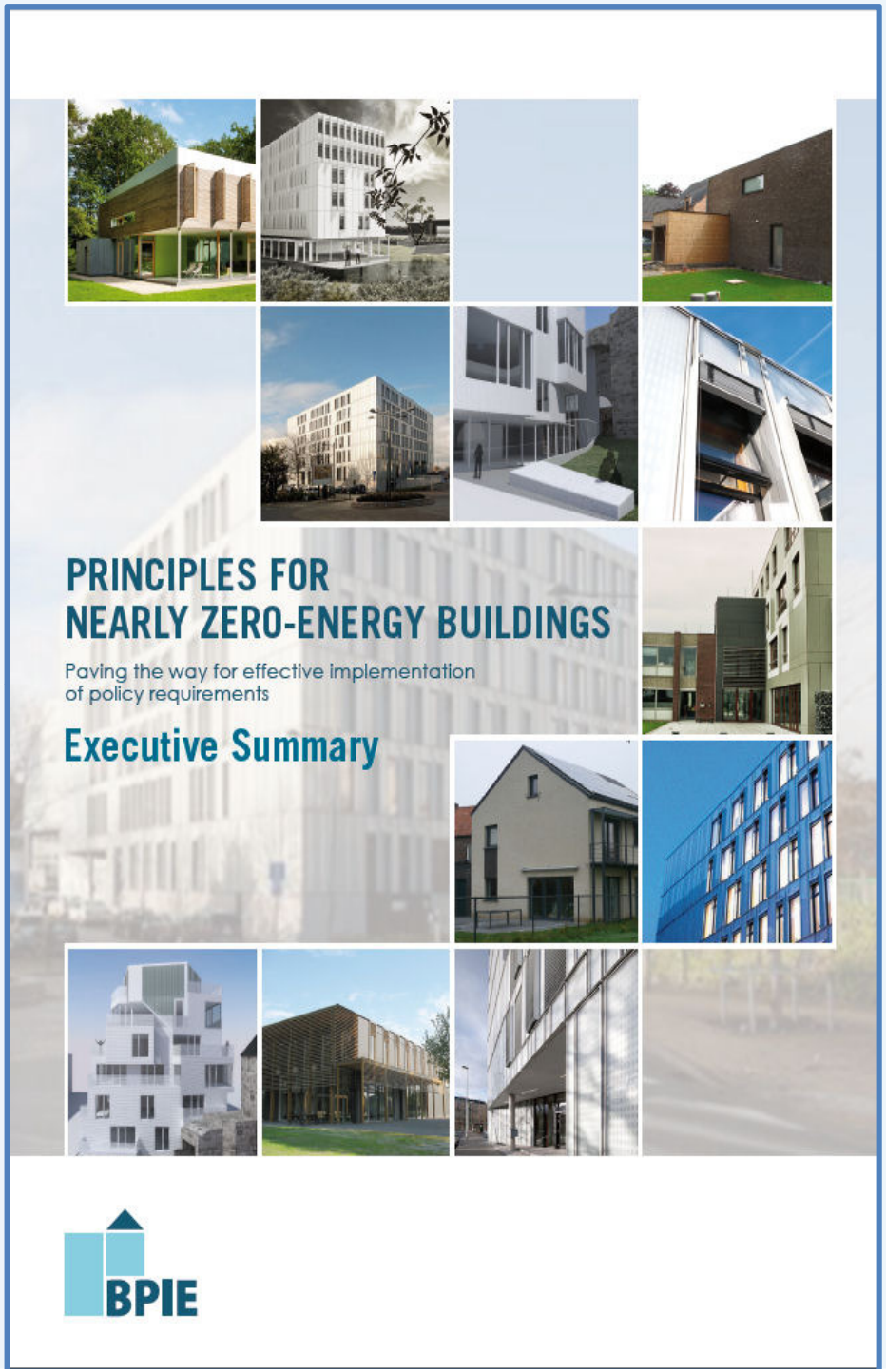

PRINCIPLES FOR NEARLY ZERO-ENERGY BUILDINGS

Paving the way for effective implementation of policy requirements

BPIE

Rationale – recast EPBD implementation

- **Art. 9: Nearly Zero-Energy Buildings (nZEB)**
  - by 31 December 2020, all new buildings are nZEB
  - after 31 December 2018, new buildings occupied and owned by public authorities are nZEB
  - national plans for nZEB & public sector leading example

- **EPBD requirements are very flexible; there is a need for giving more guidance to Member States for agreeing and implementing a sustainable nZEB definition!**

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EPBD - nearly Zero-Energy Buildings (nZEBs)

- National plans; public sector to lead by example
- Need for a clear definition:
  - ✓ Principles, criteria and boundaries.
  - ✓ Impact on the current sectorial and overall targets of the EU
  - ✓ (nearly) zero CO2 and zero energy
  - ✓ Avoidance of the lock-in effects
  - ✓ Groups of buildings or a single building?
  - ✓ Time disparities (e.g. daily vs. annual balance) and local disparities (e.g. on-site vs. off-site production) between produced and consumed energy
  - ✓ Proper balance of energy efficiency and renewable energy
  - ✓ Cost optimality and nearly zero energy buildings

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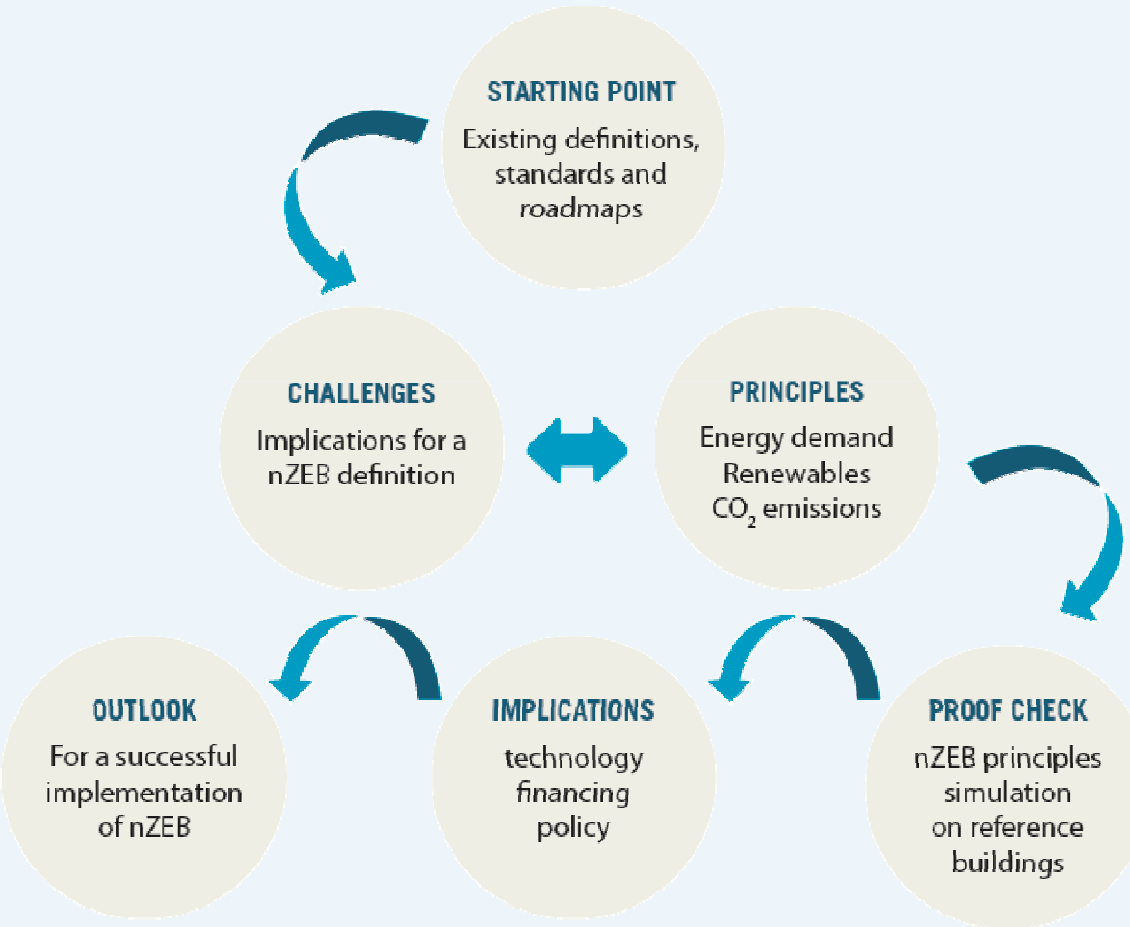
Aim and structure of the study



To contribute to a common and cross-national understanding on:

- **an ambitious, clear definition and fast uptake of nZEB in all EU MSs**
- **common principles of sustainable, realistic nZEB**
- **possible technical solutions and their implications for national building markets, buildings and market players.**

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Answers to the nZEB main challenges

- **The study analyses the implications of:**
  - Current sectorial and overall EU climate & energy targets
  - Bridging the gap between (nearly) zero CO2 and zero energy
  - Having an open concept and avoiding lock-in effects
  - Groups of buildings vs. a single building
  - Time disparities (e.g. monthly vs. annual balance) and local disparities (e.g. on-site vs. off-site production) between produced and consumed energy
  - Proper balance of energy efficiency and renewable energy
  - Cost optimality and nearly zero energy buildings
- **…and defines a set of principles, criteria & boundaries for energy demand, renewable energy share and related CO2 emissions**

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nZEB Principles

First nZEB Principle:
Energy demand

There should be a clearly defined boundary in the energy flow related to the operation of the building that defines the energy quality of the energy demand with clear guidance on how to assess corresponding values.

Second nZEB Principle:
Renewable energy share

There should be a clearly defined boundary in the energy flow related to the operation of the building where the share of renewable energy is calculated or measured with clear guidance on how to assess this share.

Third nZEB Principle:
Primary energy and CO_2 emissions

There should be a clearly defined boundary in the energy flow related to the operation of the building where the overarching primary energy demand and CO_2 emissions are calculated with clear guidance on how to assess these values.

Corollary of First nZEB Principle:
Threshold on energy demand

A threshold for the maximum allowable energy need should be defined.

Corollary of Second nZEB Principle:
Threshold on renewable energy share

A threshold for the minimum share of renewable energy demand should be defined.

Corollary of Third nZEB Principle:
Threshold on CO_2 emissions in primary energy

A threshold for the overarching primary energy demand and CO_2 emissions should be defined.

