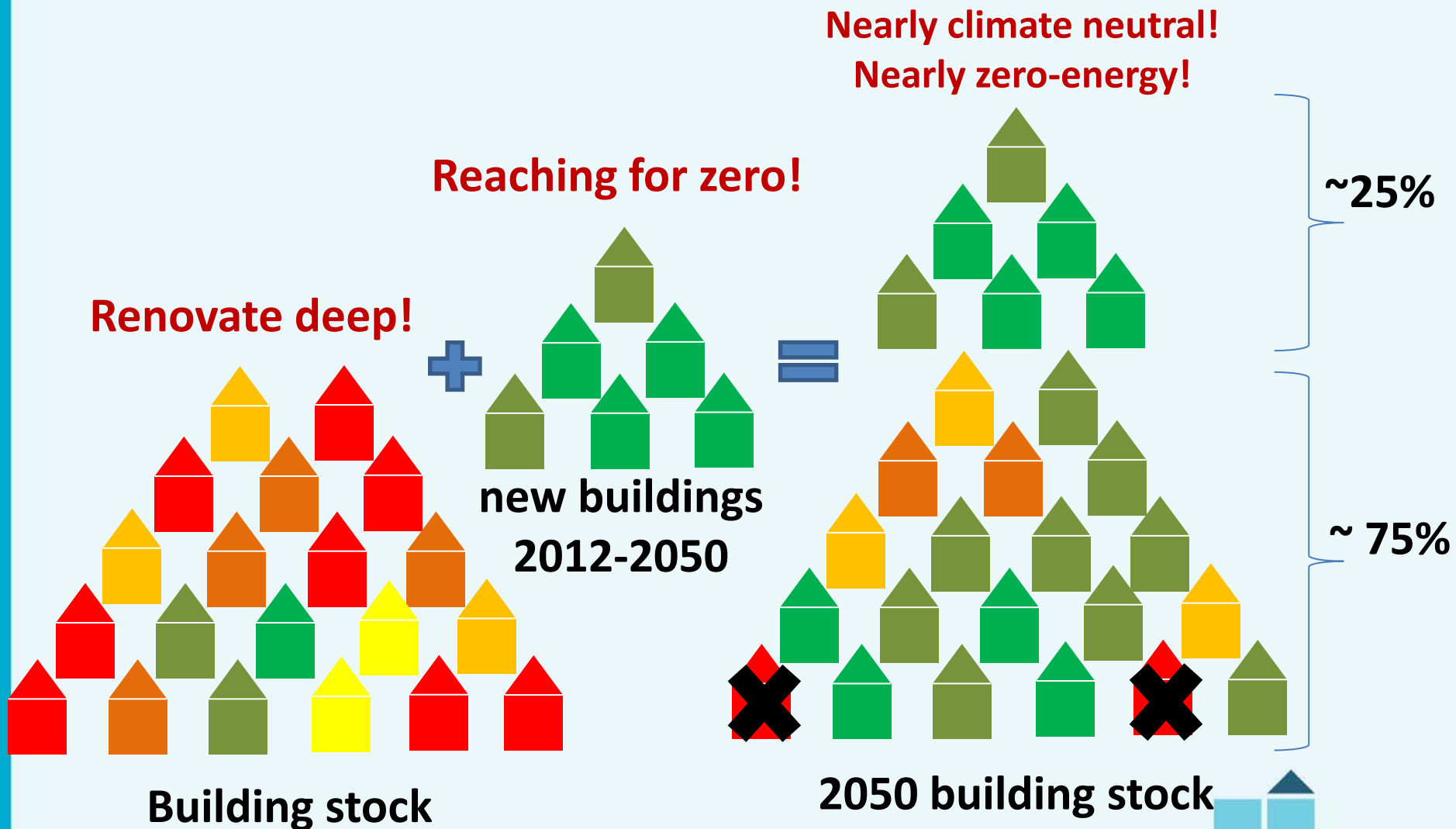


# Moving towards nearly Zero-Energy Buildings in Bulgaria

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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



