nZEB in the EU: National Practices and some remarks for the Greek Agenda

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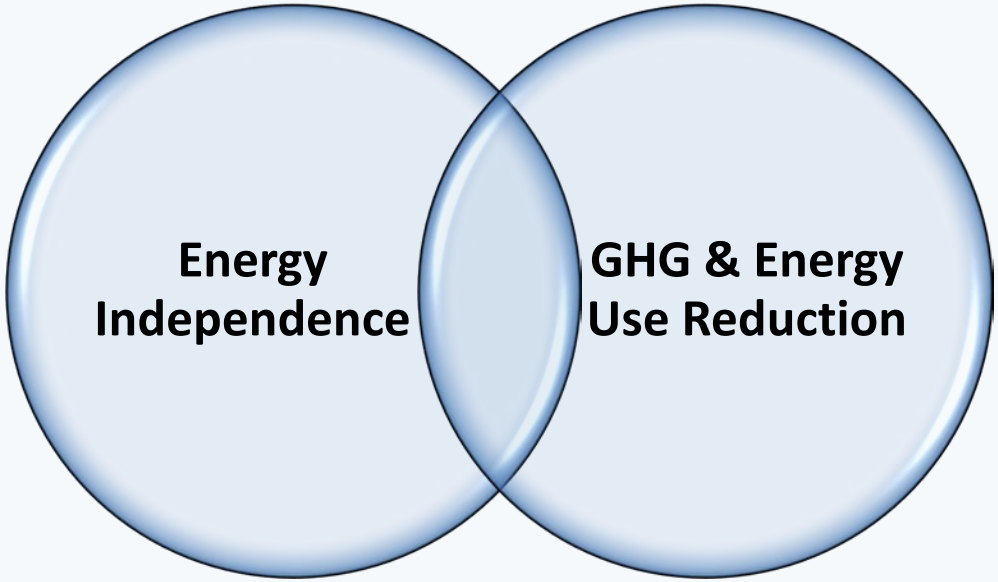
Zero Energy Building

Structure of the presentation

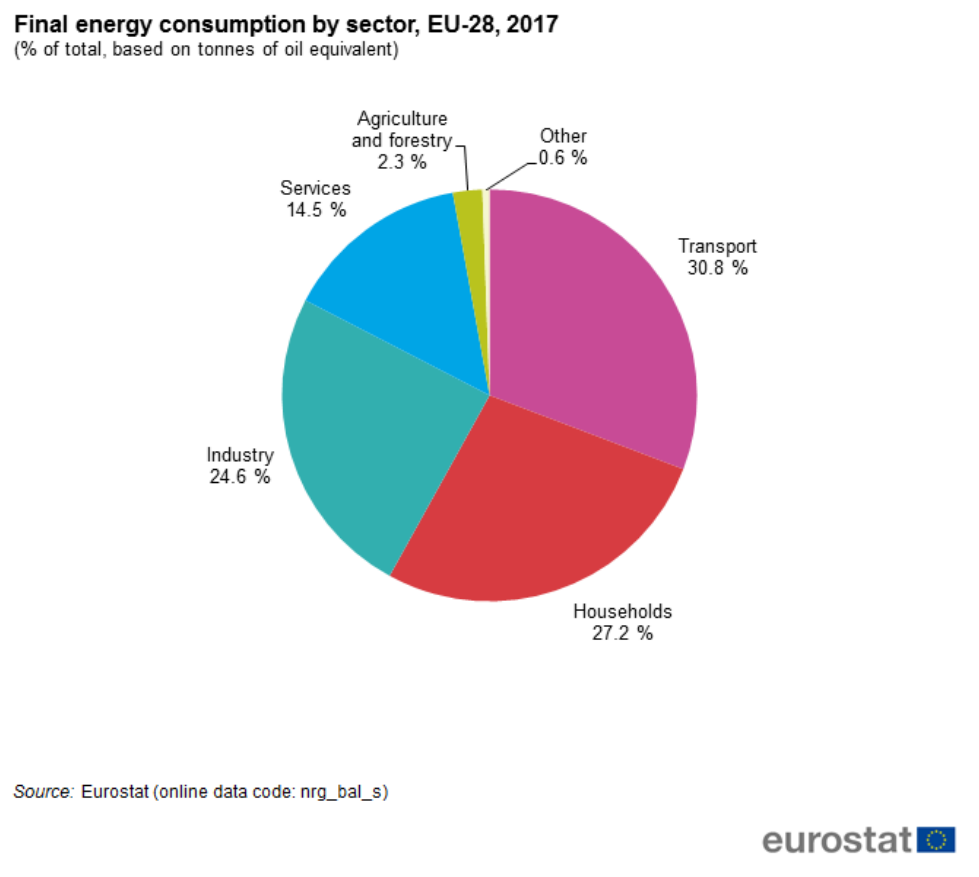
1. Landscape of nZEB institutions in EU
   - Institutional context for energy efficiency policy in the EU
   - Motivation for nZEB in the EU
   - Institutional context for nZEB in the EU
2. Presentation of EU national nZEB definitions and national policies
3. Remarks from national practices
4. nZEB in Greece
   - Institutional actions
   - Definition of nZEB in Greece
5. Comparison of Greek practice to EU Members
6. Issues related to the new EPBD (2018)
7. Key points

