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ASSESSMENT OF THE PROGRESS TOWARDS THE ESTABLISHMENT OF DEFINITIONS OF EFFICIENT BUILDINGS IN EUROPEAN

MEMBER STATES

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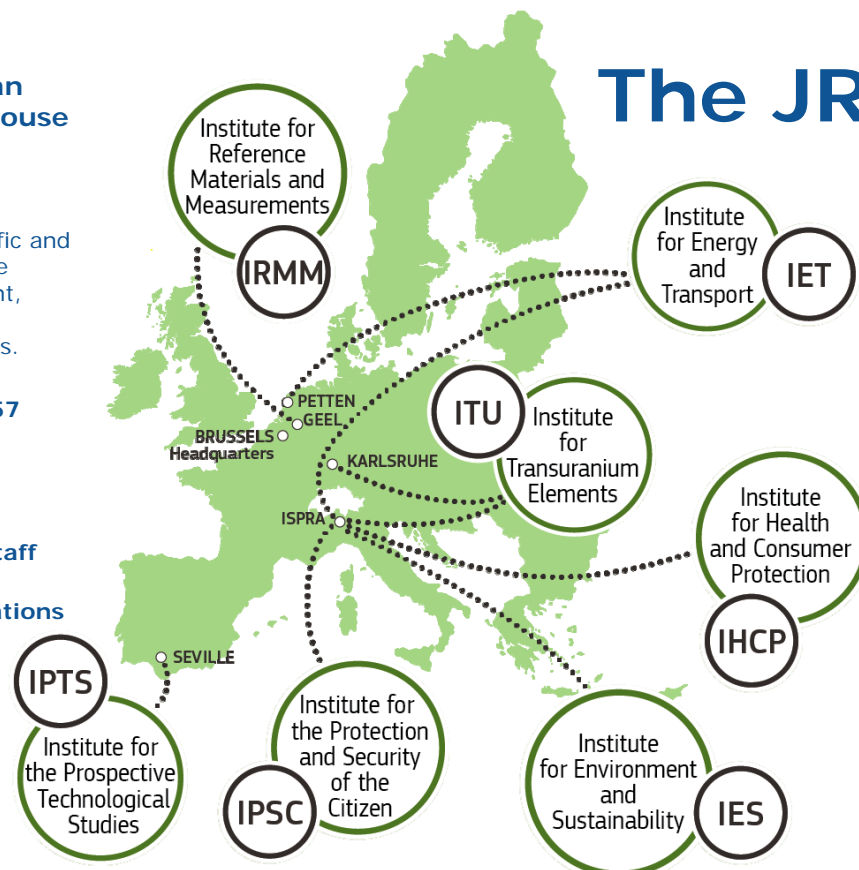


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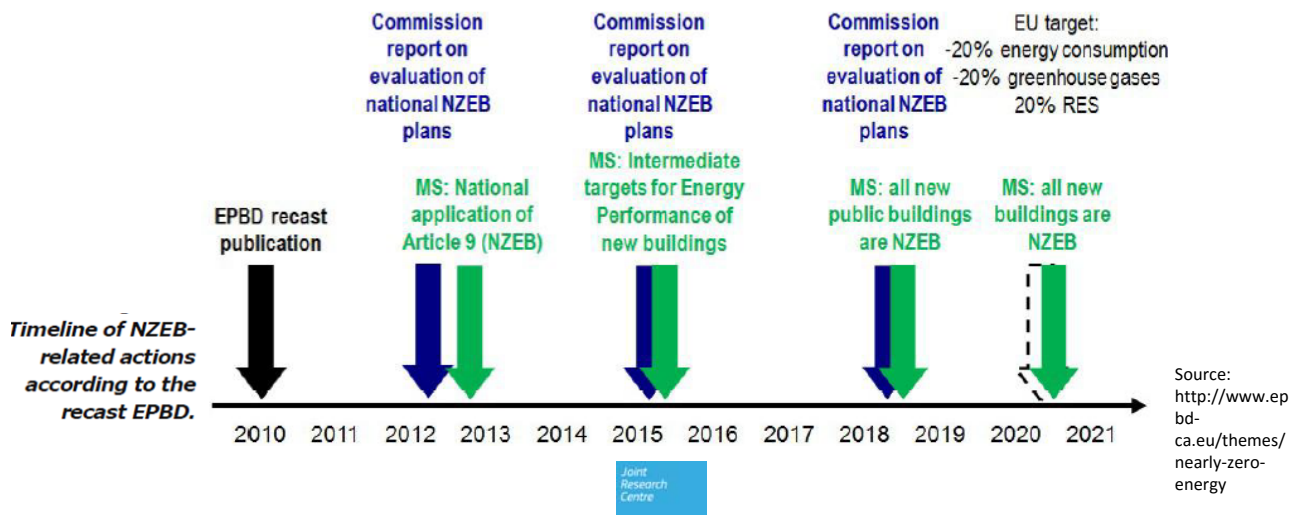
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Policy context

