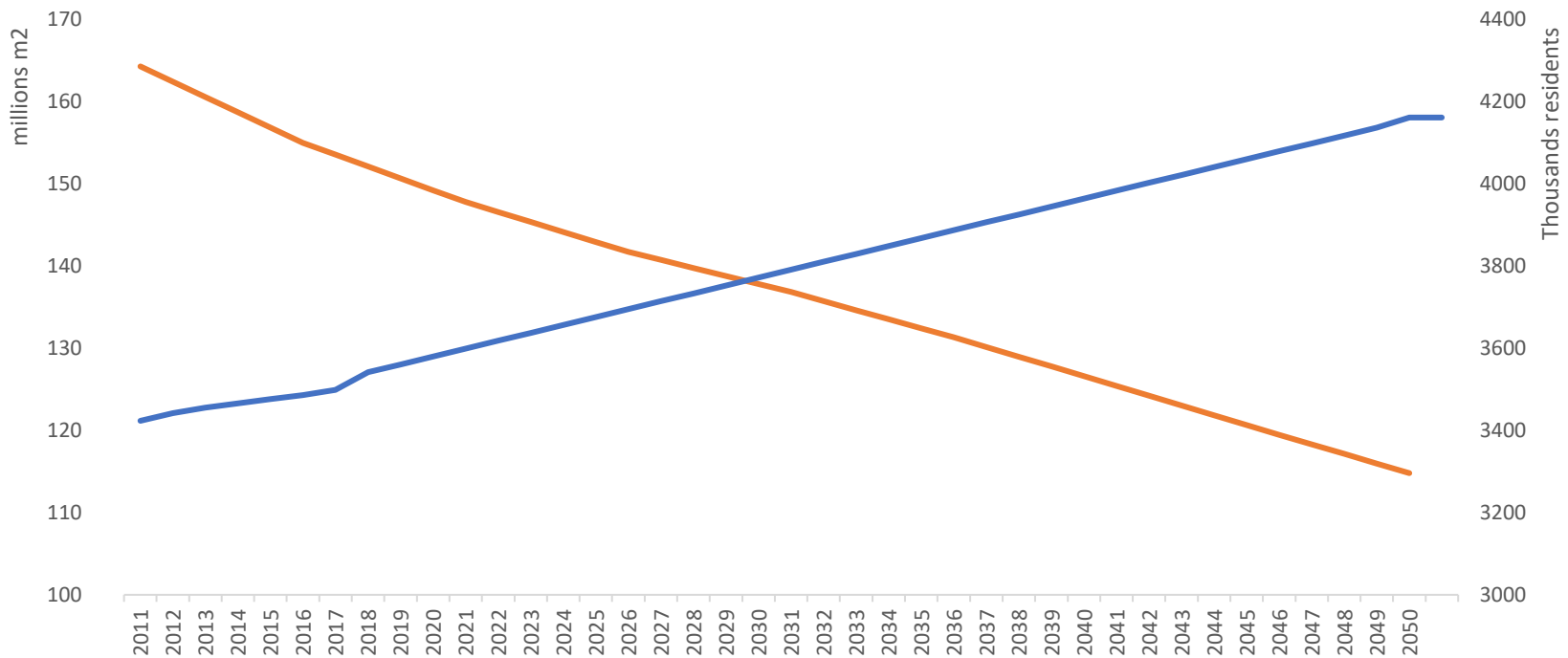


# Revision of Long Term Renovation Strategy for Republic of Croatia

Toni Borković, dipl. ing. arh.