Institutional Context for Energy Efficiency in the EU



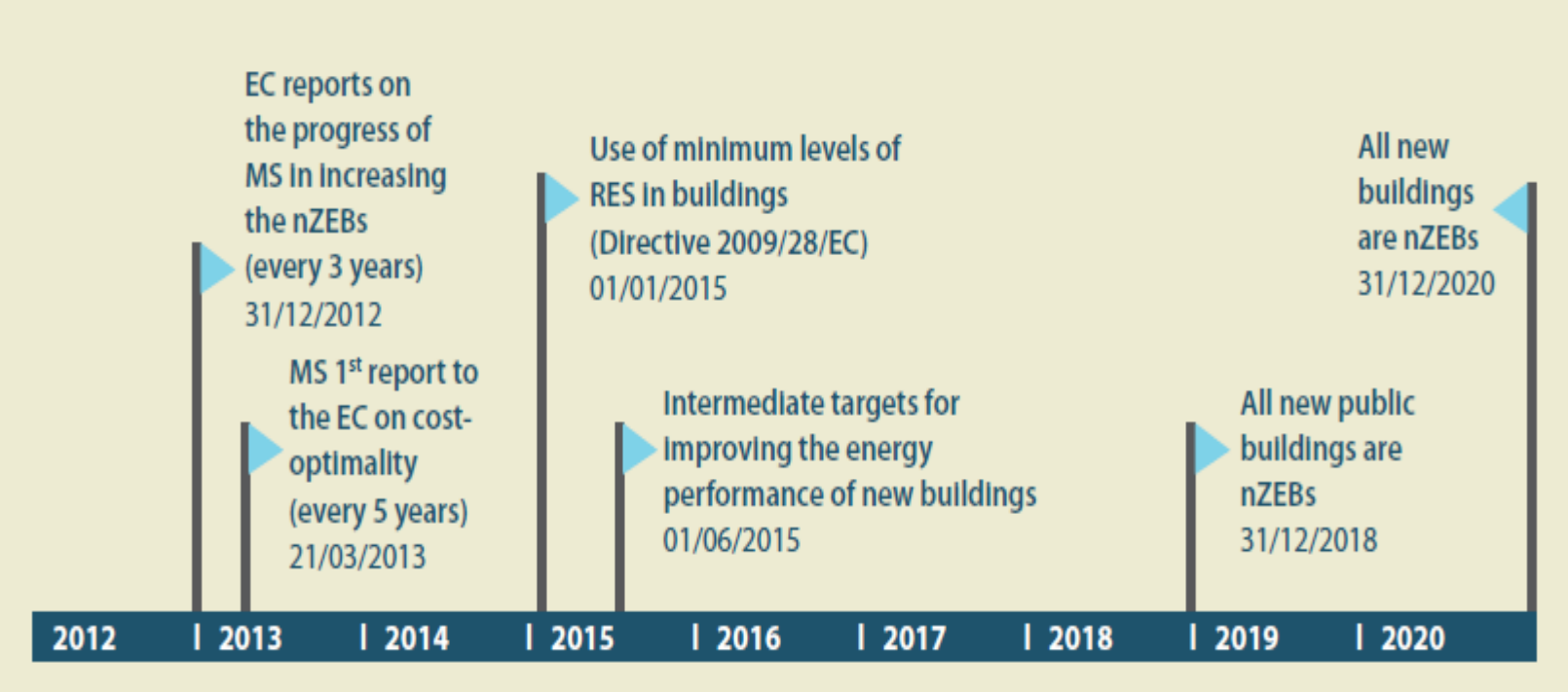
- **2030 Climate and Energy framework:**
  - **Overall target for 2030 cut GHG emissions by at least 40% as compared to the 1990 levels.**
- **Renewable Energy Directive:**
  - **Binding minimum share of 32% of RES for final energy use as EU average.**
- **Energy Efficiency Directive:**
  - **Indicative target of at least 32.5% improvement in energy efficiency by 2030 at EU level versus the projections**