- Buildings: 40% primary energy / 24% greenhouse emissions.
Energy demand reduction: - 20% impact on the environment.
- EPBD 2002/91/EC, EPBD Recast 2010/31/EU, EED 2012/27/EU, RED 2009/28/EC



ZEBs categories

- Nearly ZEB** : ... « has a **very high energy performance** with a low amount of energy required covered to a **very significant extent** by energy from RES, including energy from RES produced **on-site or nearby**».
- Net ZEB**: ... «energy **neutral over a year**, it delivers as much energy to the supply grids as it draws back.».
- ZEB** (Zero Energy building) : ... « a residential or commercial energy efficient building with **greatly reduced energy needs and/or carbon emissions**, achieved through efficiency gains ».
- Autonomous ZEB**: ... « does **not require connection to the grid**. Stand-alone buildings can supply the own energy needs, as they may store energy for night-time or winter-time use».
- + Building**: produce more energy from RES than it imports from the supply grid over a year.





Progress of Member States towards NZEBs

- Administrative Agreement DG ENER "Technical and scientific support on the implementation of the related EPBD provisions"

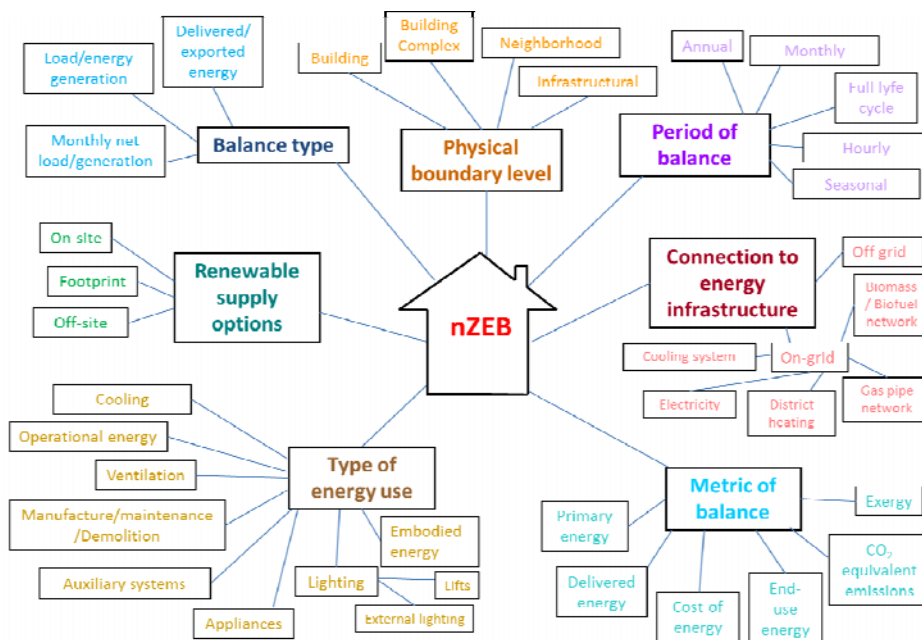
- NZEBs
 - Review of definitions
 - Analysis of National Plans
 - Comparison among Member States
 - Focus on interim targets, policies and supporting measures for refurbishing the existing stock to nZEBs.
 - Evaluation of MS progress and policy implications.
 - EU 2050 decarbonisation target

- A formal, comprehensive and consistent framework that considers the relevant aspects of nZEBs is missing



Main arguments around NZEBs to be established

- An approved definition is a first step towards nZEB requirements in EPBD recast.