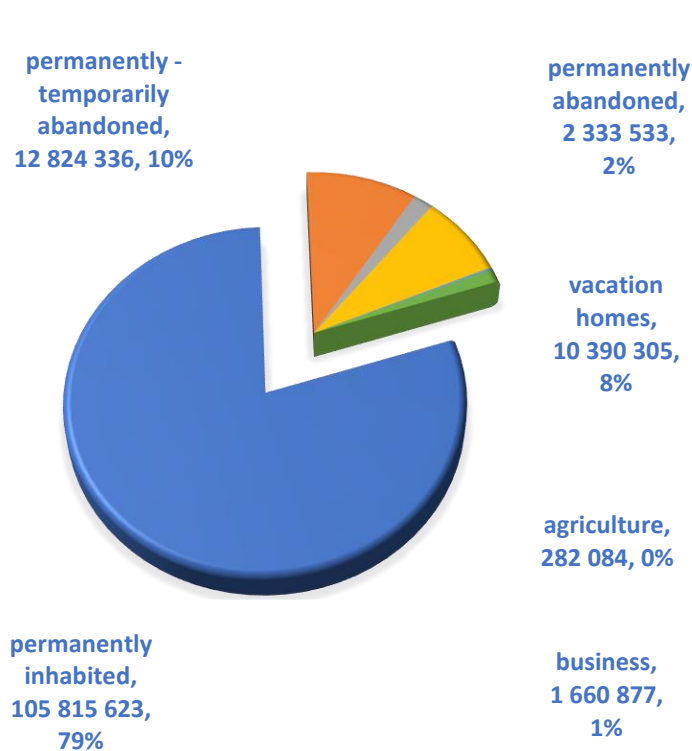
# Building stock development until 2050 based on medium demographic development scenario (3,3 mil residents)