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nZEB technology, financial and policy implications

- **The principles are verified on reference buildings in different EU climate zones. → Several important implications:**

Technology & markets	Financial	Policy
-Foster the market penetration of new technologies -Upscale several times the markets for main existing technologies (for insulation and ventilation, heat pumps, RES) -Training for professionals	-Significant additional investments are required for nZEB technologies to implement nZEB requirements in every new building (aprox. EUR 62 billion per year) -Important benefits as reward: around 345,000 additional jobs at EU level!	-Gradually tightening of buildings codes within EU MSs -Support policies for market penetration of building related technologies (energy efficient and renewable) -Synergies with sustainable cities policies

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Further steps for a successful implementation of nZEBs

What to do	Whose responsibility
Agreement on a concrete outline of a definition for nZEB	EU MSs, EU Commission, EU Parliament and main stakeholders.
Create benchmarks for suitable nZEB in different EU MSs as a basis for comparison.	EU MSs, EU Commission and main Stakeholders.
Agree on a corridor for the value of an overarching threshold for nZEB.	EU Member States, EU Commission, EU Parliament.
Generate a common reporting format for EU MSs to be used for reporting national plans on how to move towards nZEB.	EU MSs, EU Commission.
Support for investors to understand the necessary up-front investment, by helping to build planning and implementation capacities.	EU MSs, EU Commission.
Ellaborate a definition for buildings renovation at nZEB level.	EU MSs, EU Commission, EU Parliament and main stakeholders.

Moving towards ZEB:

Which is the right road, where is the target?

- Evidence-based policy support in several EU MSs needed
- Goal is to reduce both energy consumption and emissions
- Risk of having sub-optimal nZEB definitions
- Risk of having sub-optimal implementation of the nZEB

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BPIE support for nZEB definitions and implementation roadmaps in the EU Member States

- Ongoing BPIE studies for Pl, Ro and Bg
- Based on preliminary analysis of local market conditions, existing policies, technology costs and local practice in construction
- Definition of reference SFH, MFH and office buildings
- Evaluation on simulated improvement options towards nZEB levels for new buildings
- Financial implication and co-benefits
- Proposing affordable but ambitious nZEB definitions
- Proposing policy implementation roadmaps by 2020

- Romanian study - end of September
- Polish and Bulgarian studies - October 2012

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Romania: actual status

- No energy performance requirements in building codes
- Actual practice lower than in more developed countries
- Compliance to be significantly improved
- A -class label threshold in buildings certificates is too high (between 125-150 kWh/m2/yr)
- Only few support schemes for new buildings (i.e. 'Casa Verde')
- Extensive DH systems in cities but old and inefficient
- Low purchase power
- Lower prices for en eff and RES technology and materials but less developed market

Building type		Region	Number of buildings (1000)	Floor area (million m²)	New construction rate (%)
Residential buildings	Detached SFH	urban	1 189.2	97	Above average
		rural	3 660.9	237	Below average
	Semi-detached and terraced SFH	urban	112.0	20	Above average
		rural	54.9	6.3	Below average
	MFH	urban	80.9	191	Below average
		rural	5.1	5.3	Below average
	Other buildings	urban	6.3	1.1	Below average
		rural	8.6	0.5	Below average
	Total		5 118	559	0.6
Non-residential buildings	Commercial and public offices		19.1	7.8	Much above average
	Retail		133.5	18.3	Above average
	Hotels & restaurants		5.0	5.2	Above average
	Health facilities		51.3	9.3	Below average
	Educational facilities		8.1	17.4	Below average
	Total		217.1	59.4	1.5-2.5

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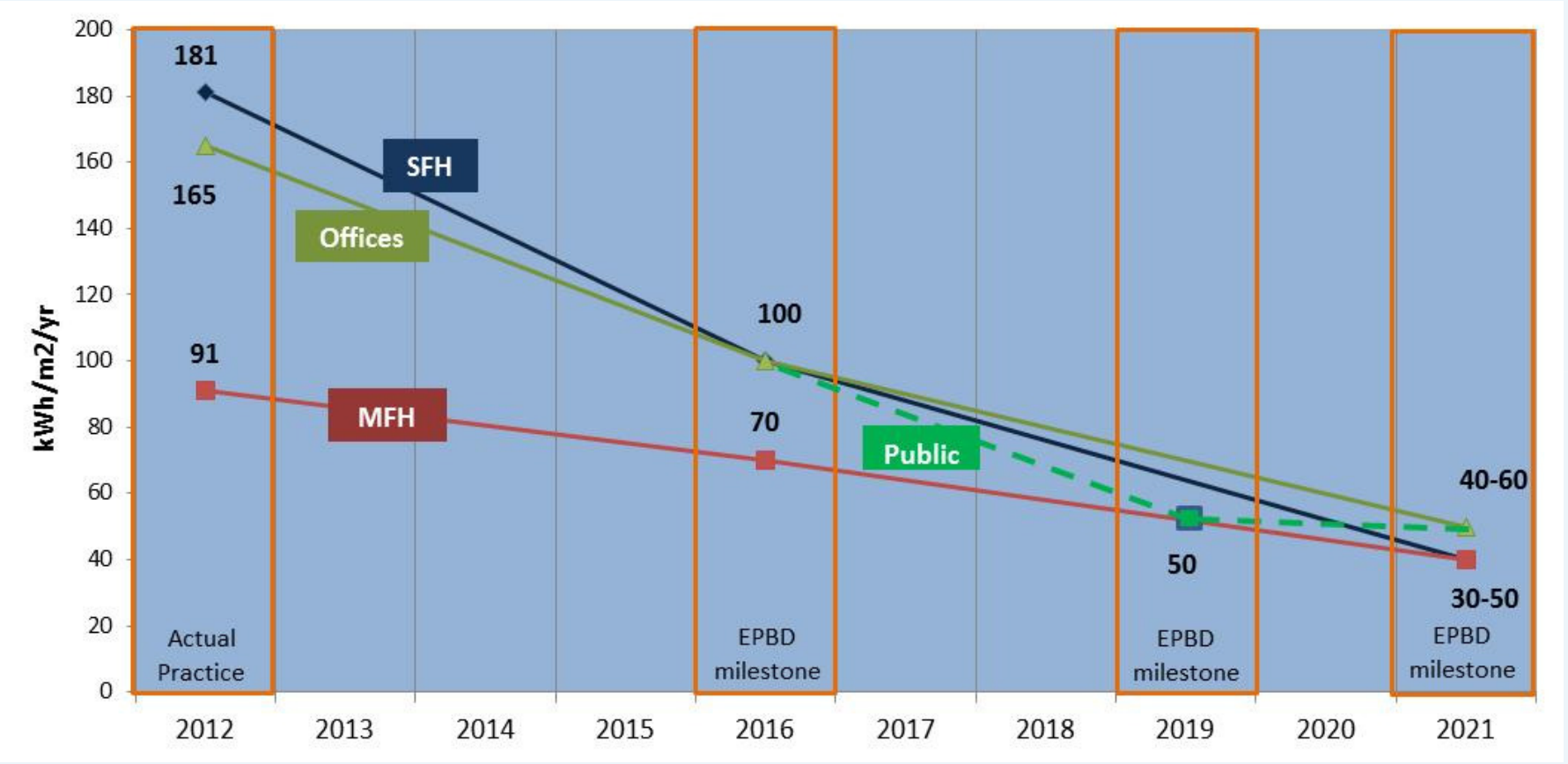
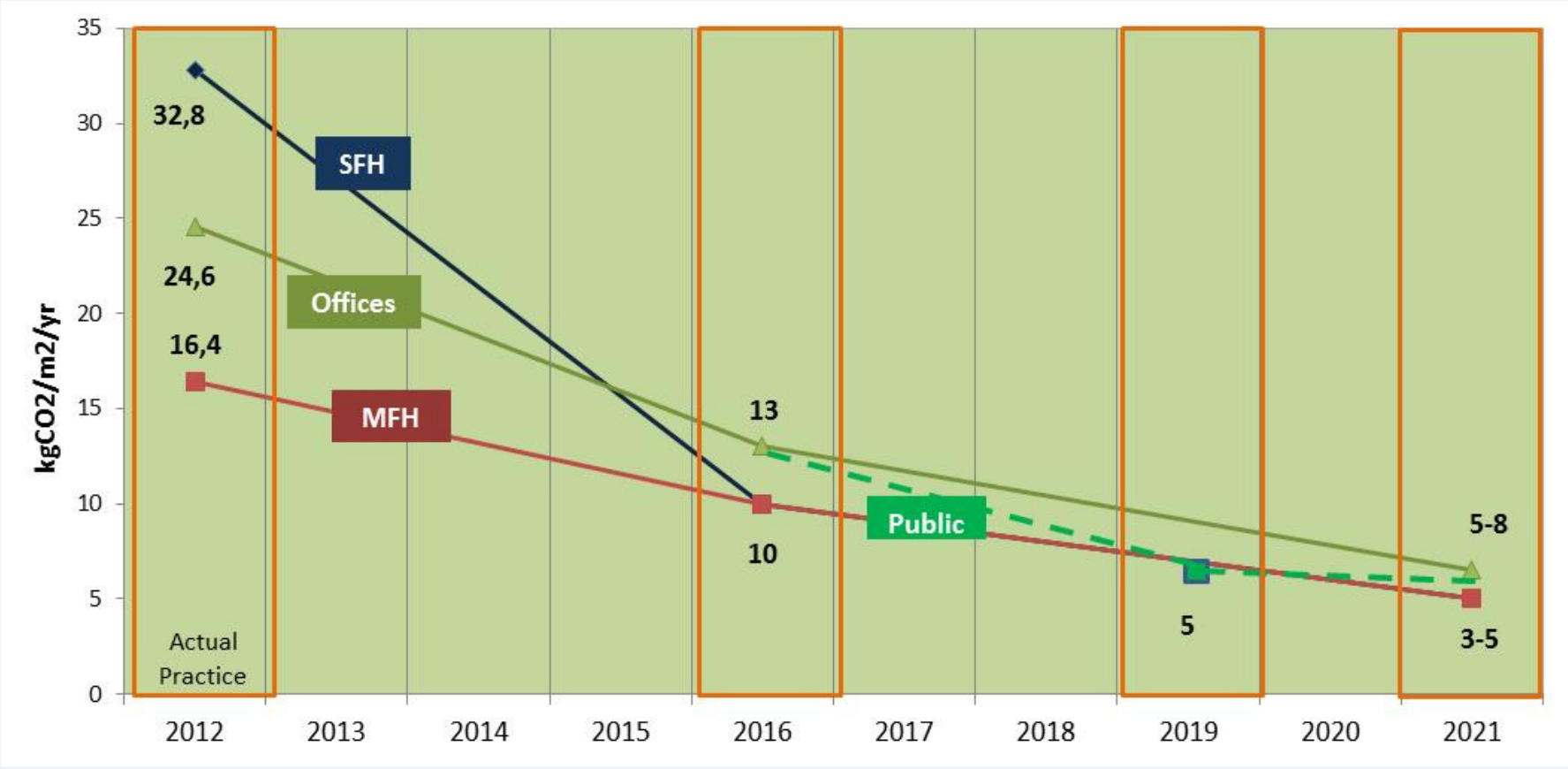
Proposed Romanian nZEB definition by 2020 (1)