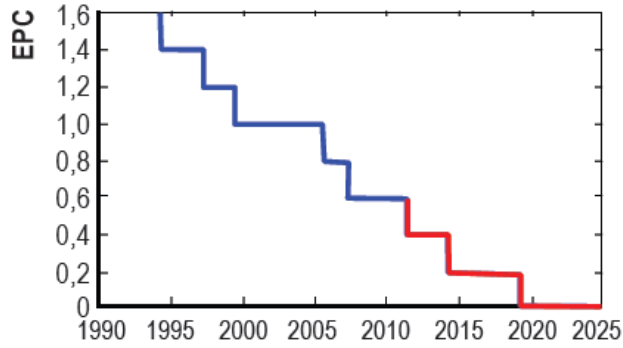
# Recommendation for nZEB 'golden' principles

From BPIE (2011) study on 'Principles for nearly Zero-Energy Buildings' ([www.bpie.eu](http://www.bpie.eu))

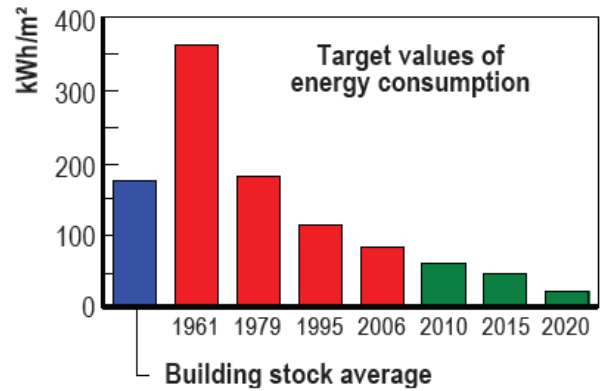
<b>Set clear boundaries in the building's operational energy flow</b>	<b>Set thresholds:</b>
<p><b>Energy need</b></p> <p>...that defines the energy quality of the energy need</p>	<p>...for the maximum allowable energy need <i>(proposal: fix threshold in a corridor between C-O and BAT)</i></p>
<p><b>Renewable energy share</b></p> <p>...where the share of renewable energy is calculated or measured</p>	<p>... for the minimum share of renewables demand <i>(proposal: 50%&lt;&gt;90%)</i></p>
<p><b>Primary energy &amp; CO2 emissions</b></p> <p>... where the overarching primary energy need and CO2 emissions are calculated</p>	<p>... for the overarching primary energy demand and CO2 emissions <i>(proposal: &lt;3kgCO2/m2/yr)</i></p>