Projection of residential building stock size and population

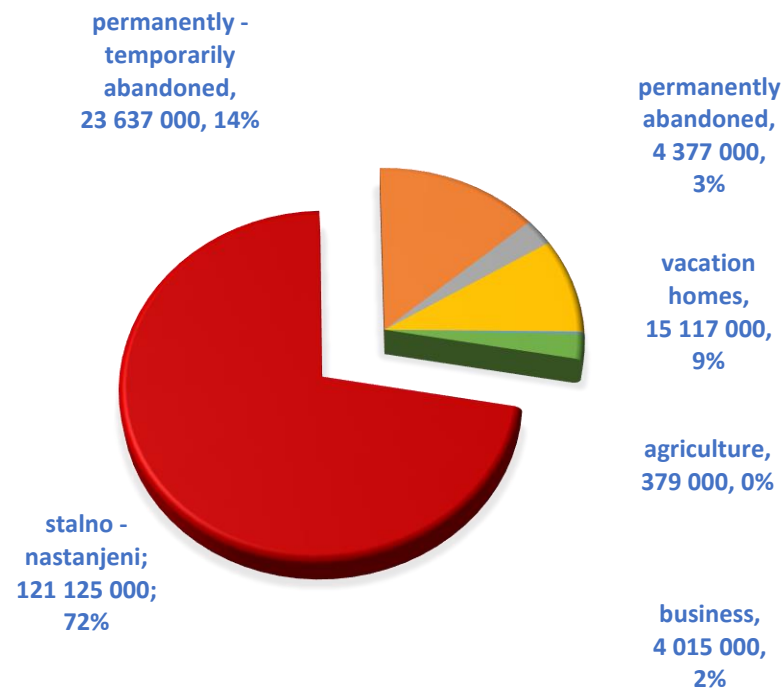


# Change in use of residential building stock 2001 to 2011

## RESIDENTIAL STOCK 2001

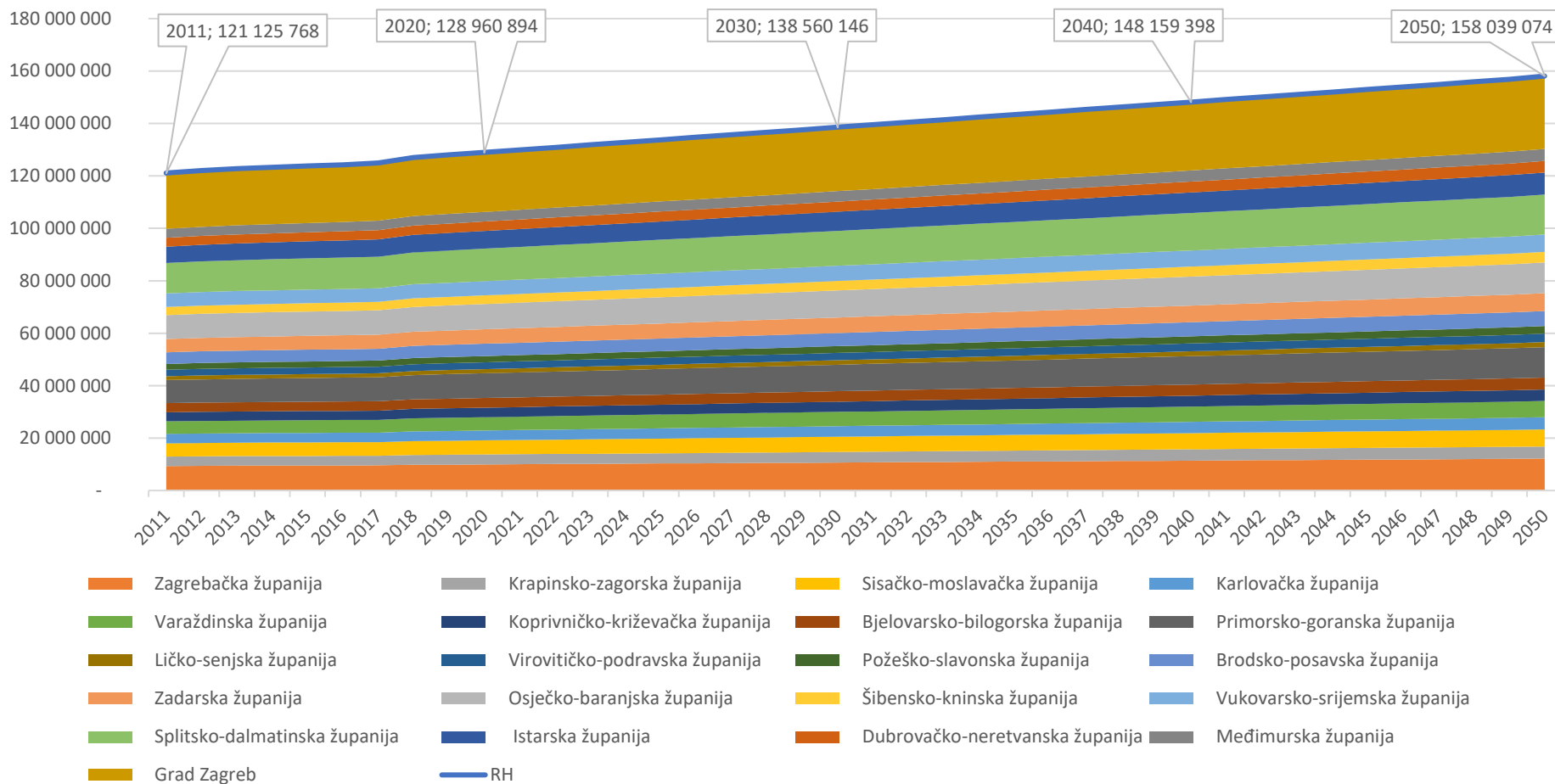


## RESIDENTIAL STOCK 2011



# Building stock development until 2050 following medium demographic development scenario (3,3 mil residents)

Building stock 2021 - 2050



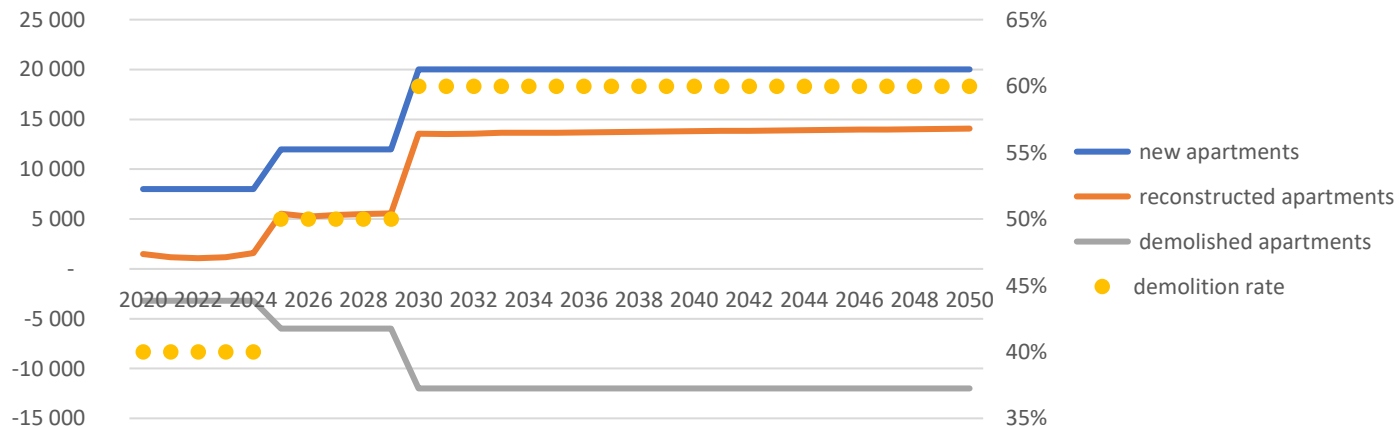
Annual residential building area growth index

ID		2012/2011	2013/2012	2014/2013	2015/2014	2016/2015	2017/2016	
16	K	Vukovarsko-srijemska županija	1,008	1,003	1,002	0,999	1,000	1,002
6	K	Koprivničko-križevačka županija	1,004	1,002	1,002	1,002	1,002	1,003
2	K	Krapinsko-zagorska županija	1,004	1,004	1,002	1,002	1,002	1,002
14	K	Osječko-baranjska županija	1,004	1,005	1,002	1,002	1,001	1,002
3	K	Sisačko-moslavačka županija	1,004	1,003	1,005	1,001	1,001	1,001
7	K	Bjelovarsko-bilogorska županija	1,005	1,003	1,003	1,002	1,002	1,002
4	K	Karlovačka županija	1,003	1,003	1,004	1,003	1,002	1,002
10	K	Virovitičko-podravska županija	1,007	1,003	1,002	1,002	1,002	1,002
11	K	Požeško-slavonska županija	1,006	1,003	1,003	1,003	1,003	1,002