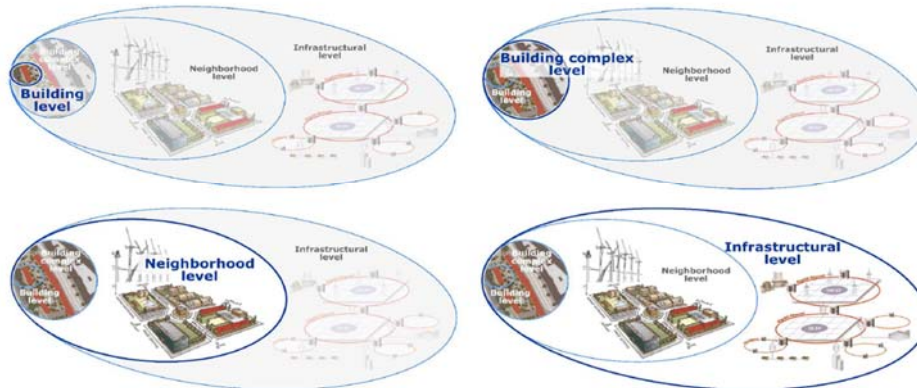
nZEBs definition aspects

Metric

definition and calculation methodology: **primary energy, final or delivered energy, end use or un-weighted energy, CO₂ equivalent emissions, cost of energy.**

Boundary

Possible boundaries for integrating renewable energy into NZEB calculations.



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Source:
<http://www.epbd-ca.eu/themes/nearly-zero-energy>

Period of balance

Monthly, Seasonal, Annual, Full life cycle of a building or its operating time

Type of balance

Off Grid/ Grid-connected ZEBs

Energy use - renewable energy generation (design phase)

Energy delivered to the building - energy feed into the grid (monitoring phase)

Type of energy use

Energy uses are considered in the balance: heating, cooling, ventilation, DHW, lighting, plug-loads, embodied energy (materials, technology constructions, maintenance, demolition), charging of electrical vehicles...

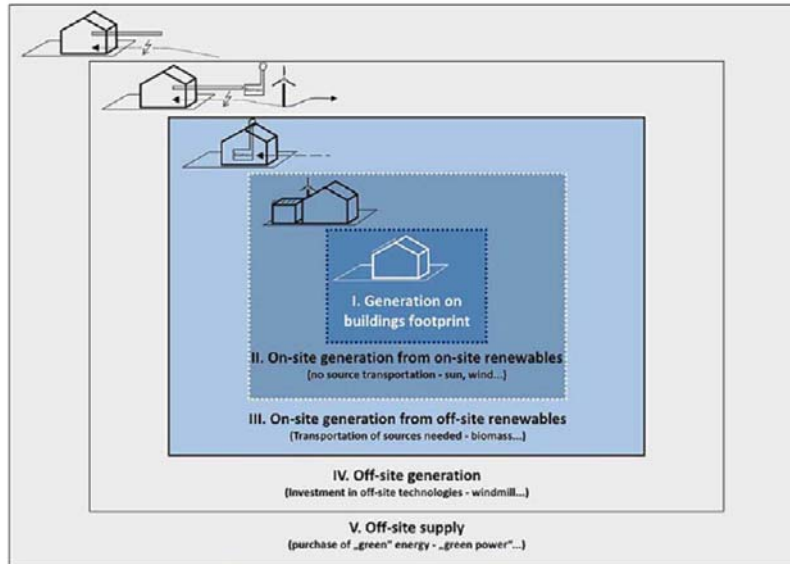
EN 15603: 2008 "Energy performance of buildings – overall energy use and definition of energy rating": the calculation **should include only the energy use that does not "depend on the occupant behaviour, weather conditions and other (indoor and environment) conditions"** (heating, cooling, dehumidification, ventilation, hot water - lighting for non-residential buildings).



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Renewable supply options

On-site/off-site depending on the availability on site (sun, wind) or to be transported to the site (biomass). Five options can be distinguished following the location of energy supply option with respect to the building.



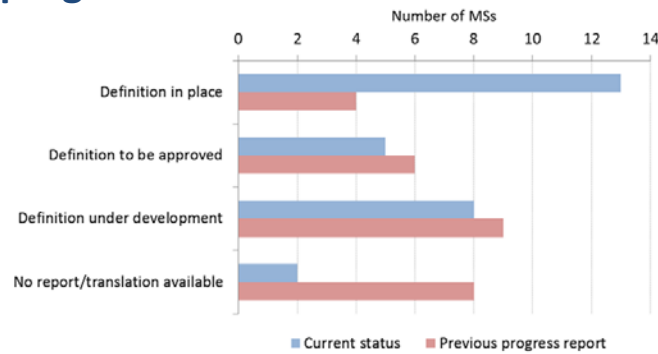
A.J. Marszal, P. Helsenberg, J.S. Bourrelle, E. Musall, K. Voss, I. Sartori, A. Napolitano, Zero energy building – a review of definitions and calculation methodologies, *Energy and Buildings* 43, April 4, (2011) 971–979.