Minimum requirement - primary energy consumption (EPBD scope)



Proposed Romanian nZEB definition by 2020 (2)

Additional requirement – CO2 emissions in primary energy (EPBD scope)



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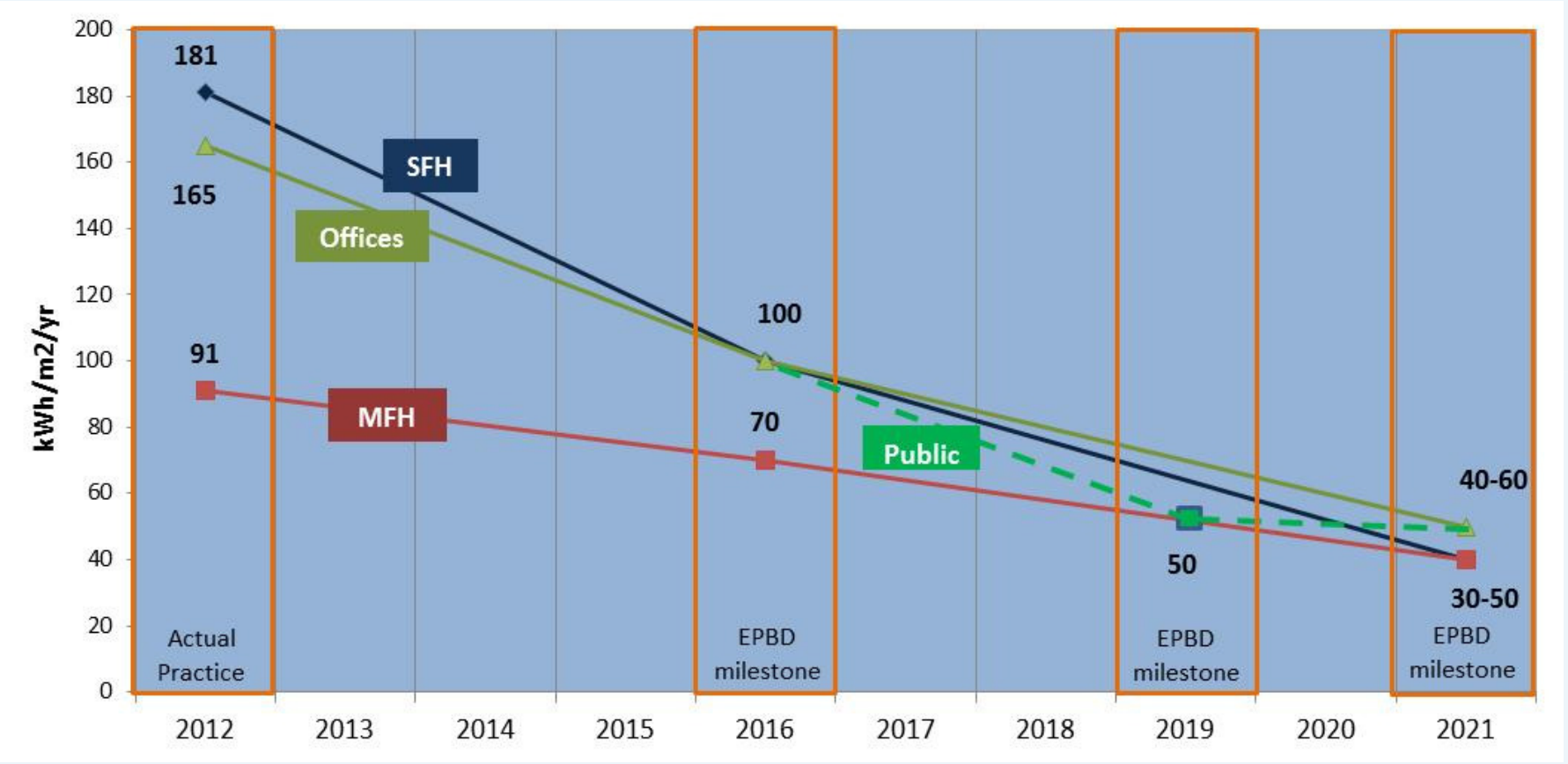
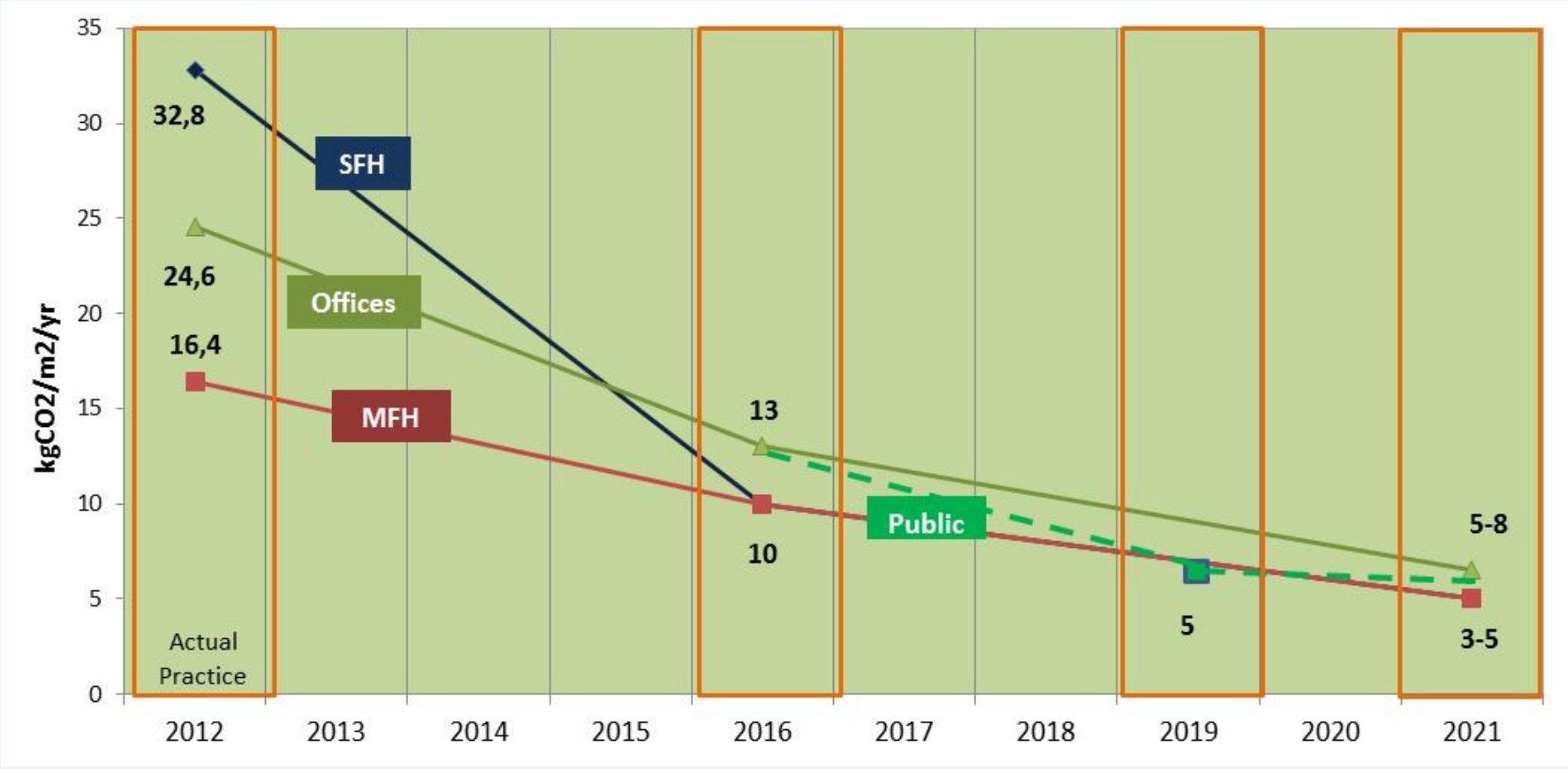
Proposed Romanian nZEB definition by 2020 (1)

Minimum requirement - primary energy consumption (EPBD scope)



Proposed Romanian nZEB definition by 2020 (2)

Additional requirement – CO2 emissions in primary energy (EPBD scope)



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Modeling results for multi-family buildings in Romania