Motivation for nZEB (1)



- The building sector is the largest single energy consumer in Europe. It is estimated that by 2050 at least 75% of today's buildings will still exist. Therefore, energy renovation is key to shift to a low carbon building stock.
- new constructions serve as technology locomotive for energy renovation; buildings erected between today and 2050 will still have a significant share of 20-25% in the building stock and therefore need high attention as wel

Institutional Context for nZEB (2)



- the Energy Performance of Buildings Directive (EPBD, 2010/31/EC) introduced the definition of nZEB as **a building with very high energy performance** where the nearly zero or very low amount of **energy required** should be **extensively covered by renewable sources** produced **on-site** or **nearby**
- The EPBD foresees that after **31 December 2020, all new buildings** will be nZEBs, while for public buildings the deadline is set for 31 December 2018

The application of Subsidiarity in nZEB definition

	nZEB definition for new buildings									nZEB definition for existing buildings		
Country	Status of the definition	Main reference(s)	Year of enforcement		EPBD scope of nZEB definition [1]	Numerical indicator	Maximum primary energy [kWh/m²y]		Share of renewable energy	Other indicators	Status of the definition	Maximum primary energy [kWh/m²y]	
			Public	Non-public			Residential buildings	Non-residential buildings				Residential buildings	Non-residential buildings
Austria	✓	OIB Guidelines 6	1/01/2019	1/01/2021	✓ [7]	✓	160	170 (from 2021)	Minimum share proposed in the draft of OIB guidelines for all buildings	EP, CO_2	✓	200	250 (from 2021)
Belgium - Brussels	✓	Amended Decree of 21/12/2007	1/01/2015	1/01/2015	✓	✓	45	~90 [2]	✓ Qualitative	EP, OH	✓	54	~ 108 [2]
Belgium - Flanders	✓	Regulation of 29/11/2013	1/01/2019	1/01/2021	✓	✓	30% PE [5]	40% PE [5]	✓ Quantitative [4]	EP, OH	Under development		
Belgium - Wallonia	Under development	Consolidated report to EC	1/01/2019	1/01/2019	✓	Under develop-ment			Quantitative	EP	Under development		
Bulgaria	Still to be approved	National nZEB Plan, BPIE study	1/01/2019	1/01/2021	✓	Still to be approved	~30-50	~40-60	Quantitative	EP	As for new buildings	~30-50	~40-60
							Included in the calculation; building needs to comply with class A					Included in the calculation; building needs to comply with class A	
Croatia	✓	Regulation OG 97/14, National nZEB Plan	1/01/2019	1/01/2021	✓	✓	33-41[3]	Under de-velopment	Minimum share in current requirements for all buildings	EP	ND		
Cyprus	✓	Decree 366/2014, Law 210(I)/2012	1/01/2019	1/01/2021	✓	✓	100	125	✓ Quantitative	EP	✓ As for new buildings	100	125
Czech Republic	✓	Regulation 78/2013 Coll.	2016-2018 depending on size	2018-2020 depending on size	✓	✓	75-80% [2,5]	90% [5]	✓ Quantitative	EP, TS	✓ As for new buildings	75-80% [2,5]	90% [5]
Denmark	✓	Building Regulations 2010	1/01/2019	1/01/2021	✓	✓	20	25	✓ Qualitative	EP, OH, TS	✓ As for new buildings	20	25
Estonia	✓	Regulation 68:2012	1/01/2019	1/01/2021	✓ [7]	✓	50-100 [2]	90-270 [2]	✓ Qualitative		✗		
Finland	Under development	Consolidated report to EC	1/01/2018	1/01/2021	✓ [7]	ND			ND		ND		
France	Definition of Positive Energy Buildings under development [8]	Thermal Regulation 2012, National nZEB Plan	28/10/2011	1/01/2013	✓	✓	40-65 [2,3]	70-110 [2,3]	✓ Quantitative [4]	EP, OH, TS	✓	80 [3]	60% PE [2]