Summary of the EPBD requirements related to different NZEBs aspects

EPBD reference	NZEBs aspects
Article 9.1a/b	Private/Public
Preamble recital 15 Article 9.2	New/Retrofit
Annex I	Building category
Article 2.4	Balance type
Article 1.2a Article 2.1	Physical boundary
Article 2.4	System boundary demand
Article 2.6 (RED - Article 13.4)	System boundary generation
Preamble recital 9	Balance period
Article 9.3a	Normalization
Annex 1 9.3a	Metrics
Article 2.5	
Article 9.3a	Time weighting
Article 2.2 (RED Article 13.4)	Fraction of renewables
Annex 1	Energy performance
Article 1.1 Annex 1 Preamble recital 9	Comfort & IAQ
Article 2.4 Article 8.2	Monitoring



Member States progress towards NZEBs definitions



- MS definition with a numerical target of primary energy use: AT, BE (Brussels, Flanders), CY, CZ, HR, DK, EE, FR, IE, LU, LV, LT, NL and SK. MS having both a numerical target of primary energy use and the share of RES: (BE (Brussels, Flanders), DK, FR, IE, LV, LT, NL and SK).

- Source of information:
 - National Plans
 - Templates
 - 2013 and 2014 Commission progress report
 - EPBD Concerted Action
 - Energy Efficiency Action Plans
 - National Codes



Status of NZEB definition development in EU Member States

MS	Included in an official document	Under development	To be approved
AT	✓		
BE - Brussels	✓		
BE - Flanders	✓		
BE - Wallonia	✓		
BG			✓
CY	✓		
CZ	✓		
DE		✓	
DK	✓		
EE	✓		
EL		✓	
ES		✓	
FI		✓	
FR	✓		
HR	✓		
HU		✓	
IE	✓		
IT	✓		
LV	✓		
LT	✓		
LU	✓		
MT		✓	
NL	✓		
PL	✓		
PT		✓	
RO	✓		
SI	✓		
SK	✓		
SE		✓	
UK		✓	



Building subcategory accounted in Member States definitions

(✓ = Included in national definition, - = not defined, X = not considered)

MS	Single family houses	Apartment blocks	Offices	Educational buildings	Hospitals	Hotels/ restaurants	Sport facilities	Wholesale and retail
AT	✓	✓	✓	-	-	-	-	-
BE	✓	✓	✓	-*	-*	-*	-*	-*
BG	✓	✓	✓	✓	✓	✓	✓	✓
CY	✓	✓	✓	✓	✓	✓	✓	✓
CZ	-	-	-	-	-	-	-	-
DK	✓	✓	✓	✓	✓	✓	✓	✓
EE	✓	✓	✓	✓	✓	✓	✓	✓
FI	✓	✓	✓	✓	✓	✓	✓	✓
FR	✓	✓	✓	✓	✓	✓	✓	✓
HR	-	-	-	-	-	-	-	-
HU	✓	✓	✓	✓	✓	✓	✓	✓
IT	✓	✓	✓	✓	✓	✓	✓	✓
LV	-	-	-	-	-	-	-	-
LT	✓	✓	✓	✓	✓	✓	✓	✓
LU	✓	✓	✓	✓	✓	✓	✓	✓
MT	✓	✓	✓	✓	✓	✓	✓	✓
NL	✓	✓	✓	✓	✓	✓	✓	✓
PL	✓	✓	✓	✓	✓	✓	✓	✓
PT	-	-	-	-	-	-	-	-
RO	✓	✓	✓	✓	✓	-	-	-
SK	-	-	-	-	-	-	-	-
SE	✓	✓	✓	✓	✓	✓	✓	✓
UK	✓	✓	✓	✓	✓	✓	✓	✓

*not def. in Brussels Capital region, Walloon Region, Flemish region.