# Some guys already started: Roadmap towards nZEB

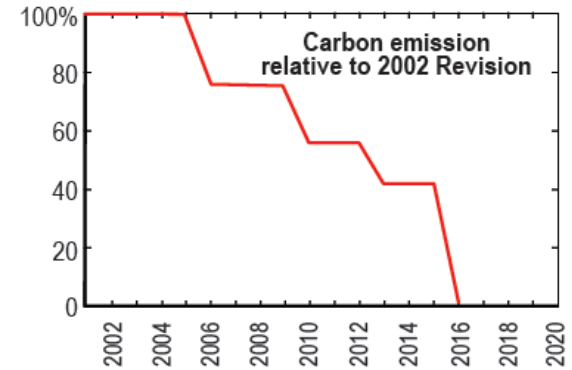
## The Netherlands



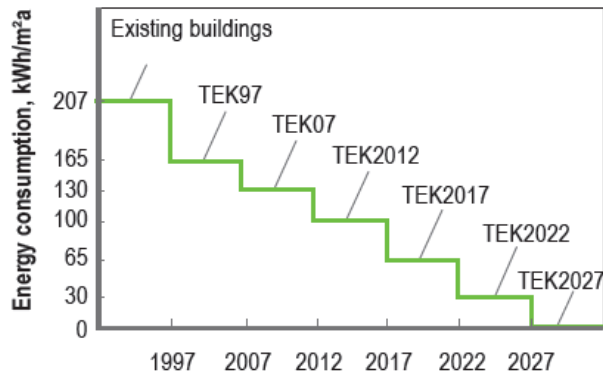
## Denmark



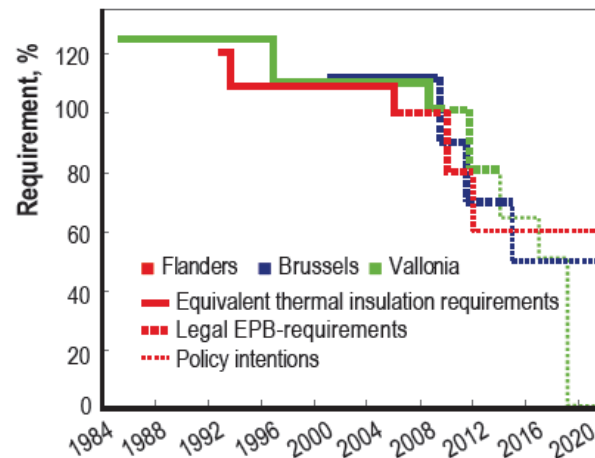
## United Kingdom



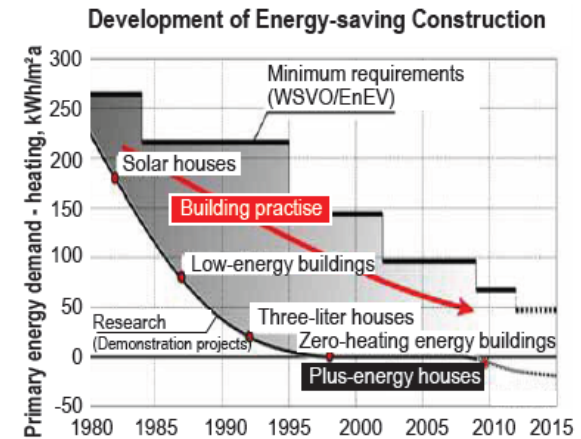
## Norway



## Belgium

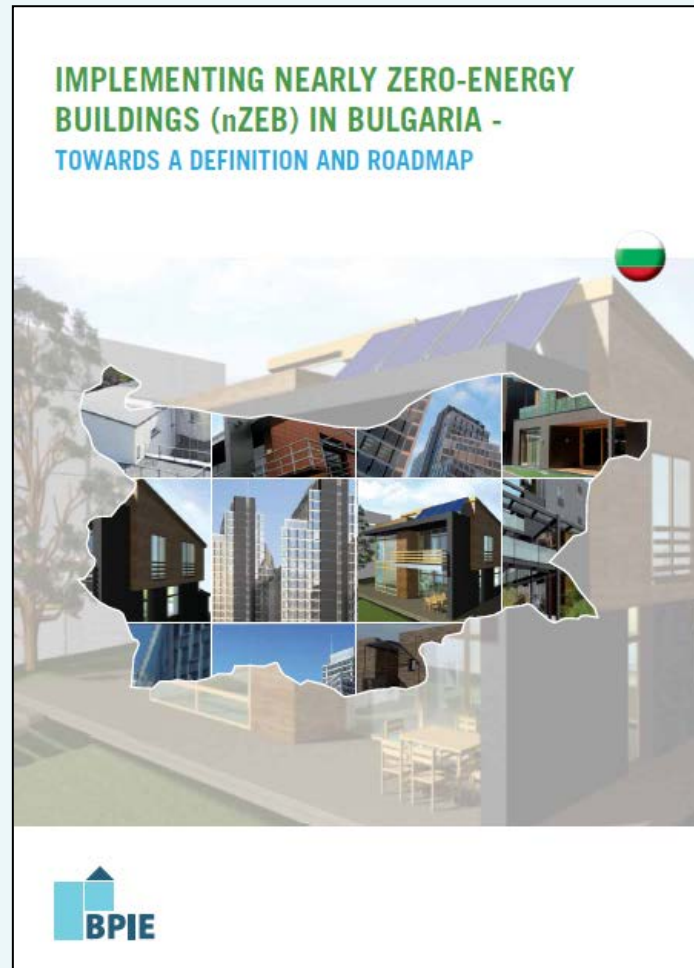


## Germany



Source: REHVA