EPBD neither prescribes a common approach to implement nearly Zero-Energy Buildings nor describes the assessment categories in detail

The application of Subsidiarity in nZEB definition

Country	nZEB definition for new buildings									nZEB definition for existing buildings		
	Status of the definition	Main reference(s)	Year of enforcement		EPBD scope of nZEB definition [1]	Numerical indicator	Maximum primary energy [kWh/m²y]		Share of renewable energy	Other indicators	Status of the definition	Maximum primary energy [kWh/m²y]	
			Public	Non-public			Residential buildings	Non-residential buildings				Residential buildings	Non-residential buildings
Italy	Still to be approved (under publication)	Draft of the new EPBD decree	1/01/2019	1/01/2021	✓	Still to be approved	Included in the upcoming updated version of the National nZEB Plan [2,3]		Quantitative	EP, TS	✓ As for new buildings	Included in the upcoming updated version of the National nZEB Plan [2,3]	
Latvia	✓	Regulation 383/2013	1/01/2019	1/01/2021	✓	✓	95	95	✓ Quantitative	EP	✓ As for new buildings	95	95
Lithuania	✓	Regulation STR 2.01.09 :2012	1/01/2019	1/01/2021	✓	✓	Included in the calculation; building needs to comply with class A++		✓ Quantitative	EP	✓ As for new buildings	Included in the calculation; building needs to comply with class A++	
Luxembourg	✓ Details to be fixed	National nZEB Plan	1/01/2019	1/01/2021	✗ [6]	✓	Included in the calculation; building needs to comply with class A-A-A		✓ Qualitative	EP, CO_2	ND		
Malta	Under development	National nZEB Plan	1/01/2019	1/01/2021	✓	Current values to be revised	40	60	Qualitative	EP	ND		
Netherlands	✓	National nZEB Plan	1/01/2019	1/01/2021	✓	✓	Included in the calculation; building needs to comply with energy performance coefficient = 0		✗	EP	ND		
Norway	Under development	Presentation by Research Centre on Zero Emission Buildings	1/01/2021	1/01/2021	✓	Under development			Minimum share in current requirements for all buildings	CO_2 (main indicator), EP, TS	ND		
Poland	Under development	Consolidated report to EC	1/01/2019	1/01/2021	✓	Under development	60-75 [2]	45-70 [2]	✗		ND		
Portugal	Under development	Law 118/2013	1/01/2019	1/01/2021	✓	In current requirements for buildings			✗		ND		
Romania	✓	National nZEB Plan	1/01/2019	1/01/2021	✓	✓	93-217 [2,3]	50-192 [2,3]	✓ Quantitative	CO_2	ND		
Slovakia	✓	Decree 364/2012	1/01/2019	1/01/2021	✗ [6]	✓	32-54 [2]	34-96 [2]	✓ Quantitative	EP	ND		
Slovenia	Still to be approved	Official Journal 17/14, National nZEB Plan	1/01/2019	1/01/2021	✓	Still to be approved	45-50 [2]	70	Under development	EP	Still to be approved	70-90 [2]	100
Spain	Under development	Decree 235/2013	1/01/2019	1/01/2021	✓	Under development	Included in the calculation; it is foreseen that buildings will need to comply with class A		Minimum share in current requirements for all buildings	CO_2 (main indicator)	Under development		
Sweden	Under development	National nZEB Plan	1/01/2019	1/01/2021	✓	Under development	30-75 [2,3]	30-105 [2,3]	✗		ND		
UK (England)	✓ Details to be fixed	National nZEB Plan, presentation by Zero Carbon Hub	1/01/2018 (from 2016 for residential buildings) [9]	1/01/2019 (from 2016 for residential buildings) [9]	✓	✓	~ 44 (2)	ND	✓ Qualitative	CO_2 (main indicator), EP, TS	ND		
							Included in the calculation; building will need to comply with carbon emissions ~ 0						