Building Typology and Building classification



- New buildings
- New buildings and renovations
- Not available



- Private buildings
- Private and public buildings
- Not available



- Energy demand vs energy generation
- Virtual balance between demand and generation
- Energy import vs energy export
- Not specified
- Not available



- Building unit
- Building site
- Single building
- Building / building unit / part of building / zone
- Other
- Not available

Balance and Physical boundary



Energy uses included in NZEBs EU Member States definitions

(✓ = Included in national definition, - = not defined, X = not considered)

MS	Heating DHW	Ventilation, Cooling, Air conditioning	Auxiliary energy	Lighting	Plug loads, Appliances, IT	Central services	Electric vehicles	Embodied energy
AT	✓	✓	✓	✓	✓	X	X	X
BE*	✓	✓	✓	✓	X	-	X	X
BG	✓	✓	✓	✓	✓	✓	X	X
CY	✓	✓	✓	✓	X	X	X	X
CZ	✓	✓	✓	✓	X	X	X	X
DE	✓	✓	✓	✓	X	X	X	X
DK	✓	✓	✓	✓	-	-	-	-
EE	✓	✓	✓	✓	✓	✓	-	-
FI	✓	✓	✓	✓	✓	/	-	-
FR	✓	✓	✓	✓	X	X	X	X
HR	✓	✓	✓	✓	X	✓	X	X
HU	✓	✓	✓	✓	/	X	X	X
IE	✓	✓	✓	✓	X	X	X	X
IT	✓	✓	✓	✓	X	✓	X	X
LT	✓	✓	✓	✓	✓	✓	✓	✓
LU	✓	✓	✓	✓	X	✓	X	X
LV	✓	✓	✓	✓	✓	X	X	X
MT	✓	✓	-	✓	X	X	X	-
NL	✓	✓	✓	✓	✓	✓	✓	-
PL	✓	✓	✓	✓	-	-	-	-
PT	✓	✓	-	✓	-	-	-	-
RO	✓	✓	✓	✓	X	X	X	X
SE	✓	✓	✓	✓	-	-	-	X
SK	✓	✓	✓	✓	X	✓	X	X
UK	✓	✓	✓	✓	X	X	✓	X

* Plug loads, Appliances, IT, Central services possible to add in Belgium Flemish region, Central services not considered in Belgium Walloon region at the moment.



System boundary generation in Member States definitions

(✓ = Included in national definition, - = not defined, X = not considered)

MS	Generation on site	Generation off site (e.g.	External generation	Crediting ⁵
AT	✓	✓	X	X
BE*	✓	✓	✓	-*
BG	✓	✓	✓	X
HR	✓	X	X	X
CY	✓	✓	-	-
CZ	✓	✓	✓	X
DK	✓	✓	✓	X
EE	-	-	-	-
FI	✓	✓	-	X
FR	-	-	-	-
DE	✓	✓	✓	X
HU	✓	✓	✓	X
IE	-	X	-	-
IT	✓	✓	✓	X
LV	✓	✓	X	X
LT	✓	X	✓	X
LU	✓	✓	✓	-
MT	✓	✓	✓	-
NL	✓	✓	✓	-
PL	✓	✓	✓	-
PT	-	-	-	-
RO	✓	-	✓	-
SK	✓	✓	X	X
SE	✓	✓	-	-
UK	✓	-	-	-

* In the BE Flemish region, crediting is foreseen in law (investments in nearby renewable energy infrastructure of at least 20 euro/m²).



Balance period and Metric



- Monthly
- Yearly
- Life cycle balance
- Other (i.e. seasonal)
- Not specified
- Not available



- Primary/source energy
- Energy need
- Delivered/site energy
- Energy use
- Equivalent carbon emission
- Other
- Not available



- Gross floor area
- Net floor area
- Treated floor area
- Conditioned area
- Usable floor area
- Other
- Not available



- Static conversion factors
- Quasi-static conversion factors
- Not specified
- Not available

