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Öko-Institut e.V.
Institut für angewandte Ökologie
Institute for Applied Ecology

German *Energiewende* – Different visions for a (nearly) climate neutral building sector in 2050

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Panel 6: buildings policies, directives and programmes
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Agenda

1 Background and objectives of the study

2 Methodology and basic assumptions

3 Different visions how a nearly climate neutral building stock could look like in 2050

4 Conclusions and policy challenges

Background

- Study „Klimaneutraler Gebäudebestand 2050“, funded by the German Federal Environment Agency
- Main aim to investigate how the German building stock can be transformed into a “nearly climate-neutral” state by 2050
- In detail different visions/target states explored of how a nearly climate-neutral building stock could be realised in 2050
- Visions/target states parameterized as to reflect a rather broad corridor of visions in terms of two central dimensions
  - the reduction in final energy demand (efficiency) and
  - the composition of the fuel and technology mix (mainly the share of renewables)
- Important note: Analysis has been carried out before COP 21. Paris agreements imply even more mitigation efforts than presented here.

Methodology and basic assumptions

- Definition for nearly climate-neutral building stock
  - reduction of the non-renewable primary energy demand for the thermal conditioning of the building stock by 80% (compared to 2008)
  - the remaining, very low final energy demand, mainly supplied by renewable energy sources
- Indicators such as final and primary energy demand, CO_2-emissions and costs calculated based on stock model of the German building stock (residential and non-residential buildings)
- Eligible heating technologies: gas condensing boilers, wood/pellet condensing boilers, electric heat pumps, gas driven CHP, DH, +/- solar thermal, +/- ventilation/heat recovery, +/- onsite PV, absorption cooling)
- Three energy/renovation standards (non-renovated, fully renovated, fully renovated plus)
- Biomass restricted to 85 TWh; no imports of biomass, RES-E or PtX

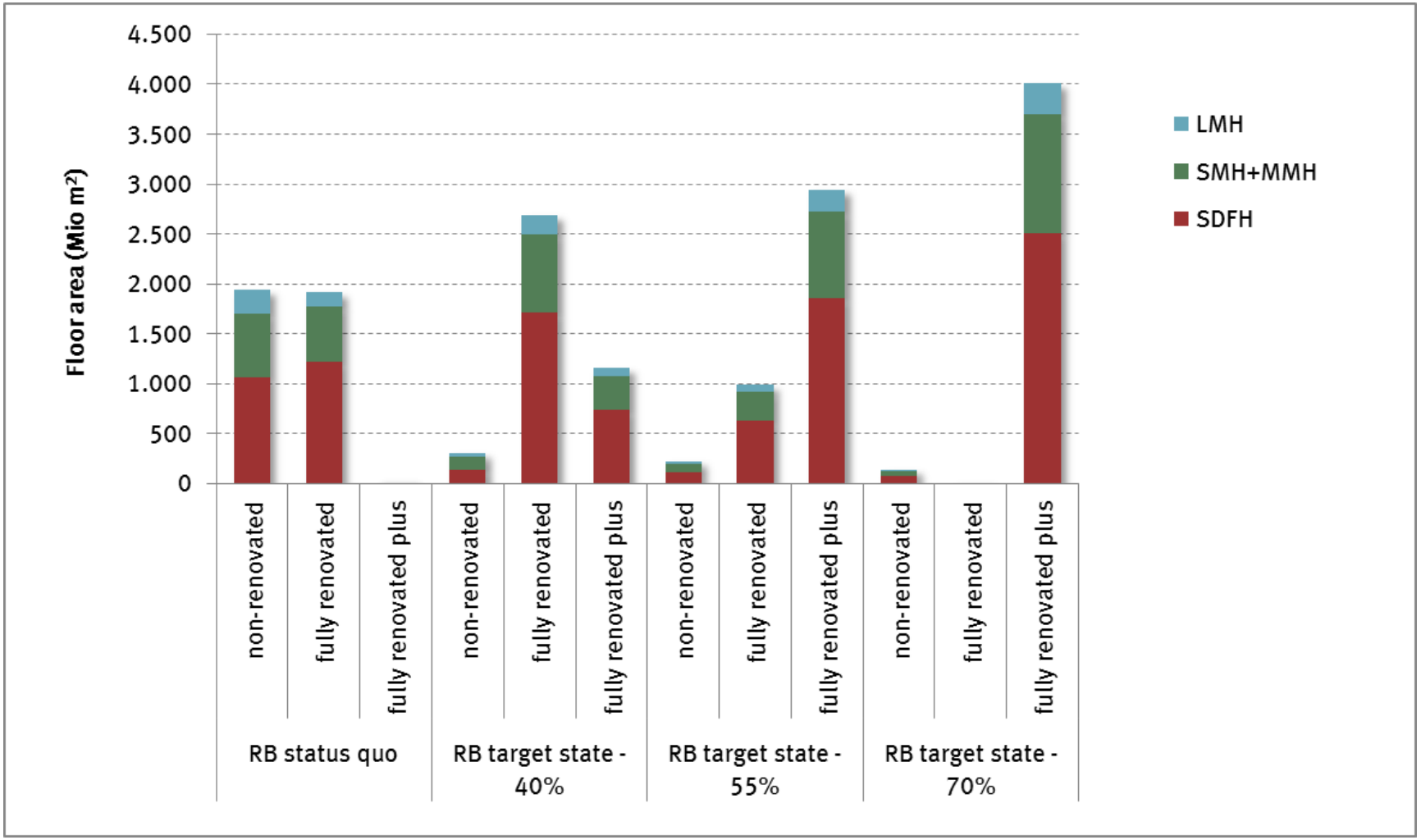
Key parameters characterising the two renovation standards