5	K	Varaždinska županija	1,007	1,003	1,003	1,004	1,004	1,004
12	K	Brodsko-posavska županija	1,007	1,005	1,003	1,004	1,003	1,004
1	K	Zagrebačka županija	1,008	1,005	1,003	1,003	1,003	1,003
21	K	Grad Zagreb	1,008	1,005	1,004	1,004	1,003	1,007
17	J	Splitsko-dalmatinska županija	1,008	1,005	1,006	1,006	1,005	1,006
20	K	Međimurska županija	1,007	1,005	1,006	1,005	1,006	1,008
15	J	Šibensko-kninska županija	1,008	1,007	1,006	1,005	1,005	1,007
9	J	Ličko-senjska županija	1,008	1,007	1,006	1,010	1,008	1,007
8	J	Primorsko-goranska županija	1,012	1,009	1,007	1,006	1,007	1,007
19	J	Dubrovačko-neretvanska županija	1,011	1,011	1,008	1,006	1,008	1,008
18	J	Istarska županija	1,014	1,010	1,009	1,007	1,007	1,010
13	J	Zadarska županija	1,013	1,010	1,008	1,009	1,008	1,012

# Renovation rate 3% and 1,6%

Scenario	S1			S2		
period	2021. – 2030.	2031. – 2040.	2041. – 2050.	2021. – 2030.	2031. – 2040.	2041. – 2050.
Renovation – residential (millions m <sup>2</sup> )	17,42	18,21	19,00	8,71	9,11	9,50
Renovation – non residential (millions m <sup>2</sup> )	8,94	8,94	8,94	4,88	4,88	4,88
Investment – residential and nonresidential (billion kn)	26,13	27,32	28,50	13,06	13,66	14,25
Total investment (billions kn)	81,95			40,97		