# BPIE study for nZEB definitions and implementation roadmap in Bulgaria



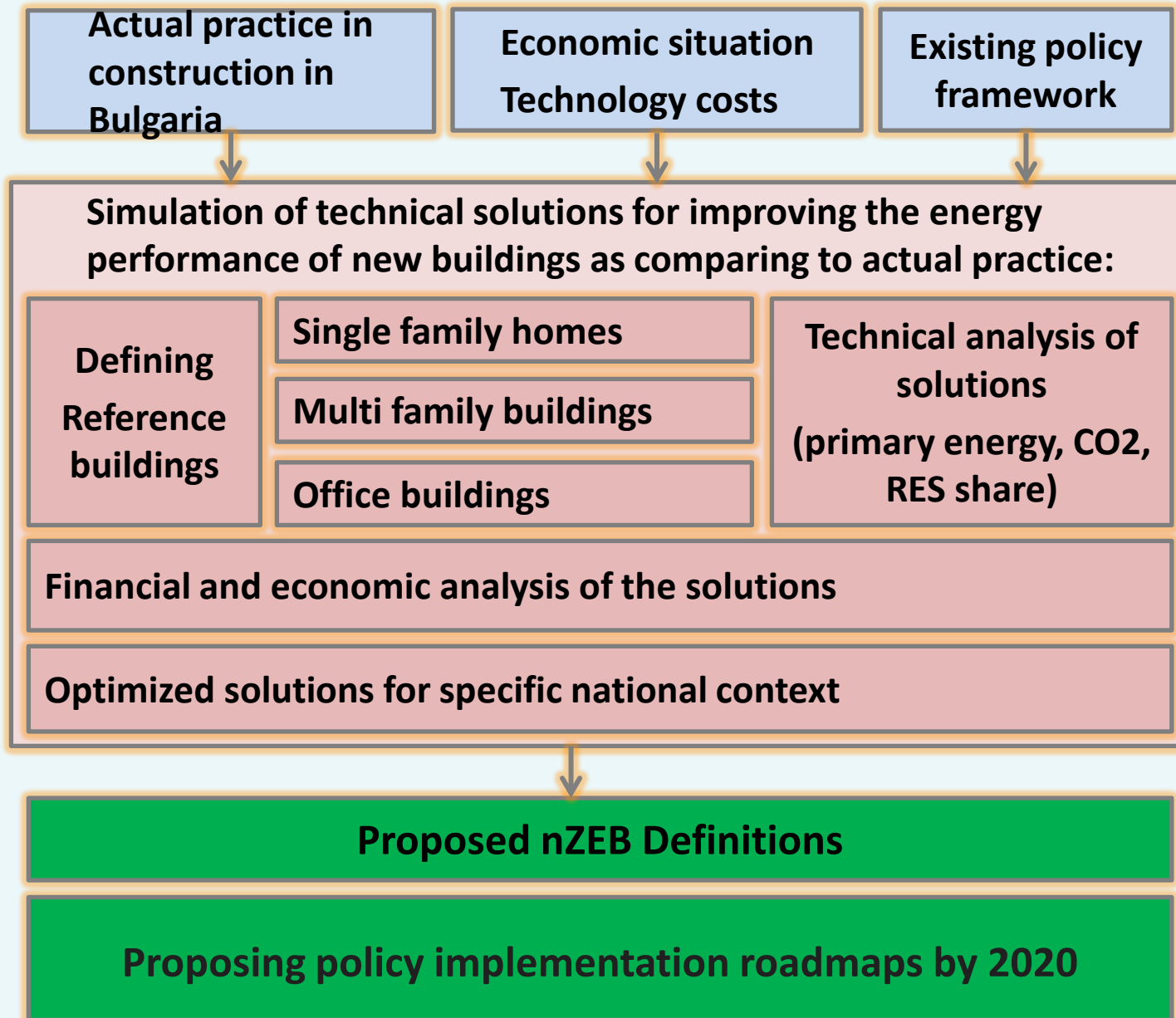
Authors:

BPIE, Ecofys Germany, EnEffect Bulgaria

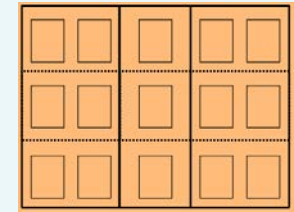
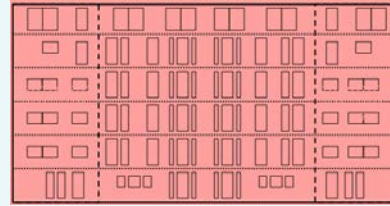
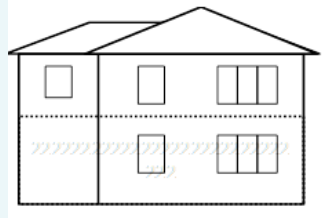
Soon available at: [www.bpie.eu](http://www.bpie.eu)