		Fully renovated	Fully renovated plus
		according to minimum standard from building code (EnEV 2014) for new buildings	according to the standard for passive houses
U-value external wall	W/(m²*K)	0,29	0,10
U-value roof	W/(m²*K)	0,21	0,10
U-value floor	W/(m²*K)	0,37	0,20
U-value window	W/(m²*K)	1,37	0,70
g-value window	W/(m²*K)	0,63	0,45

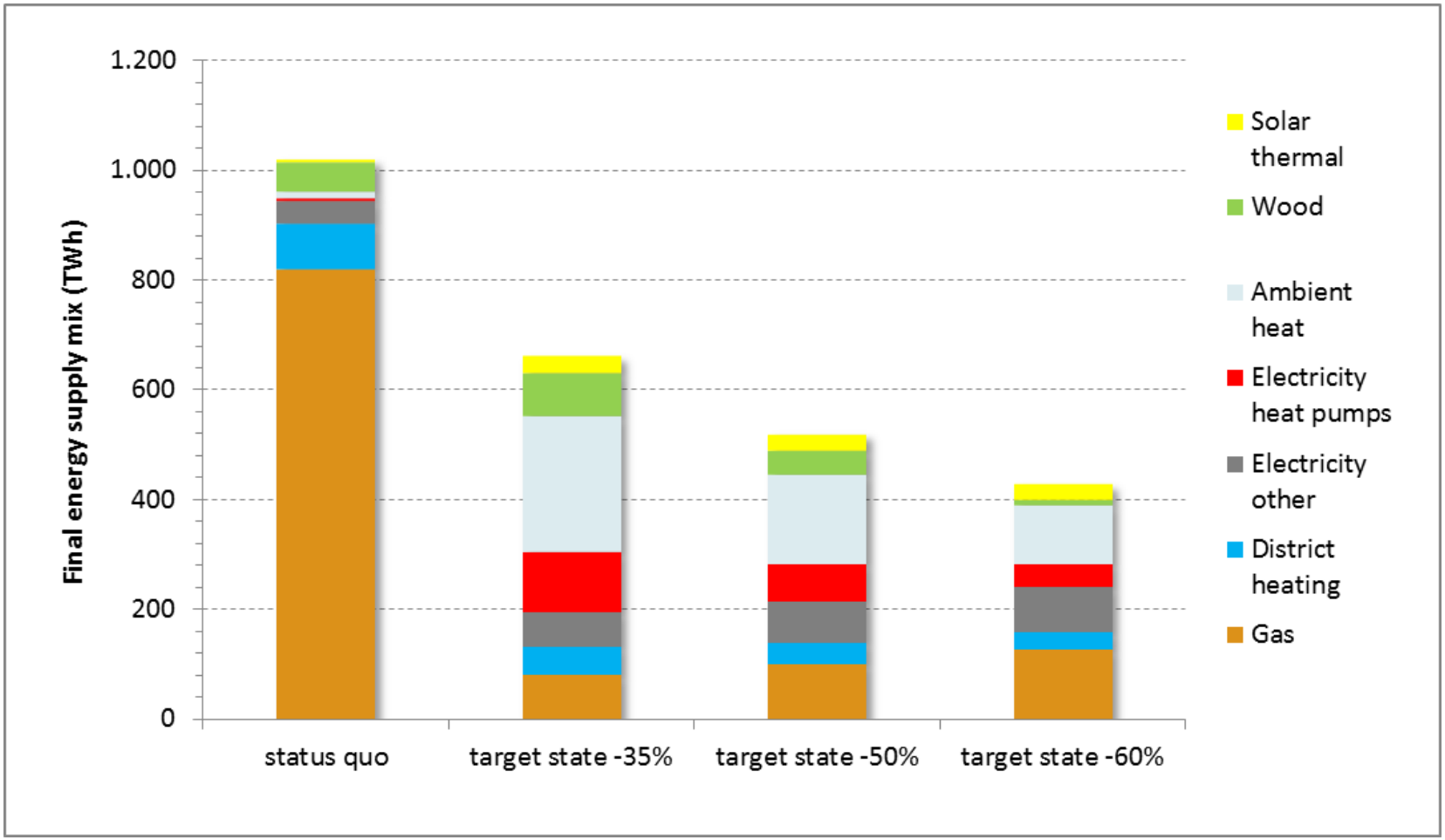
Definition of visions/target states

	Residential buildings			Non-residential buildings		
Rate at which new buildings are being built	decreasing from 0,85% in 2015 to 0,2 % in 2050			constant at 1,35 % annually		
Rate at which buildings are taken out of use	constant at 0,3 % annually			constant at 1,35 % annually		
Floor area development until 2050	+ 7 %			+/- 0 %		
Visions/target states	**Target state -70 %**	**Target state -55 %**	**Target state -40 %**	**Target state -45 %**	**Target state -35 %**	**Target state -25 %**
Reduction in final energy consumption until 2050	-70 %	-55 %	-40 %	-45 %	-35 %	-25 %