Variants	final specific demand [kWh/m²/yr]	Without CO_2 compensation: primary energy demand [kWh/m²/yr]	Without CO_2 compensation: CO_2 emissions [kgCO_2/m²/yr]	Without CO_2 compensation: Renewable share [%]	Without CO_2 compensation: total additional annualized costs [Euro/m²/yr]	With CO_2 compensation (by additional PV): primary energy demand* [kWh/m²/yr]	With CO_2 compensation (by additional PV): CO_2 emissions [kgCO_2/m²/yr]	With CO_2 compensation (by additional PV): Renewable share [%]	With CO_2 compensation (by additional PV): total additional annualized costs [Euro/m²/yr]
V0 - Reference	80.7	91	16.4	0	0	n.a.	n.a.	n.a.	0
V1 - Air heatpump	20.4	40.8	5.1	40%	3	5.7	0,7	120%	3.8
V1 - Brine heatpump	17.8	35.5	4.5	40%	2.9	0.4	0,1	130%	3.7
V1 - Bio boiler	62.3	18	0.8	100%	1.7	11.9	0	100%	1.8
V1 - Gas boiler	62.3	71.3	12.7	0	-1.2	36.2	8.3	30%	-0.5
V1 - District heating	59.3	55.7	8.7	50%	-4.3	20.5	4.3	80%	-3.5
V2 - Air heatpump	22	43.9	5.5	40%	5.5	8.8	1.1	110%	6.3
V2 - Brine heatpump	19.5	39.1	4.9	40%	5.6	3.9	0.5	120%	6.4
V2 - Bio boiler	62.2	21.9	1.3	90%	3.3	11.4	0	100%	3.5
V2 - Gas boiler	62.2	73.2	12.8	0	1.6	38.1	8.4	30%	2.4
V2 - District heating	59.3	58.1	8.9	50%	-0.3	23	4.5	80%	0.6
V3 - Air heatpump	20.5	41.1	5.2	40%	5.1	6	0.8	120%	5.9
V3 - Brine heatpump	18.5	37.1	4.7	40%	5.1	2	0.2	130%	6
V3 - Bio boiler	55.1	21.2	1.4	90%	3.1	9.9	0	100%	3.4
V3 - Gas boiler	55.1	65.7	11.4	0	1.7	30.6	7	40%	2.5
V3 - District heating	52.5	52.7	8	50%	0.4	17.5	3.6	80%	1.2
V4 - Air heatpump	18.4	36.8	4.6	40%	6.4	5.7	0.7	120%	7.1
V4 - Brine heatpump	15.8	31.6	4	40%	6.3	0.5	0.1	130%	7.1
V4 - Bio boiler	45.4	19.5	1.5	90%	4.2	7.9	0	100%	4.5
V4 - Gas boiler	45.4	55.2	9.5	0	3.1	2.1	5.5	40%	3.8
V4 - District heating	43.3	44.7	6.8	50%	1	13.6	2.8	80%	1.7
	<40	<40	<4	>50	<5	<40	<4	>50	<5
	40<x<60	40<x<70	4<x<7	30<x<50	5<x<10	40<x<70	4<x<7	30<x<50	5<x<10
	>60	>70	>7	<30	>10	>70	>7	<30	>10

Additional costs are below 5 Euro per m2 and year in most cases!

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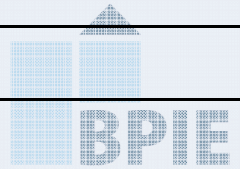
Proposed implementation roadmap by 2020

Policy process	Strategies and planning, preparatory studies, set milestones, monitoring, evaluation and continuous improvement based on public consultation
Building codes	Gradual improvement for meeting proposed targets.
Energy certification	Adjust the existing energy class A for coping with nZEB (the actual A class includes all buildings below 125kWh/m2/yr). Need for better control & national database.
Enforcement and compliance	Introduce stricter enforcement criteria on energy performance of buildings and components, penalties and fines. Increase the compliance check at the design and construction phase of the building.
New Policies	Gradually reduce the actual subsidies; build support schemes; better integrate buildings and DH policies; support development of supply chain industry, stricter public procurement for buildings, remove market barriers
Capacity building	Reinforce responsibilities, more and targeted info and advice points, improve data collection of buildings data, integrate all in one national database
Workforce skills	Elaborate basic and long-life educational and training programs for workforce, with energy efficiency and renewables in mainsteam.
Information and awareness	More info and awareness, more guidance, support market champions promotting low-energy buildings
Demo projects	Implement nZEB demo-projects for all building types
Research	Support research on new technologies and techniques

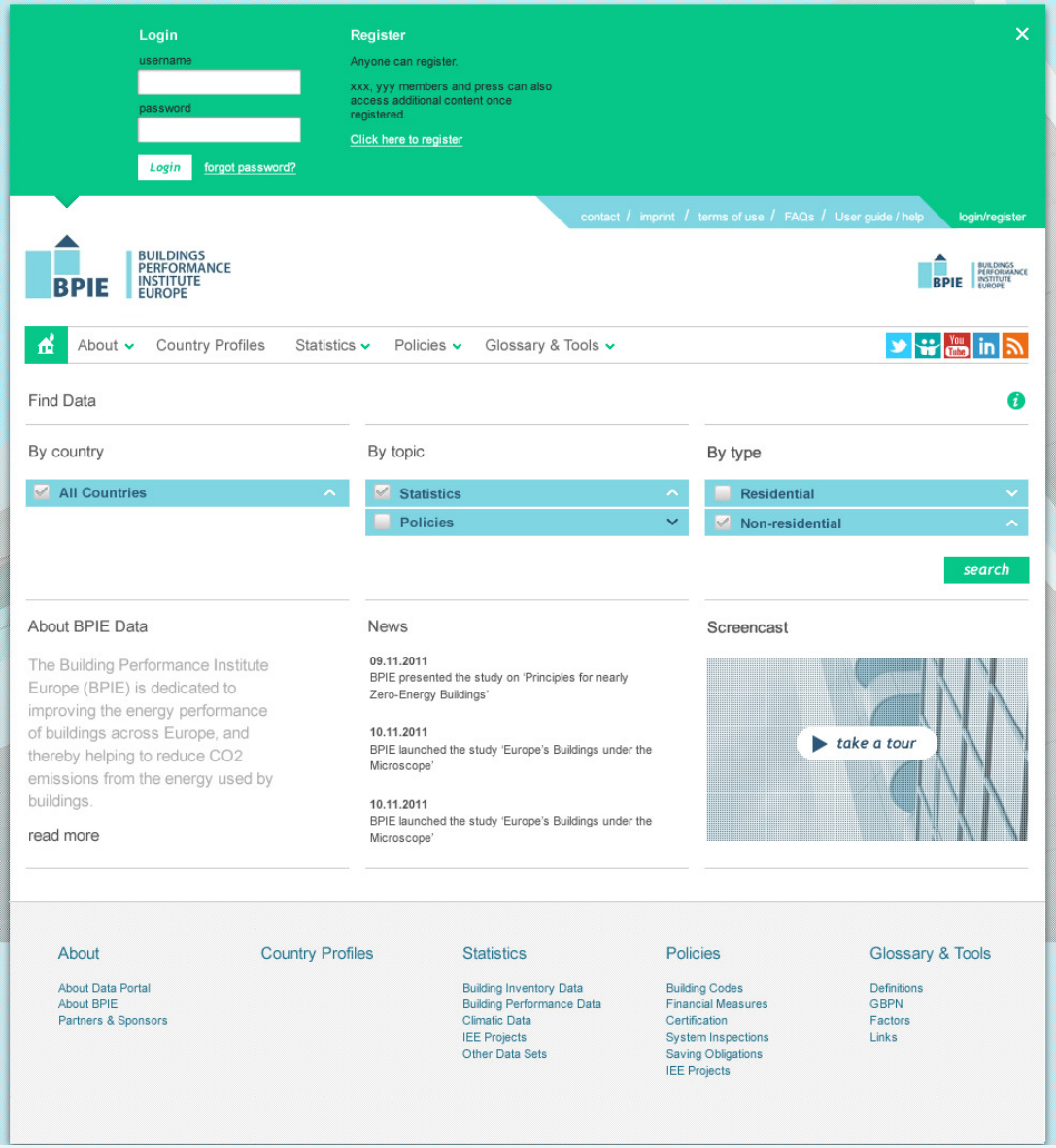


What to expect

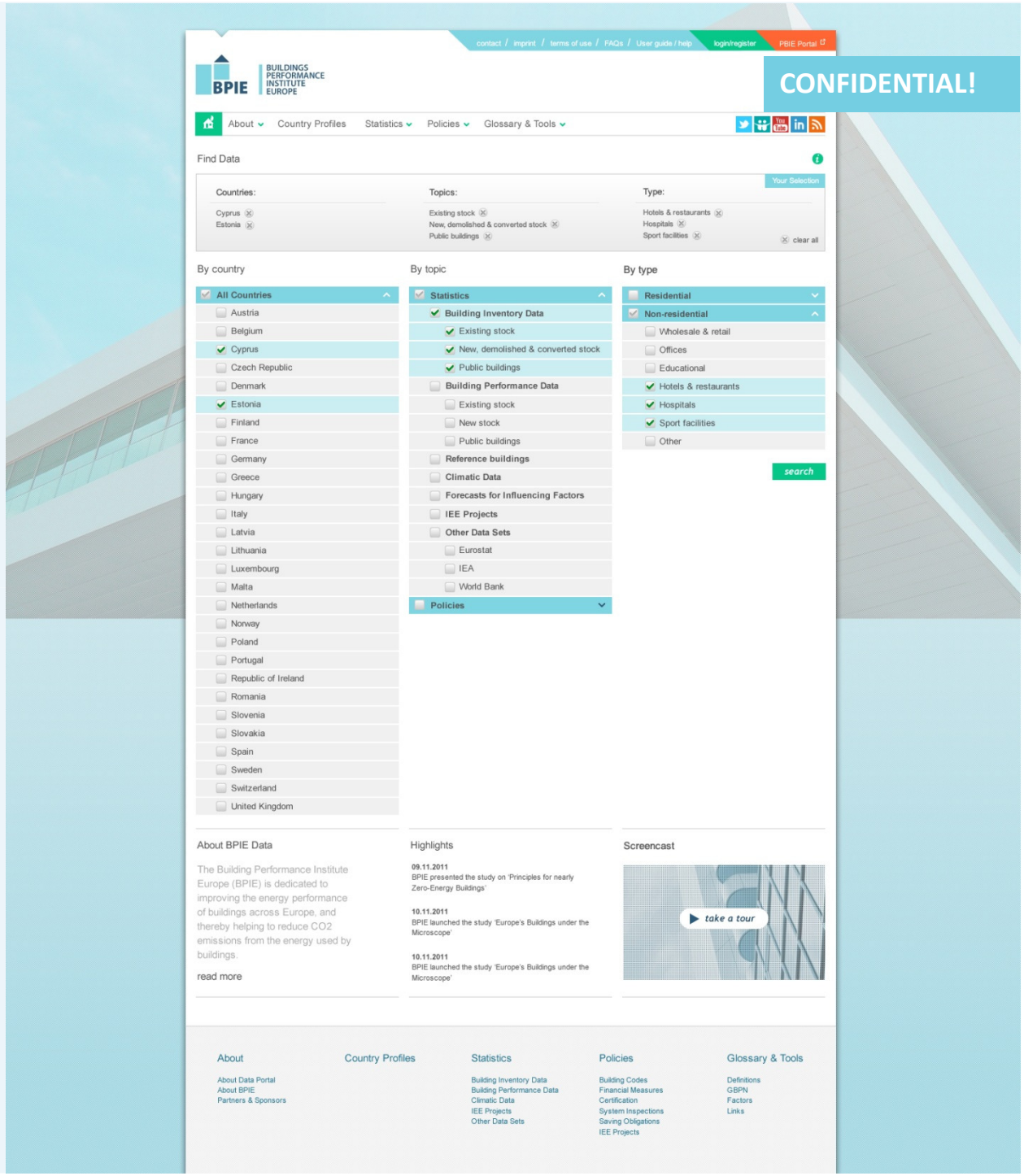
The BPIE interactive online platform will allow for:

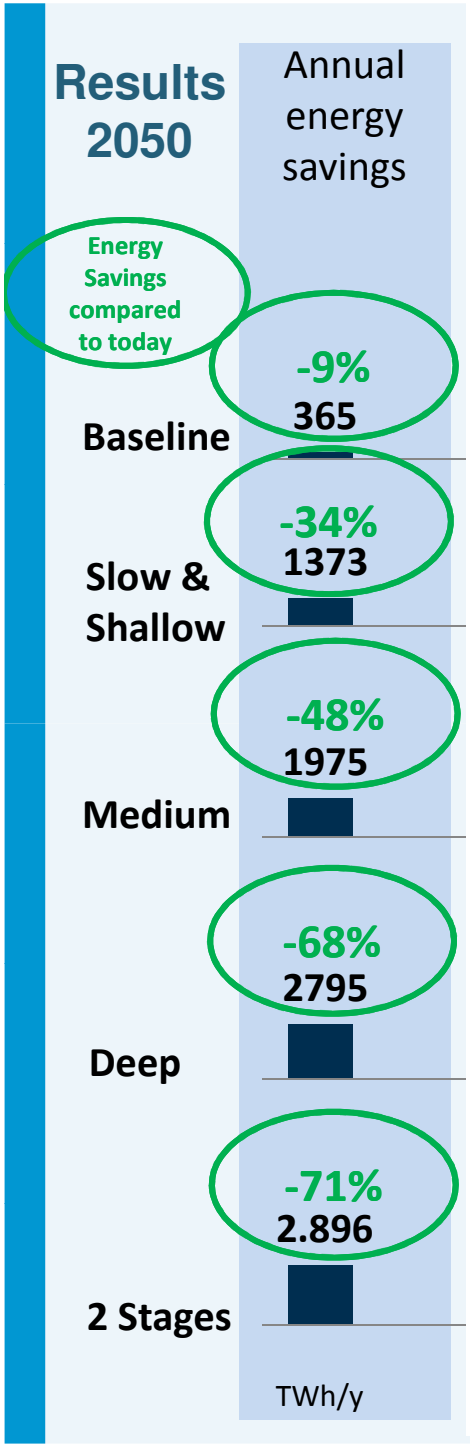
- Database repository and management (quantitative data and textual information)
  - Country Comparison Dashboard
  - Country Profiles/country fact sheets
  - Information on key legislation – Time lines & information
  - Link to other data/information available on the web
- Data presentation and visualisation
- Data collection through online surveys

Screen Design – Start Page

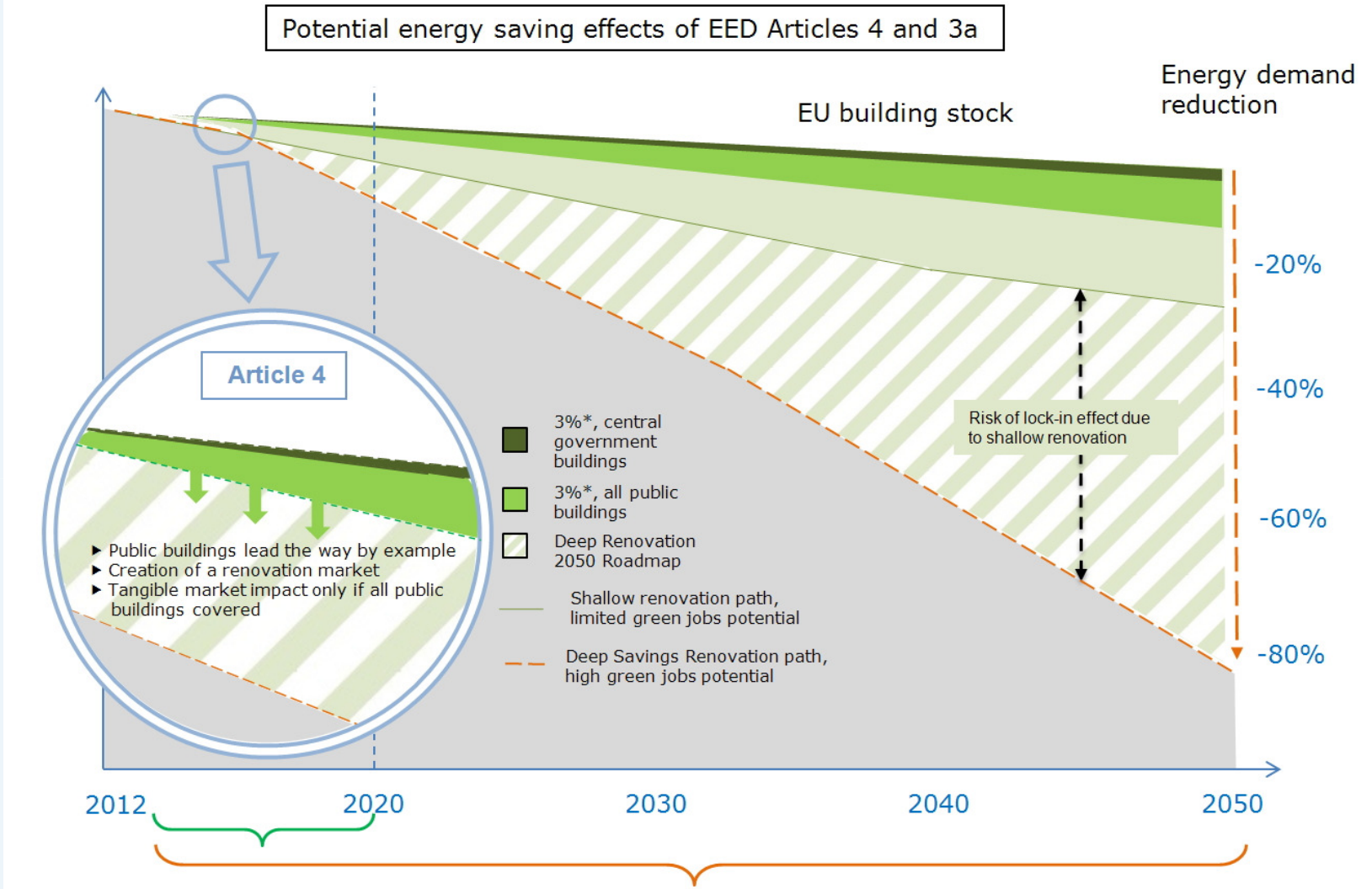


Screen Design
Data selection




Results 2050
Annual energy savings
Energy Savings compared to today
-9%
365
Baseline
-34%
1373
Slow & Shallow
-48%
1975
Medium
-68%
2795
Deep
-71%
2.896
2 Stages
TWh/y

Impacts of the current political debate of the EED



Source: Coalition for Energy Savings

NZEB report DG Energy: 14 received

- Tightening the building codes for new and for the renovation of the existing buildings
  EU methodology presented in 2011, is it ambitious enough?
- MSs to elaborate their own methodologies and to communicate to the EU Commission until end June 2012

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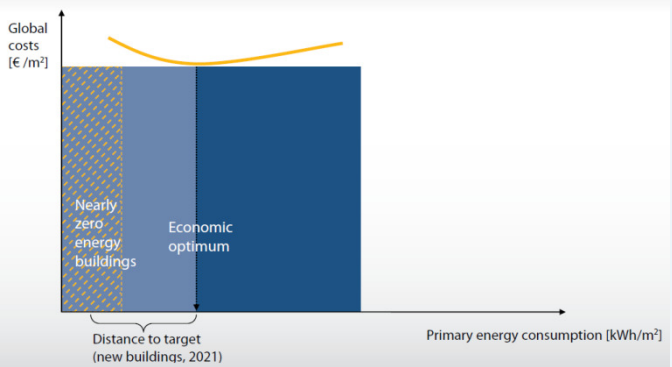
EPBD - Cost-Optimality



- Tightening the building codes for new and for the renovation of the existing buildings
  EU methodology presented in 2011, is it ambitious enough?
- MSs to elaborate their own methodologies and to communicate to the EU Commission until end June 2012

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EPBD - Existing buildings

- For reaching the 2050 EU targets:
  - Need to renovate the entire building stock at high standards
  - Need to decarbonise the power sector
- Improve data collection on buildings energy consumption and characteristics for all MS.
- Need for developing more ambitious programmes and requirements
- Significant macro-economic benefits in terms of job creation, reduction of energy import dependency, social welfare