- S1 – renovation/replacement of 55.000 residential units annually
- S2 – renovation/replacement of 30.000 residential units annually



# Retrofit options

- Implementation of **individual retrofit measures** as individual steps in staged deep retrofit
- **Integral retrofit** includes more energy retrofit measures, with mandatory measures on building envelope (demand reduction first)
- **Deep retrofit** includes measures on building envelope AND technical systems resulting in useful heating energy ( $Q_{H,nd}$ ) reduction by 50% and primary energy ( $E_{prim}$ ) reduction by 50 % compared to consumption before retrofit
- **Comprehensive retrofit** includes optimal deep retrofit or integral retrofit measures in combination with measures for healthy indoor environment, improvement of mechanical resilience and stability – particularly earthquake resistance, and fire safety measures. Comprehensive retrofit can include other measures improving fulfillment of other core requirements for buildings.

# KPI – Energy roadmap 2050

2015.	policy for energy reconstruction of buildings	+
	agreement on requirements for reconstructed buildings in 2050	+
	overview of integrated refurbishment techniques for different building categories	+
	developed techniques for integral building refurbishment for most building types	+
	training materials developed	+
	governmental support for research in energy refurbishment	+
2017.	developed techniques for integral building refurbishment for most building types	+
	5% of construction companies certified for energy refurbishment to nZEB 5% workers trained for nZEB	+/-
	energy refurbishment in university and school curriculum	+/-
	plans for governmental incentives for energy refurbishment of public buildings and social housing developed	+
	governmental support for research and introduction of energy refurbishment	+/-
	governmental support for construction workforce training	+
2020.	5% of buildings refurbished to nZEB and high energy efficiency level	+
	1% of building refurbished to nZEB annually	-
	developed refurbishment techniques for most building types	+
	integral/deep/comprehensive refurbishment techniques developed	+
	20% of construction companies certified for energy refurbishment to nZEB 20% workers trained for nZEB	-
	government secures funding for refurbishment of public buildings and incentivizes social housing refurbishment	+
	user training by energy agencies etc.	+
	training materials for schools and faculties developed	+