# Structure of the study and methodological approach



# 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 m <sup>2</sup>	2870 m <sup>2</sup>	886 m <sup>2</sup>
Room height	2.65 m	2.73 m	3.00 m
U-walls	0.34 W/(m <sup>2</sup> K)	0.64 W/(m <sup>2</sup> K)	0.46 W/(m <sup>2</sup> K)
U-roof	0.27 W/(m <sup>2</sup> K)	0.30 W/(m <sup>2</sup> K)	0.32 W/(m <sup>2</sup> K)
U-floor	0.55 W/(m <sup>2</sup> K)	0.55 W/(m <sup>2</sup> K)	0.46 W/(m <sup>2</sup> K)
U-windows, frame fraction	1.70 W/(m <sup>2</sup> K); 21%	1.70 W/(m <sup>2</sup> K), 15%	1.70 W/(m <sup>2</sup> K), 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/m <sup>2</sup>	20 W/m <sup>2</sup>	30 W/m <sup>2</sup>



# Simulated nZEB variants and heating solutions

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

**Additionally: with and without CO<sub>2</sub> compensation (by a rooftop PV system)**

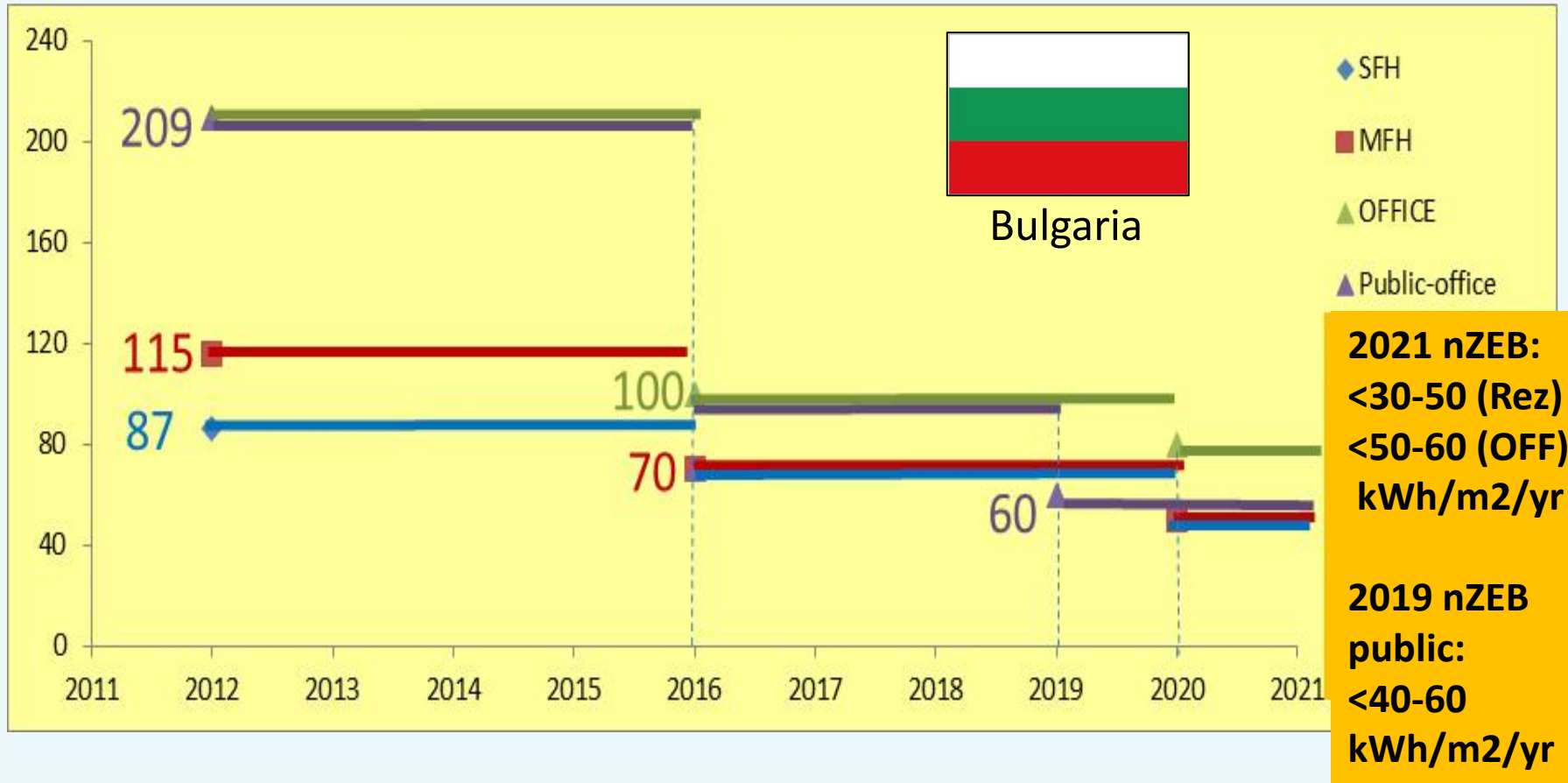
# Selected nZEB optimal solutions

	nZEB solution	Brief Description	Heating system	Additional annualised costs (Base year 2010) [€/m <sup>2</sup> -yr]	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%

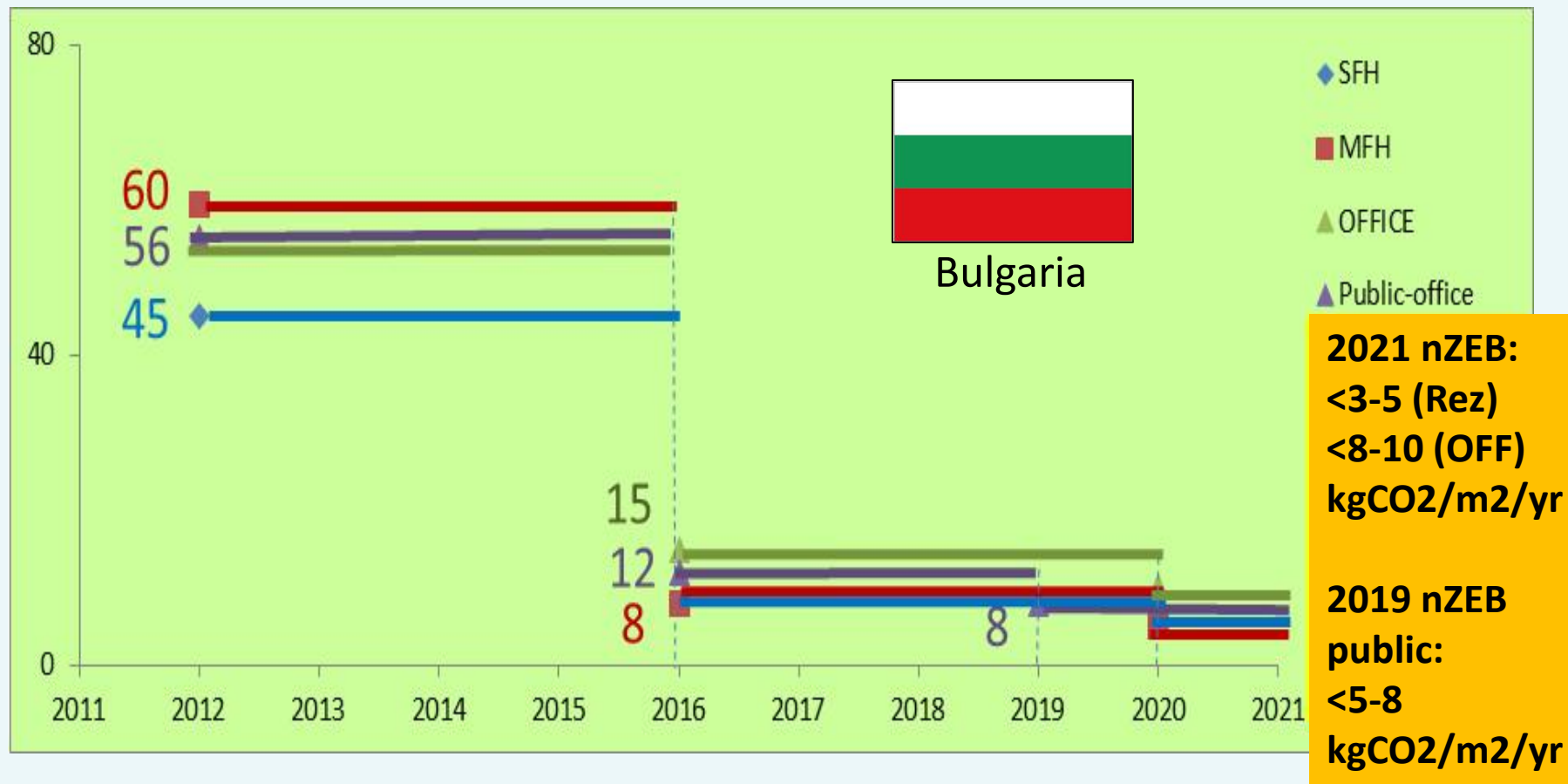
Assumed present costs on the market: SFH: 450 Euro/m<sup>2</sup>, MFH: 363 Euro/m<sup>2</sup>, Office: 275 Euro/m<sup>2</sup>