Normalization and Time dependent weighting

Energy performance expressed by EU Member States

MS	Residential buildings (kWh/m ² /y)		Non-Residential buildings (kWh/m ² /y)	
	New	Existing	New	Existing
AT	160	200	170	250
BE	45 + max (0; 30-7.5°C) + 15*max (0; 192/VEPR-1) kWh/m ² y (Brussels region) E 30 (Flemish region) E _{in} 45 and E ₂₀₀₈ 85 (equal to 85 kWh/m ² /y) (Wallon region)	~ 54	95-2.5°C Or (95-2.5°C)+(1.2*(x-15) kWh/m ² y (Brussels region) E 40 (Flemish region) E _{in} 45 (Wallon region)	~ 108
BG	~30-50	~40-60	~30-50	~40-60
CY	100	100	125	125
CZ	75-80% PE	75-80% PE	90% PE	90% PE
DE	40 % PE	55% PE	n/a	n/a
DK	20	20	25	25
EE	50 (detached houses) 100 (apartment buildings)	n/a	100 (office buildings) 130 (hotels, restaurants) 120 (public buildings) 130 (shopping malls) 90 (schools) 100 (day care centres) 270 (hospitals)	n/a
FR	40-65	80 n/a	70 (office buildings without air conditioning) 110 (office buildings with air conditioning)	60% PE n/a
HR	33-41	n/a	n/a	n/a
HU	50-72	n/a	60-115	n/a
IE	45 - defined as Energy load	75-150	~ 60% PE	n/a
IT	Class A1	Class A1	Class A1	Class A1
LV	95	95	95	95
LT	Class A++	Class A++	Class A++	Class A++
LU	Class AAA	n/a	Class AAA	n/a
MT	55 (semi-detached and fully detached houses)-75 (terraced houses) - 115 (flatted dwellings)	< 220	220-255	n/a
PL	60-75	n/a	45-70-190	n/a
RO	93-117	120-230	50-102	120-400
ES	Class A	n/a	Class A	n/a
SE	30-75	n/a	30-105	n/a
SI	75 (single family), 80 (multi-family)	95 (single family), 90 (multi-family)	55	65
SK	32 (apartment buildings)	n/a	60-96 (office buildings)	n/a
UK	54 (family houses) ~ 44	n/a	34 (schools) n/a	n/a



Intermediate targets

- Most Member States presented only qualitative intermediate targets for improving the energy performance of new buildings by 2016 (e.g. strengthening building regulations, obtaining energy performance certificates by a certain year).
- The targets appear variable, the quantitative targets are almost never defined (e.g. number or share of NZEBs, foreseen number of buildings to be NZEBs within the intermediate period of time).

Policies designed to target building renovations

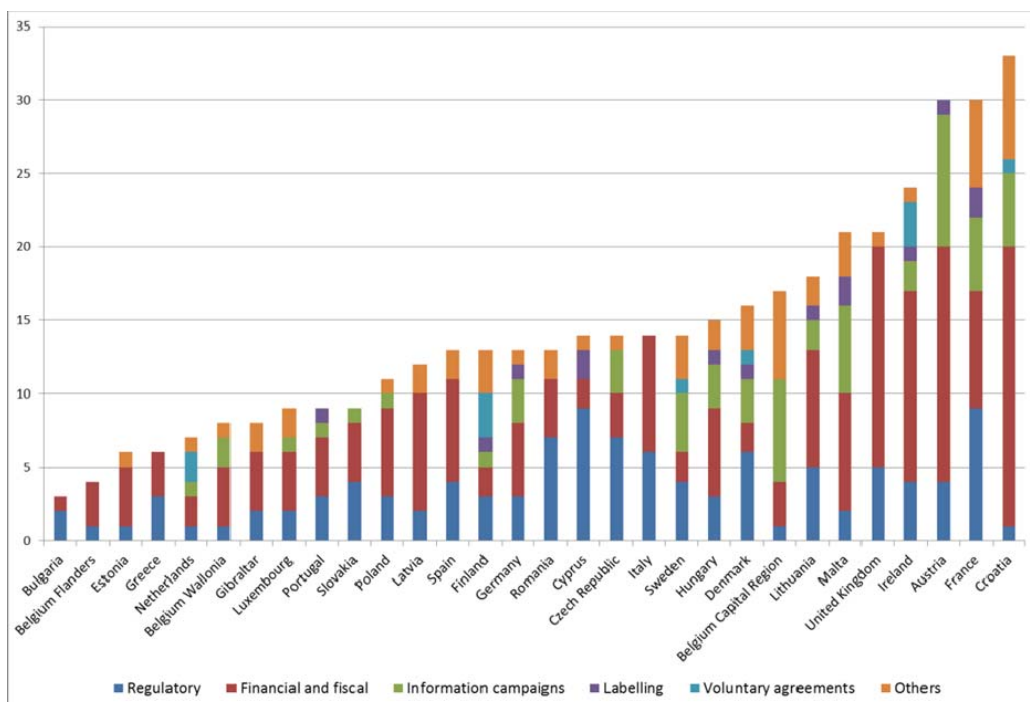
- Most Member States did not describe in a detailed way policies and measures towards NZEBs refurbishment. Reported policies are in line with the EPBD requirements, but rarely these legislative and normative measures explicitly refer to a clear definition and level of NZEBs renovation.