The application of Subsidiarity in nZEB definition

Main points of the national NZEB definition (as reported by the CA EPBD delegates)			Country																																		
				Belgium																																		
			Austria	Brussels	Flanders	Walloon	Bulgaria	Croatia	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg *	Malta	Netherlands	Norway	Poland	Portugal	Romania	Slovak Republic	Slovenia	Spain	Sweden	United Kingdom
Detailed definition	Included in a legal document	Governmental decree/law		■	■	■	■		■				■				■		■	■		■		■			■		■	■		■	
		Technical regulation						■		■	■	■		■				■	■		■								■					
		National NZEB plan	■					■																				■		■				
	Not yet included in a legal document														■	■							■		■	■		■				■		■
	Draft available														X							X		X								X		
Very high energy performance	Tighter requirements compared to current values for	General								■				■										■							X			
		Mean U-value of building envelope								■																								
		Reference technologies								■																		■						
		Heating energy demand																												■				
		Final energy	■																															
		Primary energy				■	■	■		■			■						■									■	■	■				
		(Primary) energy performance coefficient			■	■																		■										
	Top building class						■		■			■					■	■		■	■	■	X	■						■				X
	Specific new building class										■																							
	Passive house (building envelope) level			■																														
	KfW efficiency house 55/70														X																			
Nearly zero or very low amount of energy required. Limits on:	Component U-values				■	■			■								■	■	■					■		■			■	■	X			
	Thermal bridges																	■																
	Mean U-value of building envelope				■	■	■			■					X									■						■		■		
	Heat transfer coefficient/heat loss of building envelope																		■		■													
	Air permeability																	■																
	(Net) heat demand	■	■						■						X		■					■	X											
	Installed lighting power								■																									
	System efficiencies						■										■	■	■															
	Heating energy demand																		■	■											■	X		
	Cooling energy demand																		■													X		
	Total energy efficiency	■																																
	Electrical input																																■	
	Final energy (total or divided into energy uses)	■								■																	■			■				X
	Primary energy		■	■	■	■	■	■	■	■	■	■	■	■	X		■	■	■	■	■	■	X	■	X		■		■	■	■	X	■	
	CO_2 emissions	■																■										■						X
	Summer overheating																■		■															
Very significant extent of renewable energy	Direct	Minimum share in %	■		■		■	■	■						X		■	■	■	■	■		■					■	■	■				
		Minimum contribution in kWh/m².year			■									■				■																
		(Choice of) exemplary RES measures	■		■						■								■															
	Indirect **			■		■				■	■	■	■									■	X	■		■					X	■	X
Primary energy indicator in kWh/m².year	Included		■	■		■	■	■	■	■	■	■	■	■	X		■		■	■	■	■	X	■		■		■	■	■	X	■	
	Other main indicator, but PE as additional/interim result. Main indicator:	CO_2																																X
		Primary EP coefficient			■	■												■						■										