Assumed interest rate: 7.5%

# Proposed nZEB definitions - primary energy need (EPBD scope)



# Proposed nZEB definitions - CO2 emissions in primary energy



## 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.

# Estimated macro-economic benefits between 2020-2050

Indicator	Effect
CO <sub>2</sub> emissions savings in 2050	4.7-5.3 Mio t CO <sub>2</sub>
Cumulative energy savings in 2050	15.3 -17 TWh
Additional annual investments	38 - 69 Mio Euro
Additional new jobs	649 - 1180 Full time employees

# Example: simulation results for single family home

	Final specific demand [kWh/m <sup>2</sup> /yr]	Without CO <sub>2</sub> compensation				With CO <sub>2</sub> compensation (by additional PV)			
		Primary energy demand [kWh/m <sup>2</sup> /yr]	CO <sub>2</sub> emissions [kgCO <sub>2</sub> /m <sup>2</sup> /yr]	Renewable share [%]	Total additional annualised costs [Euro/m <sup>2</sup> /yr]	Primary energy demand [kWh/m <sup>2</sup> /yr]	CO <sub>2</sub> emissions [kgCO <sub>2</sub> /m <sup>2</sup> /yr]	Renewable share [%]	Total additional annualised costs [Euro/m <sup>2</sup> /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

# Proposed nZEB implementation roadmap by 2020

Policy process	<ul style="list-style-type: none"> <li>• Strategies and planning, milestones, monitoring &amp; evaluation, public consultation</li> </ul>
Building codes	<ul style="list-style-type: none"> <li>• Gradual improvement for meeting proposed targets</li> </ul>
Energy certification	<ul style="list-style-type: none"> <li>• Adjust for more visibility of nZEB. Better control &amp; national database</li> </ul>
Enforcement and compliance	<ul style="list-style-type: none"> <li>• Stricter enforcement/compliance on energy performance of buildings</li> </ul>
Reinforce existing /New Policies	<ul style="list-style-type: none"> <li>• Light support schemes (especially for compensating the high upfront capital for RES)</li> <li>• Better integrate buildings and DH and community policies (minimise the costs)</li> <li>• Support development of supply chain industry (maximise economic benefits)</li> <li>• Stricter public procurement for buildings (public sector)</li> <li>• Remove market barriers</li> </ul>
Capacity building	<ul style="list-style-type: none"> <li>• Reinforce responsibilities. More and targeted info and advice points</li> </ul>
Workforce skills	<ul style="list-style-type: none"> <li>• Basic and long-life educational and training programs for workforce. Need for improving the actual practice in design and construction.</li> </ul>
Information and awareness	<ul style="list-style-type: none"> <li>• More info and guidance,</li> <li>• Support market champions promoting low-energy buildings</li> </ul>
Demo projects	<ul style="list-style-type: none"> <li>• nZEB demo-projects for all building types</li> </ul>
Research	<ul style="list-style-type: none"> <li>• Support research on new technologies and techniques</li> </ul>





**nZEB...what else?**



**Thank you!**

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