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- Heterogeneity of policy packages in terms of absolute number and in terms of policy type, with a predominance of financial/fiscal and regulatory measures





Belgium/Brussels Region

National nZEBs definition and roadmap to 2020

Scope	Primary consumption for heating, DHW and auxiliary energy below 45 kWh/m ² /yr, and heating need below 15 kWh/m ² /yr (equivalent to Passive House requirements from 2015).	2011: Energy Performance of Buildings Ordinance: from January 2015 onwards, all new public and residential buildings have to fulfill a primary energy need of Passive House standard level.
Energy balance	Monthly Annual	



Denmark

National nZEBs definition and roadmap to 2020

Scope	2010 - 25% reduction energy consumptions compared to 2008 levels 2014 – 50 % reduction (2008 levels) 2020 – 75 % reductions (2008 levels)= 20 kWh/m ² /y	BR 10. Requirements on nZEBs are based on progressive performance classes: Class 2015 (30 kWh/m ² /y), Class 2020 (20 kWh/m ² /y). EP improvement is done by increasing requirements for buildings insulation. RES= 44-51% (2015) 51-56% (2020)
End uses considered	heating, ventilation, cooling, domestic hot water and auxiliary equipment	For non-residential buildings, lighting is included within the regulated energy
Energy balance	Monthly Annual	



France

National nZEBs definition and roadmap to 2020

Scope	EP requirements 50 kWh/m ² /yr primary energy. Minimum energy requirement is adjusted by climatic zone and altitude (40-65 kWh/m ² /yr). All new buildings will positive in 2020. 38% primary energy reduction by 2020 for the existing stock.	Low energy requirements were adopted in the recast of the French thermal regulation (RT 2012) already applied for new non-residential buildings (for new residential buildings since January 2013).
Energy balance	Monthly Annual	
End uses considered	Space heating, domestic hot water, cooling, lighting and auxiliary energy.	



Germany

National nZEBs definition and roadmap to 2020

Scope	2014 - 30% primary energy reduction compared to 2009 levels	The project "Analysis of the revised EPBD" investigated possible nZEBs definition and best solutions: new buildings in 2020 will have an energy performance by 50% better than the buildings performance nowadays (according to the EnEV2009 standard).
End uses considered	Heating, ventilation, cooling, domestic hot water	Heating for non-residential buildings
Energy balance	Monthly Annual	

> 13,000 passive houses built since the 1990s. The German building codes have been strengthened five times over the past 35 years. Energy demand for space heating and domestic hot water 300 kWh/m² → 52.5–60 kWh/m² primary energy.



United Kingdom

Zero Carbon Buildings definition and roadmap to 2016/2019: from 2016 all new homes and from 2019 all new non-domestic buildings will be built to zero carbon standards.

Scope	2013 - 44% reduction CO ₂ demand compared to 2006 2016 - Apartments 39 kWh/m ² /y 2016 - Row - Single family houses 46 kWh/m ² /y (~ 10 kg CO ₂ (eq) /m ² /y)	nZEBs definition built on the voluntary certification system "Code for Sustainable Homes (CSH)".
End uses considered	Heating, ventilation, hot water, lighting.	
Energy balance	Monthly Annual	Share of renewable based on CO ₂ requirements