Some remarks from national practices (1)

- **Progressive** tightening of the requirements has been put in place in some countries (ex. after 2015) while nZEB definition initially implemented for some types of buildings depending on energy use or consumption

- In several cases detailed definition is dependent on the results of the **cost-optimal analysis** in order to take into account evolving factors,e.g., energy prices, primary energy factors for electricity and district heating, improved efficiency of systems and material due to research and industry innovations, building material costs, etc. or

- Some would wait for lessons learned from **pilot projects** of **high performance** buildings

- Objectives which go **beyond nZEB** requirements:
  - zero energy buildings in the Netherlands,
  - positive energy buildings in Denmark and France,
  - climate neutral new buildings in Germany
  - zero carbon buildings in the United Kingdom

Some remarks from national practices (2)

- Indicators of Assessment:
  - maximum **primary energy** is one of the main indicators,
  - in a few cases (e.g. the Netherlands and the Belgian Region of Flanders) the primary energy use of the building is assessed through a **non-dimensional (primary) energy performance coefficient**, comparing the buildings' primary energy use with a "reference" building
  - **Carbon emissions** also used as the main indicator or complementary
  - Primary energy targets **vary** from 0 to 270 kWh/m²/y
  - Different targets for **different building uses** are applied in some cases (ex. Hospitals)

- Many targets consider also the share of renewables in a quantitative or qualitative way either explicitly stating the share of primary energy consumption to be covered by renewable energy sources or indirectly

- Most countries also set separate requirements on final energy use, as suggested by the European Committee for Standardisation

- Concerning criteria for nZEB renovation of buildings (existing buildings) either a less strict limit or the same applies depending on the case

Some remarks from national practices (3)

- Maximum values set on a case by case basis:
  - most cases final energy required for **space heating**
  - some **final use of energy for services**
  - also primary energy **cooling demand**
  - mean **transmittance coefficient** of the **building and components**
  - building **airtightness**,
  - in a few cases additional requirements for performance of the **technical systems (heating, ventilation, hot water, cooling and lighting**)
  - in few cases reduce the building **overheating risk** additionally

Institutional actions in Greece

N4122/2013

EPBD Directive in Greek Legislature

N4342/2015

Long term strategy for building stock renovation

2017

ΚΕΝΑΚ

National Plan for raising the number of nZEB

ΥΑ ΥΠΕΝ/ΔΕΠΕΑ 85251/21.11.2018 ΦΕΚΒ'5447

ΚΣΜΚΕ/nZEB

The nZEB definition in Greece

Definition according to **Primary energy performance coefficient**, comparing the buildings' primary energy use with a "reference" building primary energy (December 2018):

α) Energy **Class A of KENAK** or higher in cases of **newly** erected buildings
β) Energy **Class B+ or higher**, in cases of **renovated** buildings

Εύρος τιμών ενεργειακών καταναλώσεων (Στοιχεία ΠΕΑ)