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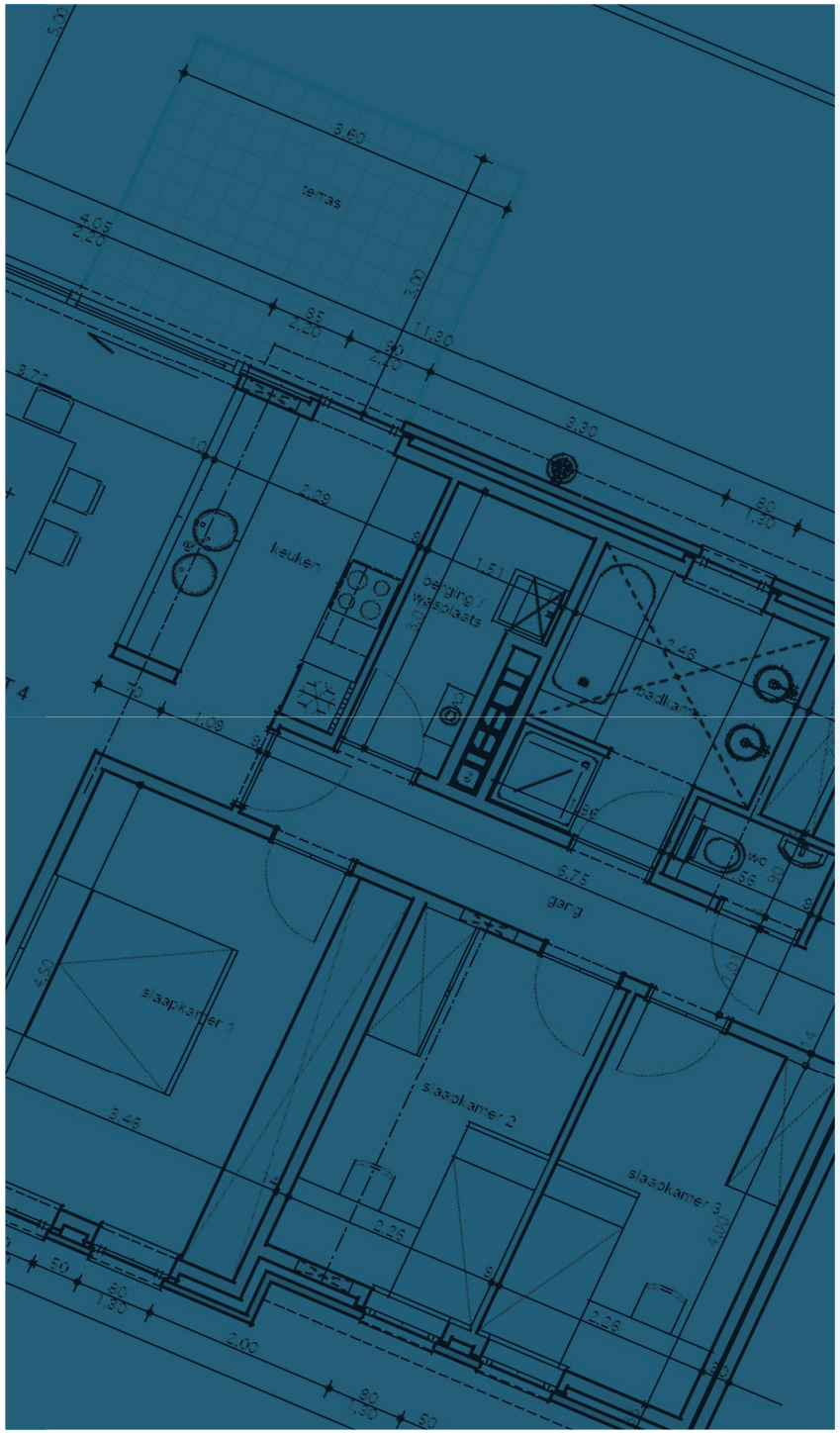

PART 2

Policies and programmes for improving energy efficiency in buildings

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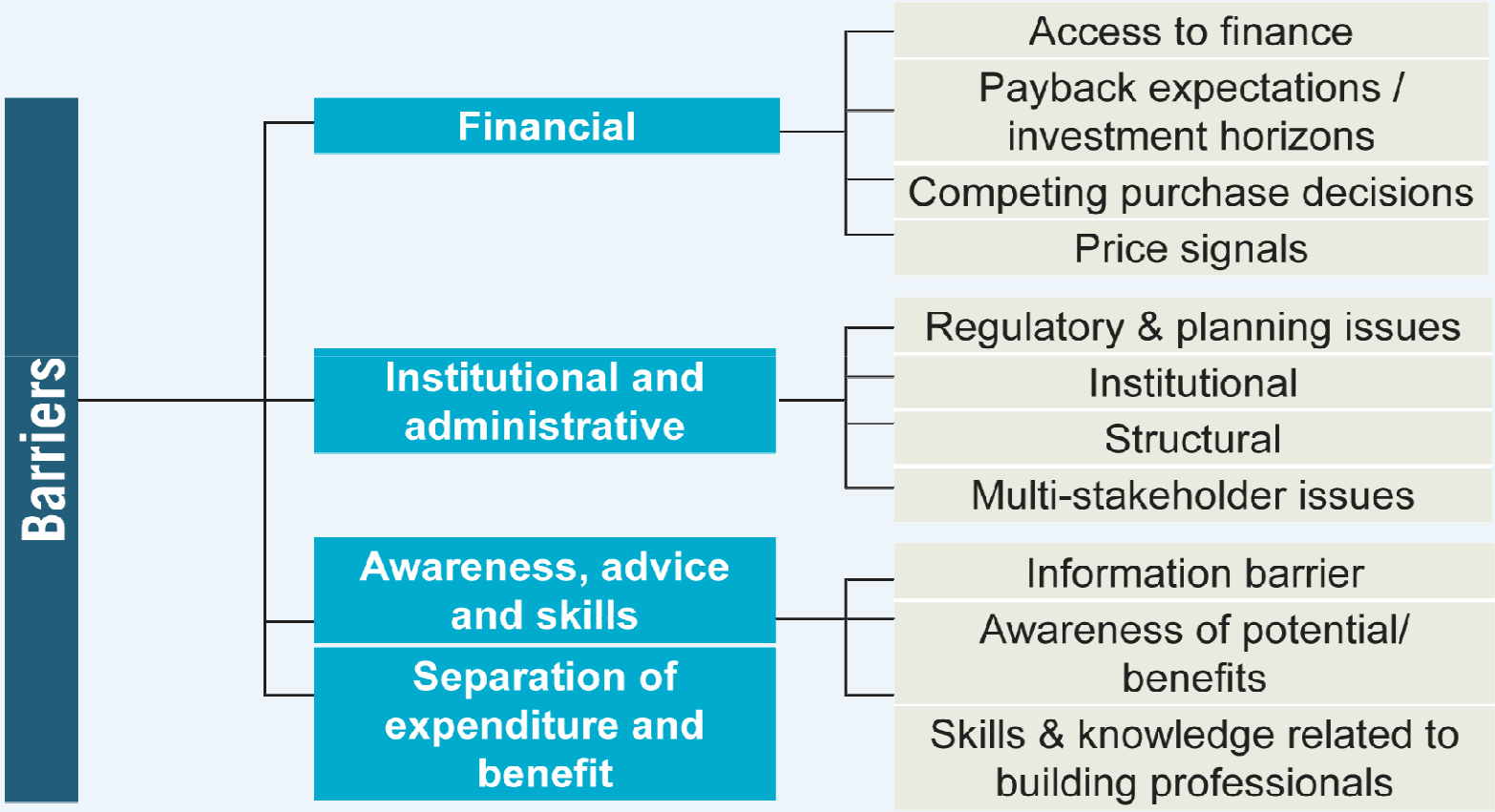
Identified barriers



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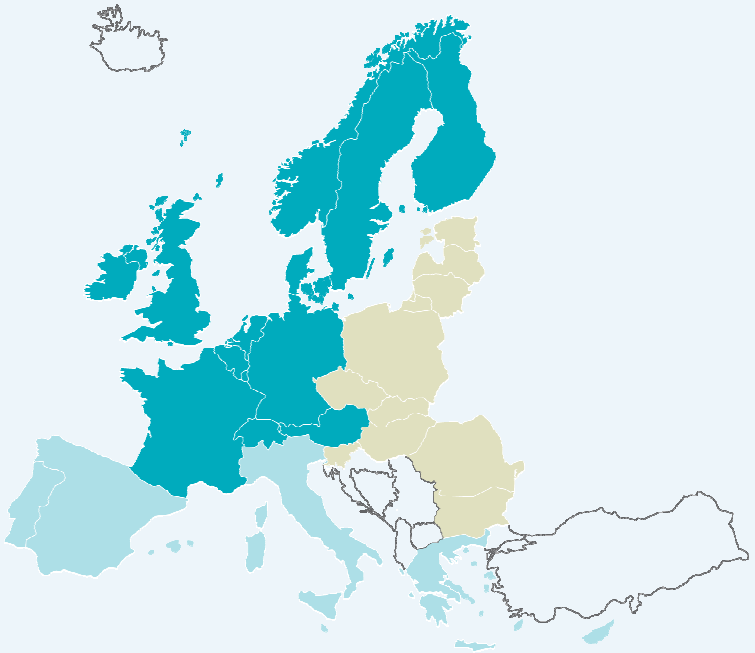
The microscope study?

- Survey template covering legal, financial and technical information on the energy performance of buildings sent out to countries
- Countries covered: EU27, Norway and Switzerland
- Buildings covered: single and multi-family houses, offices, educational buildings, hospitals, hotels and restaurants, sports facilites and wholesale and retail trade buildings
- Picture of European building stock, Policies and Financial programmes, Renovation Scenarios
- 3 regions considered for data analysis and scenario modelling



North & West	AT, BE, CH, DE, DK, FI, FR, IE, LU, NL, NO, SE, UK	Population: 281 mil
Central & East	BG, CZ, EE, HU, LT, LV, PL, RO, SI, SK	Population: 102 mil
South	CY, EL, ES, IT, MT, PT	Population: 129 mil