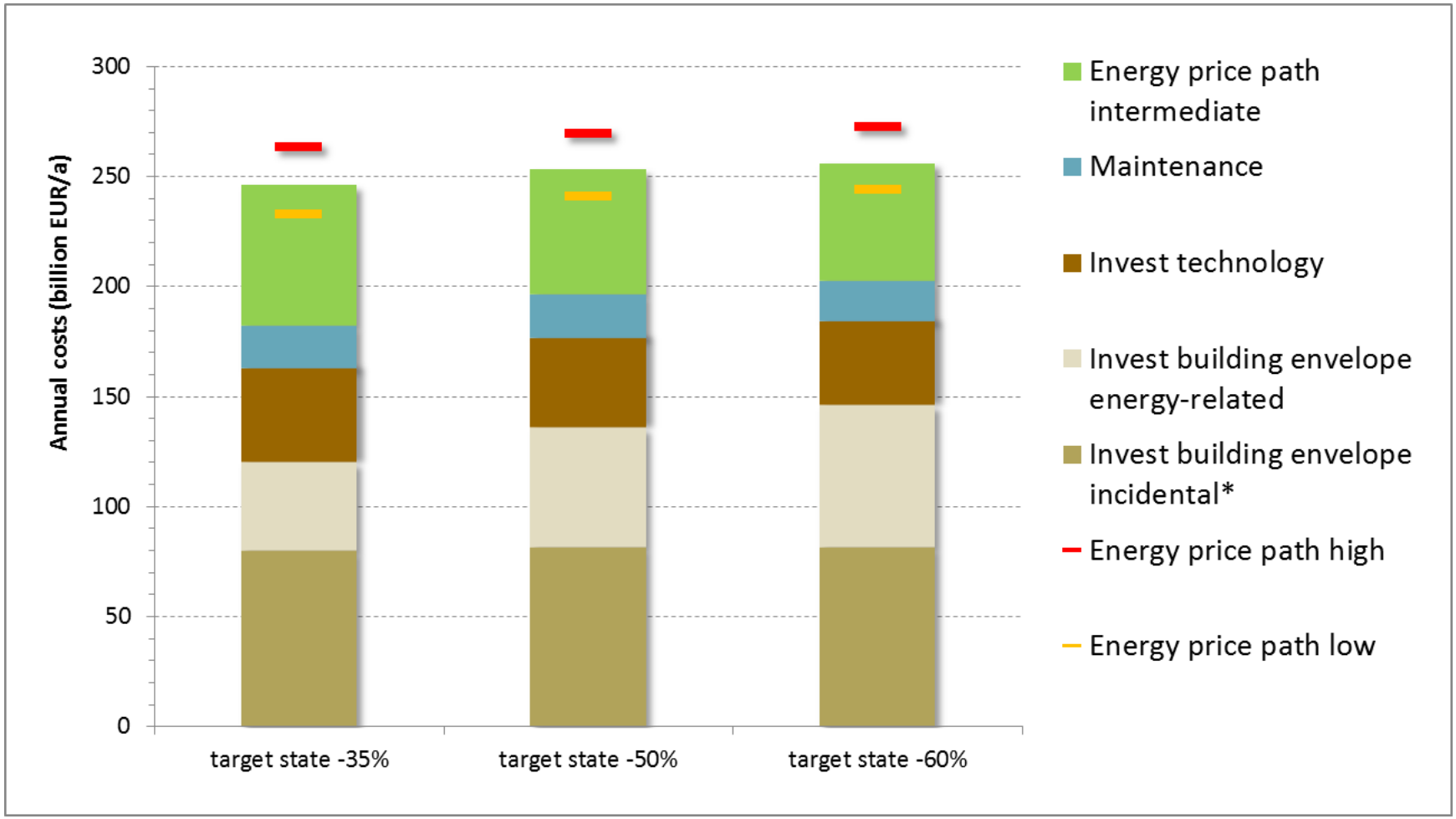
Floor area distribution of the different renovation standards in residential buildings



Final energy supply mix for the visions/three target states of the entire building sector