Ενεργειακή κατηγορία	Ενεργειακές καταναλώσεις πρωτογενούς ενέργειας κτιρίων κατοικίας ανά Κλιματική Ζώνη (kWh/m²a)			
	Α	Β	Γ	Δ
Α+	11 - 25	14 - 35	10 - 44	17 - 36
Α	18 - 56	21 - 55	26 - 74	54 – 88
Β+	32 - 81	31 - 99	45 - 125	37 - 128
Β	45 - 112	56 - 126	72 - 172	63 - 184
Ενεργειακή κατηγορία	**Ενεργειακές καταναλώσεις κτιρίων τριτογενούς τομέα ανά Κλιματική Ζώνη (kWh/m² a)**			
	Α	**Β**	**Γ**	**Δ**
Α+	12 - 77	14 - 91	52 - 69	30
Α	65 - 185	41 - 114	68 - 119	82
Β+	98 - 218	60 - 196	99 - 218	105 - 156
Β	133 - 266	115 - 245	120 - 280	149 - 218

Πίνακας 1.3. Κατηγορίες ενεργειακής απόδοσης κτηρίων.

Κατηγορία	Όρια κατηγορίας	Όρια κατηγορίας
Α+	$EP \leq 0{,}33R_R$	$T \leq 0{,}33$
Α	$0{,}33R_R < EP \leq 0{,}50R_R$	$0{,}33 < T \leq 0{,}50$
Β+	$0{,}50R_R < EP \leq 0{,}75R_R$	$0{,}50 < T \leq 0{,}75$
Β	$0{,}75R_R < EP \leq 1{,}00R_R$	$0{,}75 < T \leq 1{,}00$
Γ	$1{,}00R_R < EP \leq 1{,}41R_R$	$1{,}00 < T \leq 1{,}41$
Δ	$1{,}41R_R < EP \leq 1{,}82R_R$	$1{,}41 < T \leq 1{,}82$

Greek practice in relation to EU Members

Parameter	Greece
Progressive tightening of the requirements	De facto
Dependent on the results of the cost-optimal analysis	Yes
Pilot projects of high performance buildings	-
Objectives beyond nZEB	-
Maximum primary energy /performance coeficient	Yes
Carbon emissions limit	-
Different targets for different building uses	-
Share of renewables	-
Requirements on final energy use	-
Different target for renovation of existing buildings	Yes
Final energy required for space heating	-
Final use of energy for services	-
Primary energy cooling demand	-
Transmittance coefficient of the building and components	Pending
Building airtightness	Pending
Performance of the technical systems (heating, ventilation, hot water, cooling and lighting	Pending
Reduction of Building overheating risk	?

EPBD 2018 (1)

- **Improved Transparency of energy performance certificates procedure and calculations and inspections** to sufficiently ensure the initial assessment and continued performance of HVAC systems under varying conditions
- Set system requirements in respect of the **overall energy performance** and providing **additional numerical indicators** for nZEB

EPBD 2018 (2)

- **EV smart charging infrastructure**-targeted requirements effective Building codes-minimum number of recharging points to apply from 2025
- **Smart readiness indicator** optional but tergeted incentives for digital solutions - (consumers consumption info, effective grid management) smart meters, building automation and control systems, self-regulating devices for the regulation of indoor air temperature, built-in home appliances, recharging points for electric vehicles, energy storage and detailed functionalities and the interoperability of those features, as well as benefits for the indoor climate condition, energy efficiency, performance levels and enabled flexibility
- **Building automation and electronic monitoring of technical building systems** mandates
    - lay down requirements non residential buildings rated output for heating systems or systems for combined space heating and ventilation of over 290 kW
    - Regulated valves in different thermal zones
    - May lay down requirements for residential buildings

Key points

- Proceed with additional **technical performance indicators**, new KENAK
- Decision on different limits **per building use**
- Decision on need for additional **performance parameters (carbon, RES, final energy**)
- Objectives **beyond nZEB –** Adjust to mandates & recommendations **on EVs, BEMS, Smartness** of the new EPBD (2018)
- Decision on need for **pilot** projects

Thank you for your attention!
Special thanks to Mr. Athanasiou, EC DG Energy

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ΥΠΕΝ, 2017, National Plan for raising the number of nZEBs

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