Countries and regions considered and equivalent population

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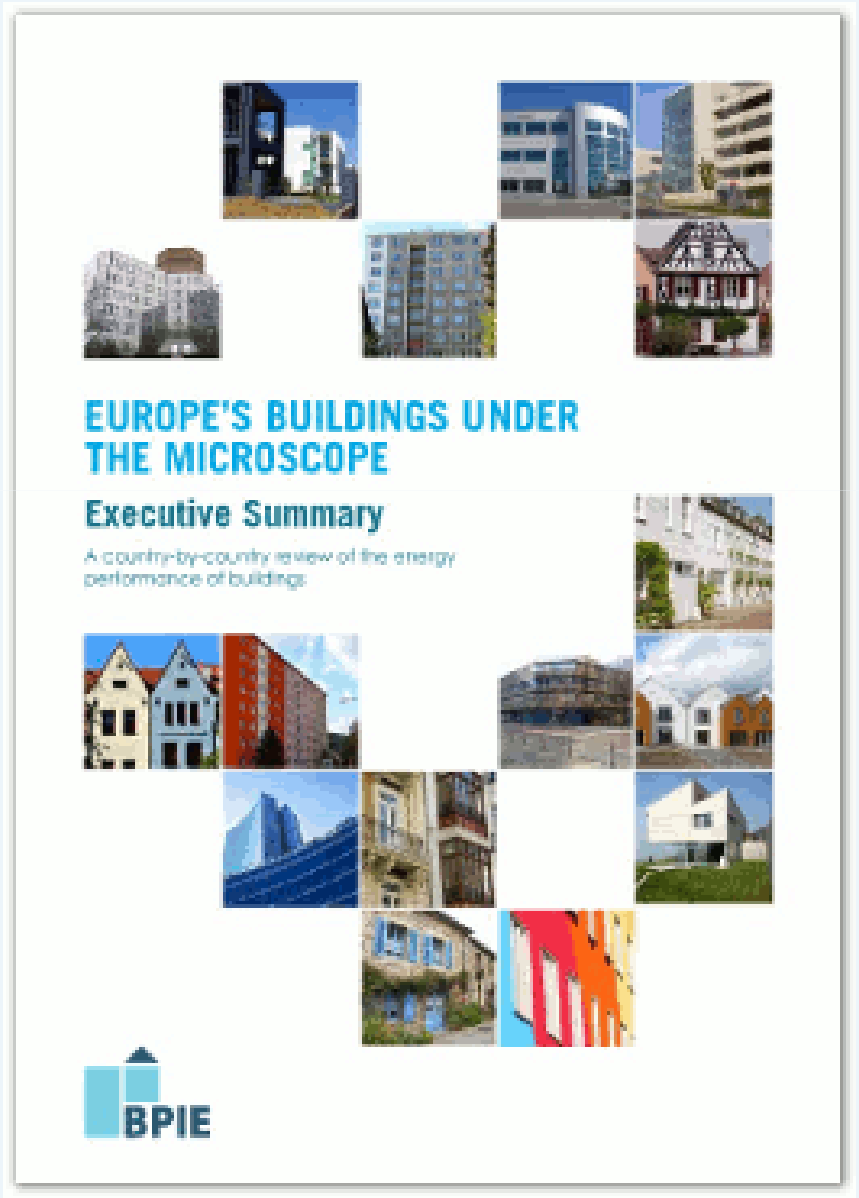
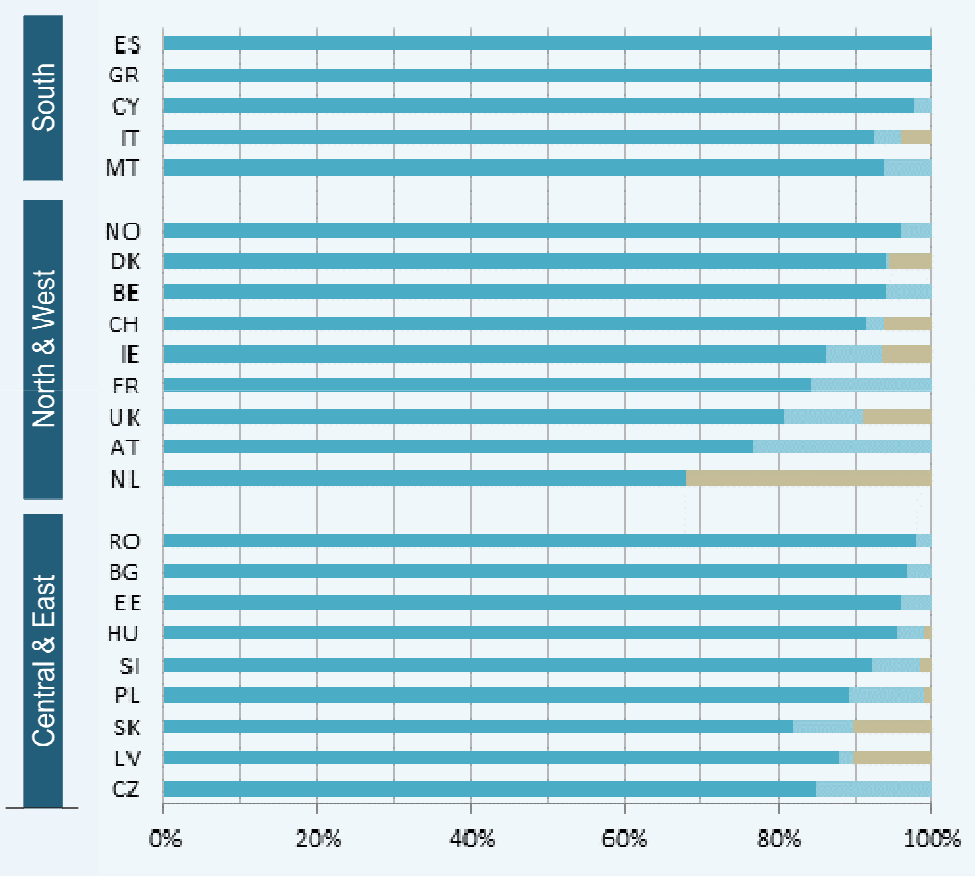

EUROPE'S BUILDINGS UNDER
THE MICROSCOPE
Executive Summary
A country-by-country review of the energy performance of buildings
BPIE

BPIE

Residential ownership



Ownership of residential buildings in Europe by number of dwellings (except for FR which is in floor area)

- The largest share of dwellings is held in private ownership, while about 20% is allocated to 'pure' public ownership.
- Only Austria reports more than 20% of residential dwellings held in public ownership

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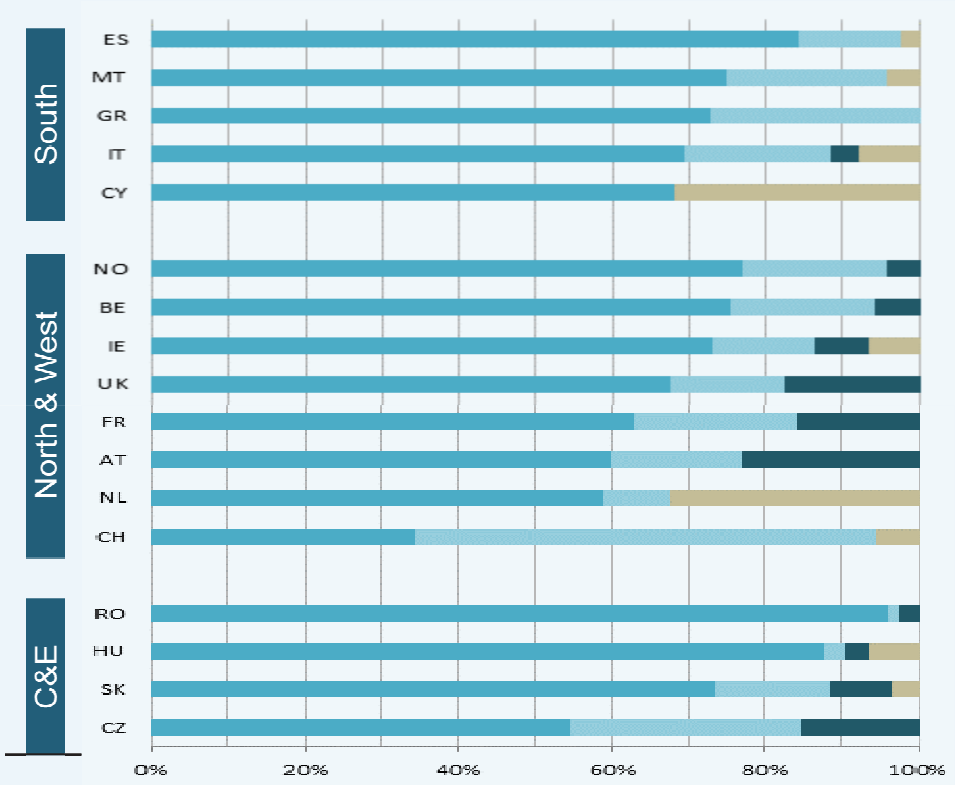
Residential tenure



Tenure of residential buildings by number of dwellings (except for FR which is in floor area)

- In all EU countries, at least 50% of dwellings are occupied by their owner
- Greece and Czech Republic are among the countries with the biggest share of private tenants
- Austria, UK, Czech Republic, The Netherlands and France have significant portions of public rented dwellings (in most cases these are occupied by social tenants)

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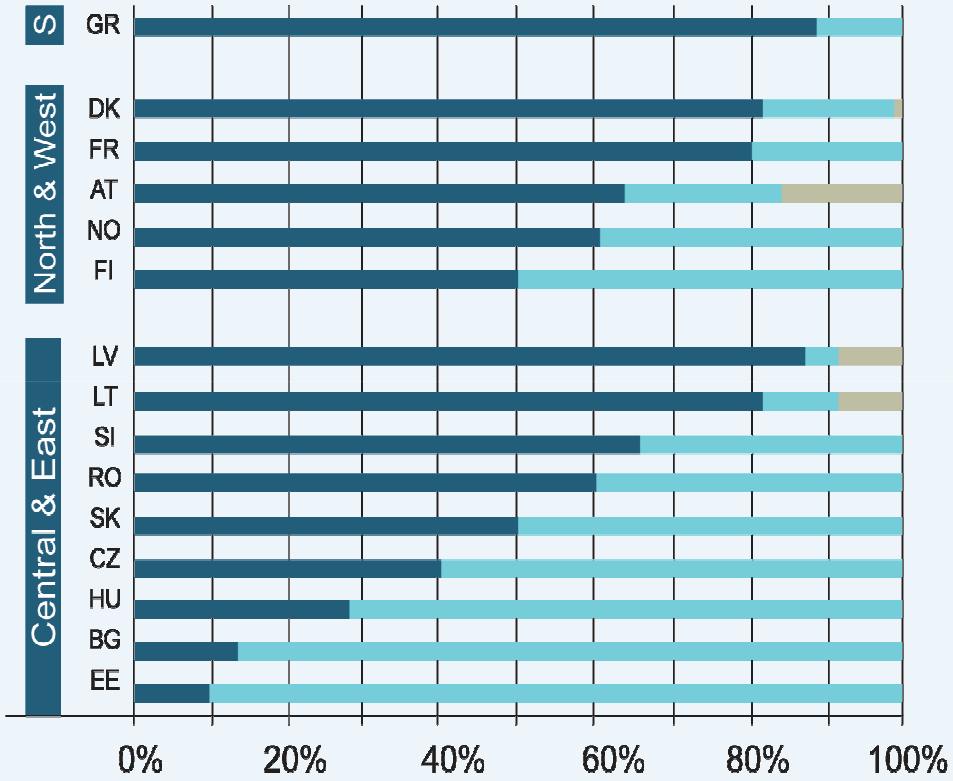
Non-residential ownership



Ownership of non-residential buildings by number of buildings (except for FR, SK,, SI which are in floor area and FI in volume of buildings)

- Data on the ownership of non-residential buildings was only available/reported from 15 countries.
- The ownership profile in the non-residential sector is more heterogeneous than in the residential sector, spanning from as low as 10% to 90% from country to country.
- Non-residential public owned buildings would be a good target for public policy to begin large-scale renovation to deliver significant reductions in energy use (the impact would be higher in some countries).