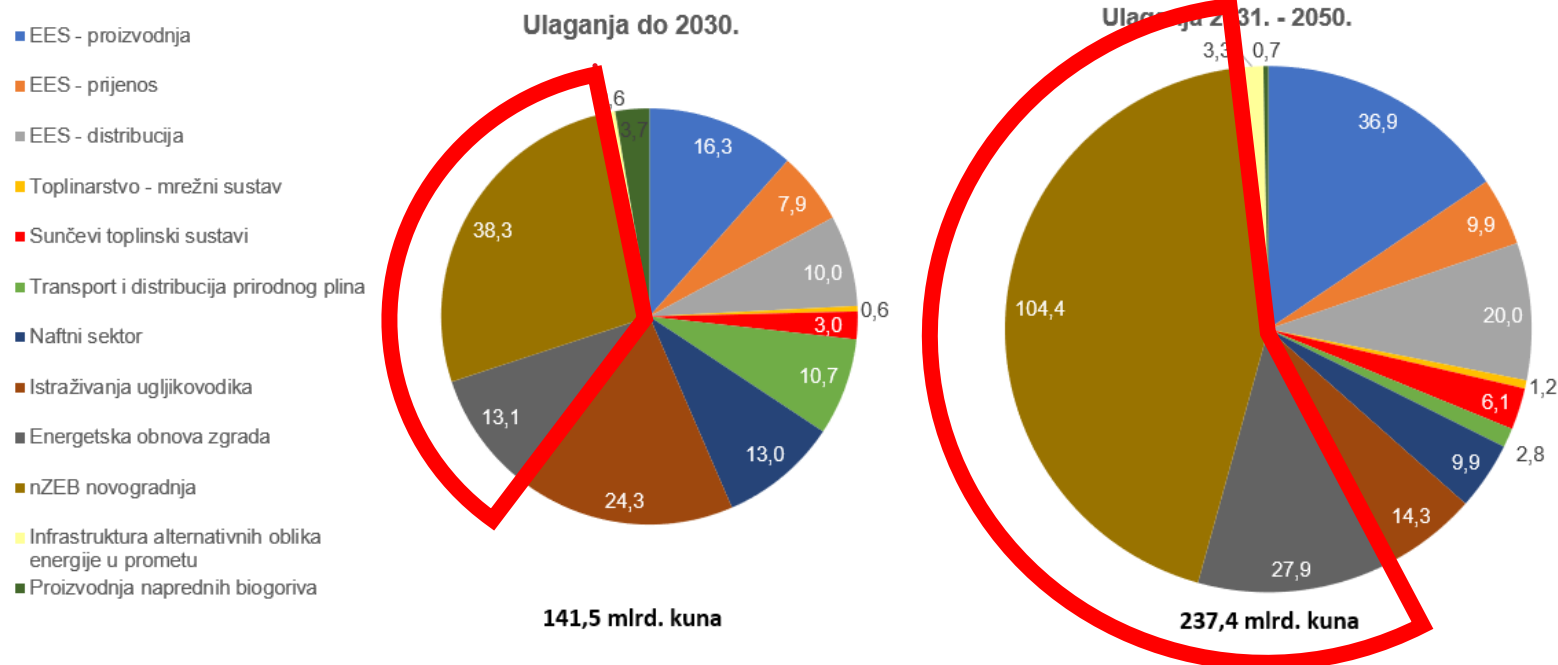
# KPI – Energy roadmap 2050

2025.	<p>12% of buildings nZEB or very energy efficient          2% of buildings integrally refurbished annually          techniques for integral refurbishment developed          20% of users aware of positive impact of energy refurbishment of buildings          techniques for refurbishment of historical buildings under development          50% of construction companies certified for energy refurbishment for nZEB, 50% of workforce trained in energy refurbishment          governmental support for the banks financing integral refurbishment for socially sensitive groups          user education for energy refurbishment</p>
2030.	<p>30% buildings nZEB or very energy efficient          3,5% buildings integrally refurbished annually          legislative for all buildings to be highly energy efficient as precondition for sale rent prepared          integral refurbishment requirements fully developed with optimized costs          construction companies certified for energy refurbishment, workforce trained in energy refurbishment          50% users aware of positive impact of energy refurbishment of buildings          techniques for refurbishment of historical buildings developed</p>
2040.	<p>60% of buildings nZEB or very energy efficient          3,5% of buildings integrally refurbished annually          4% of historical buildings refurbished annually          95% users aware of positive impact of energy refurbishment of buildings</p>
2050.	<p>GHG reduction by 80%          all buildings nZEB or very energy efficient          4% of buildings integrally refurbished annually          95% users aware of positive impact of energy refurbishment of buildings</p>

# Retrofit volume and cost

Razdobljet	2021. – 2030.	2031. – 2040.	2041. – 2050.
<b>retrofit volume - residential</b>			
(million m <sup>2</sup> )	17,77	24,57	18,58
<b>retrofit volume – non - residential</b>			
(million m <sup>2</sup> )	10,67	14,10	10,98
<b>retrofit cost – residential and non-residential</b>			
(billion kn)	71,24	97,26	74,73
<b>total retrofit cost (billion kn)</b>	243,23		
<b>replacement of demolished buildings - residential</b>			
(million m <sup>2</sup> )	2,40	2,16	2,54
<b>new buildings - residential</b>			
(million m <sup>2</sup> )	9,60	9,60	10,16
<b>new buildings – non-residential</b>			
(million m <sup>2</sup> )	3,27	2,49	1,69
<b>total cost for replacement of demolished buildings and new buildings (billion kn)</b>	118,39	108,76	107,63
<b>total cost retrofit and new buildings (billion kn)</b>	334,77		

# Required energy sector and building renovation investment – Energy strategy 2030.



Thank you

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