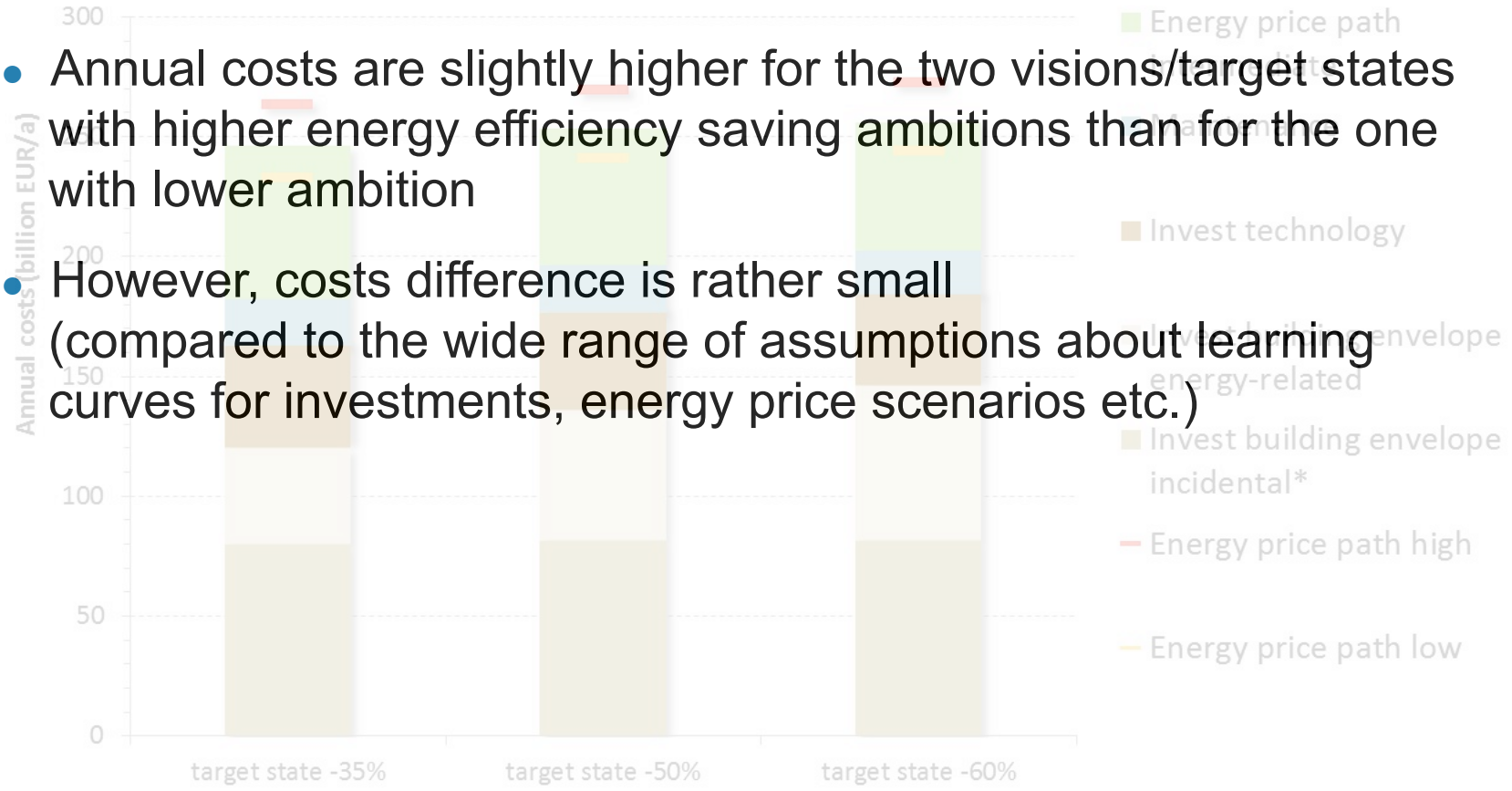
Annual costs 2050



*) *Incidential costs* are costs that would occur anyway irrespective of whether a renovation is combined with an energetic modernization

Annual costs 2050

- Annual costs are slightly higher for the two visions/target states with higher energy efficiency saving ambitions than for the one with lower ambition
- However, costs difference is rather small (compared to the wide range of assumptions about learning curves for investments, energy price scenarios etc.)



Conclusions

- Due to renovation restrictions final energy demand can at the most be reduced by approx. 65%
- From a cost perspective analysis does not lead to a clearly preferable result of one of the visions/target states
- Other criteria become more relevant when deciding which vision/ target state to be pursued, e.g.
  - acceptance regarding the various measures (roll-out of new RES incl. infrastructure vs profound renovation activities/thermal insulation)
  - challenges that arise from the increased roll-out of heat pumps, e.g. regarding the interaction with the electricity system
  - risk mitigation (cost implications if renovation measures were to be carried out beyond the typical reinvestment cycle, sensitivity to energy price increases)

Policy challenges

- Efforts to significantly increase the refurbishment rate over the coming decade
- Measures ensuring that the refurbishment market is capable to deliver the growing refurbishment volume at high quality
- Support framework aiming at a nearly zero-energy like standard to become the lead standard for renovations in the mid-term
- Strengthening incentives or regulatory requirements for gradually shifting the stock of conventional (fossil based) heating systems to RES + heat distribution systems towards lower temperatures
- Strengthening R&D efforts that aim at developing high-performance insulation materials and refurbishment concepts (e.g. industrial pre-fabrication of insulation elements)
- Development of an allocation strategy for biomass
- Improving data availability and monitoring schemes

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Vielen Dank für Ihre Aufmerksamkeit!
Thank you for your attention!

Haben Sie noch Fragen?
Do you have any questions?