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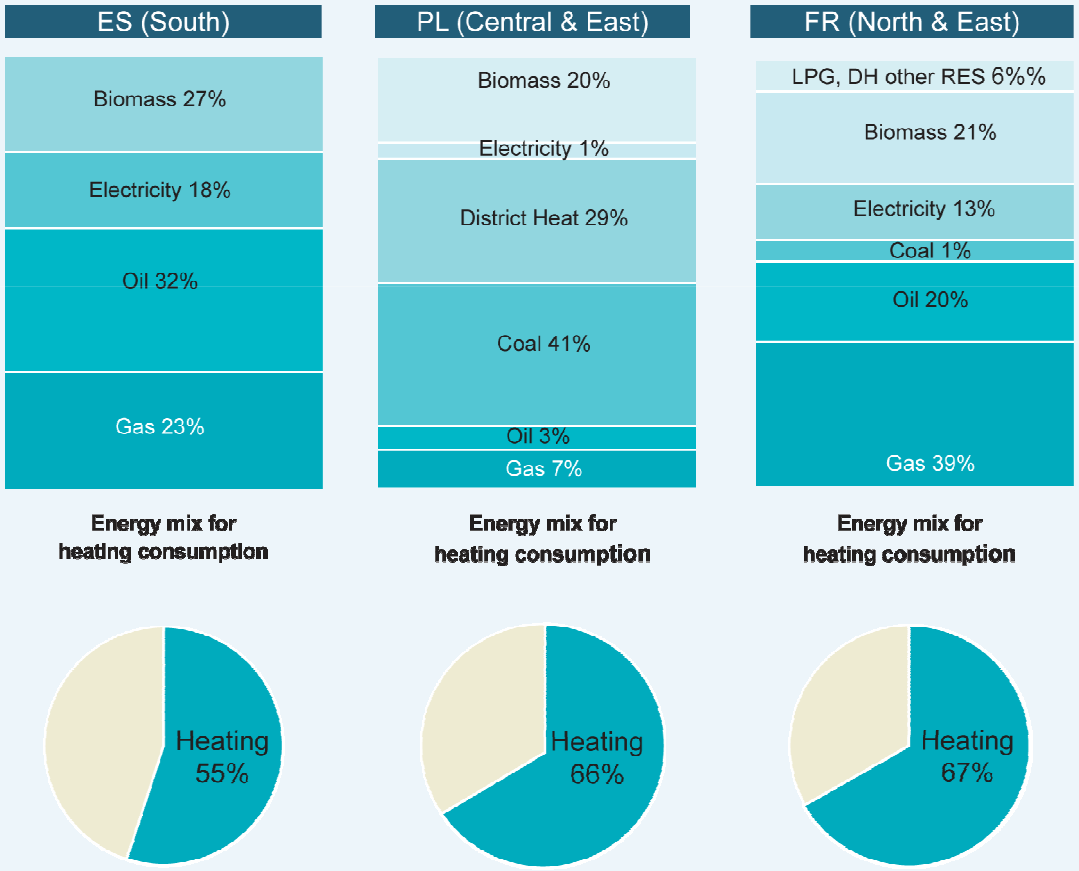
Residential energy mix

Share of heating consumption in terms of final energy use in residential buildings with corresponding energy mix



- Space heating is the most energy intense end-use in EU homes accounting for around 70% of total final energy use.
- Heating share is typically lower in warmer climates.
- The energy mix for heating varies significantly from country to country
- While Spain relies mostly on oil to fulfill its heating needs, Poland relies mainly on coal and France on gas.

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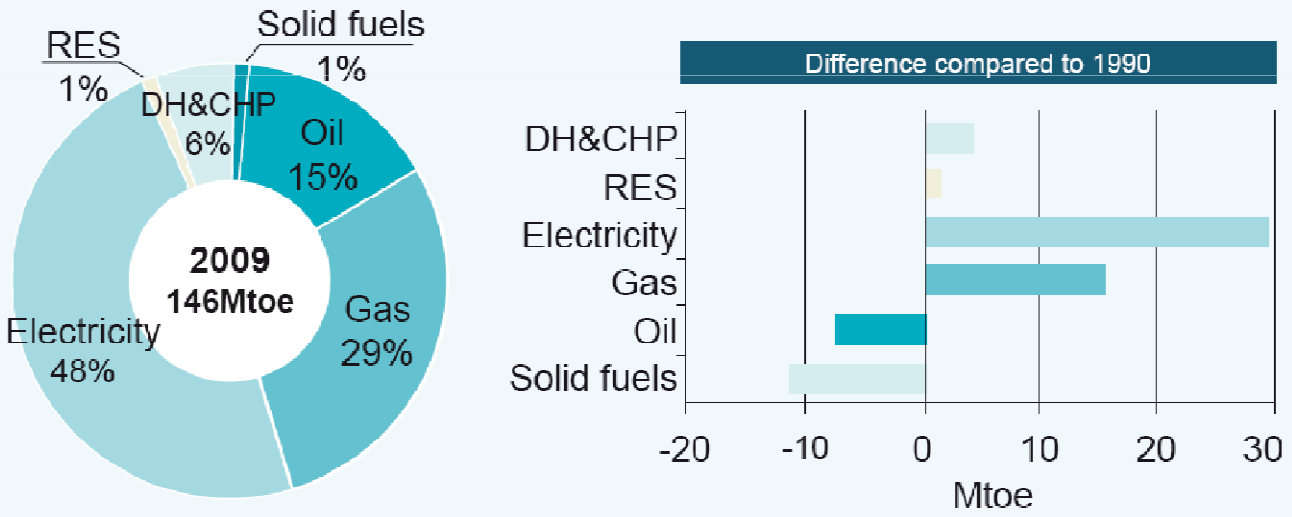
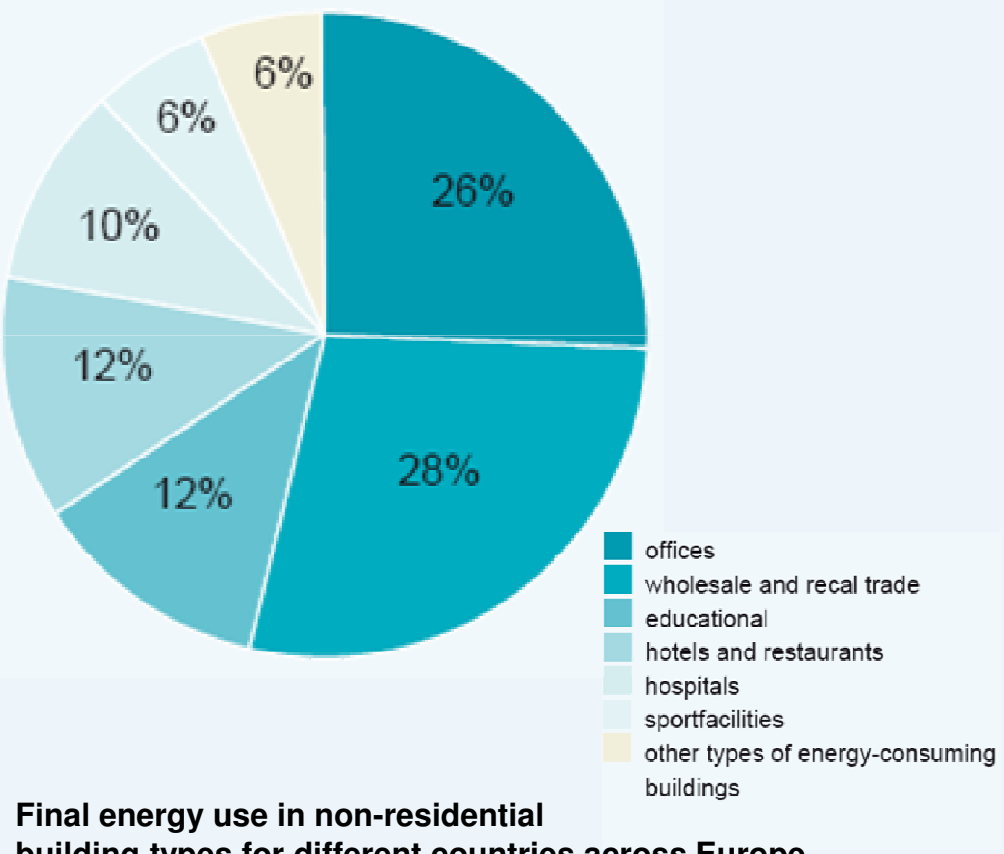
Non-residential energy mix

Since 1990, electricity consumption has increased by a remarkable 74%. Gas consumption has also had a considerable increase while oil and solid fuels decreased, mainly due to the shift ocurred a little bit throughout all Europe, from these last fuels towards gas.



Energy mix in the non-residential sector and corresponding difference compared to 1990 profile

Non-residential energy consumption shares



Final energy use in non-residential building types for different countries across Europe

- Non-residential average specific energy consumption was estimated at 280kWh/m2 (covering all end-uses), being at least 40% larger than the equivalent value for the residential sector.
- Variations are expected from country to country and also from one building type to another.
- Hospitals, hotels and restaurants represent a rather/relatively small share of the overall non-residential consumption
- Offices and wholesale and retail buildings account for over 50% of energy use
- Education and sports facilities account for a further 18% of the energy use while other buildings account for some 6%.

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Energy performance requirements

	Performance based requirements[1]				
	New build	Renov.		New build	Renov.
AT	✓	✓	HU	✓	✓
BE-Wl	✓	X	IE	✓	X
BE-Br	✓	X	IT	✓	✓
BE-Fl	✓	X	LT	✓	✓
BG	✓	✓	LV	X	X
CH	✓	✓	MT	X	X
CY	✓	✓	NL	✓	X
CZ	✓	✓	NO	✓	✓
DE	✓	X	PL	✓	✓
DK	✓	X	PT	✓	✓
EE	✓	✓	RO	X	X
EL	✓	✓	SE	✓	✓
ES	✓	✓	SI	✓	✓[3]
FI	✓	P[2]	SK	✓	✓
FR	✓	✓	UK	✓	✓

- The approach shifted from one typically expressed as a maximum permitted U-value to one based on overall building performance, including requirements for technical systems such as HVAC plant and lighting;
- Nearly all countries have adopted a national methodology setting performance/based requirements for new buildings
- In some cases, two approaches exist in parallel (e.g. NO, ES, PL, CH): 1st on holistic approach and 2nd on performance of single elements
- Many different approaches have been applied and no direct comparison can be made (see next slide)

All footnotes are listed under the table 2B6 in BPIE study Europe's buildings Under the Microscope