nZEBs roadmaps: Romania, Poland and Bulgaria

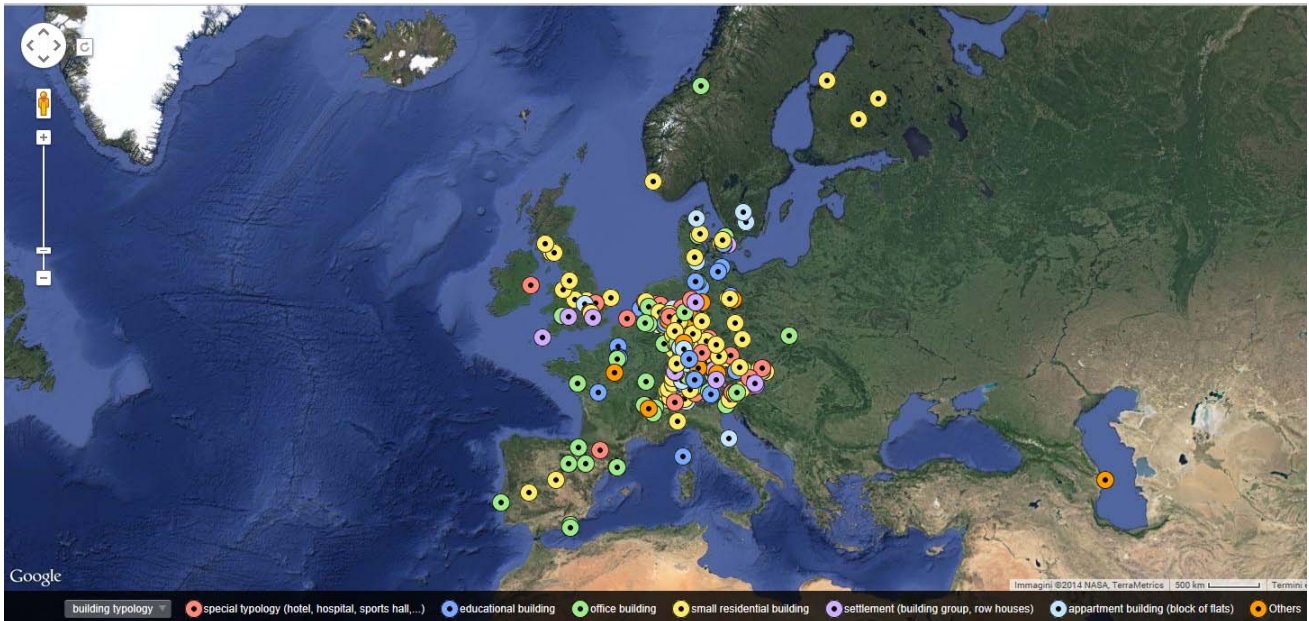
■ Estimated macro-economic benefits of implementing nZEBs 2010 - 2015

	Poland	Romania	Bulgaria
CO ₂ savings (million t)	31	68	4.7-5.3
Energy savings (TeraWh)	92	40	15.3-17
Additional investments (million Euro)	240-365	82-130	38-69
New full time jobs	4100-6200	1390-2203	649-1180
Minimum requirements in 2015/2016			
Primary energy (kWh/m ² /y)	70	100	60-70
Renewable share (%)	>20	>20	>20
CO ₂ emissions (kgCO ₂ /m ² /y)	<10	<10	<8
Minimum requirements in 2020			
Primary energy (kWh/m ² /y)	30-50	30-50	30-50
Renewable share (%)	>40	>40	>40
CO ₂ emissions (kgCO ₂ /m ² /y)	<3-6	<3-7	<3-5



World Wide ZEB Map

IEA research program "Towards Net Zero Energy Solar Buildings"



Source: <http://www.enob.info/en/net-zero-energy-buildings/map>

NZEB development evaluation in Member States

MS	NZEB Definition	RES included in the NZEB concept	Qualitative and quantitative intermediate targets	Measures promoting deep or NZEB renovation
AT				
BE Brussels				
BE Flanders				
BE Wallonia				
BG				
CY				
CZ				
DE				
DK				
EE				
EL				
ES				
FI				
FR				
HR				
HU				
IE				
IT				
LV				
LT				
LU				
MT				
NL				
PL				
PT				
RO				
SI				
SK				
SE				
UK				

Conclusions

- NZEBs: huge potential to decrease energy consumption and increase RES.
- Many NZEB definitions implemented at national level. Most refer to: new and retrofit, private and public, residential and non-residential buildings, demand/generation as balance, year balance using conditioned area as normalization factor and static conversion factors as time dependent weighting.
- No consensus on system boundaries (e.g. single /building unit, on-site production, energy efficiency level, inclusion of lighting, household electricity, renewable typology...).
- Not all Member States provided a definition with both a numerical target and a RES share.
- A few Member States mentioned objectives beyond nZEBs requirements (zero energy buildings - NL, positive energy buildings - DK and FR, climate neutral new buildings – DE, zero carbon standards in the UK).
- A few MS defined a specific minimum percentage of RES share.
- Need of a harmonized definition framework and a robust "zero" calculation methodology.
- Strengthen quantitative intermediate targets and mechanisms to monitor NZEBs implementation at national level.
- Further strengthen and evaluate measures and policies to stimulate cost-effective NZEB renovation.

Thank you for your attention

