EBC

Energy in Buildings and Communities Programme

BEST PRACTICES OF DEEP ENERGY RETROFIT BUILDING PROJECTS FROM AROUND THE WORLD

Deep Energy Retrofit of Buildings, Technical and Business Strategies
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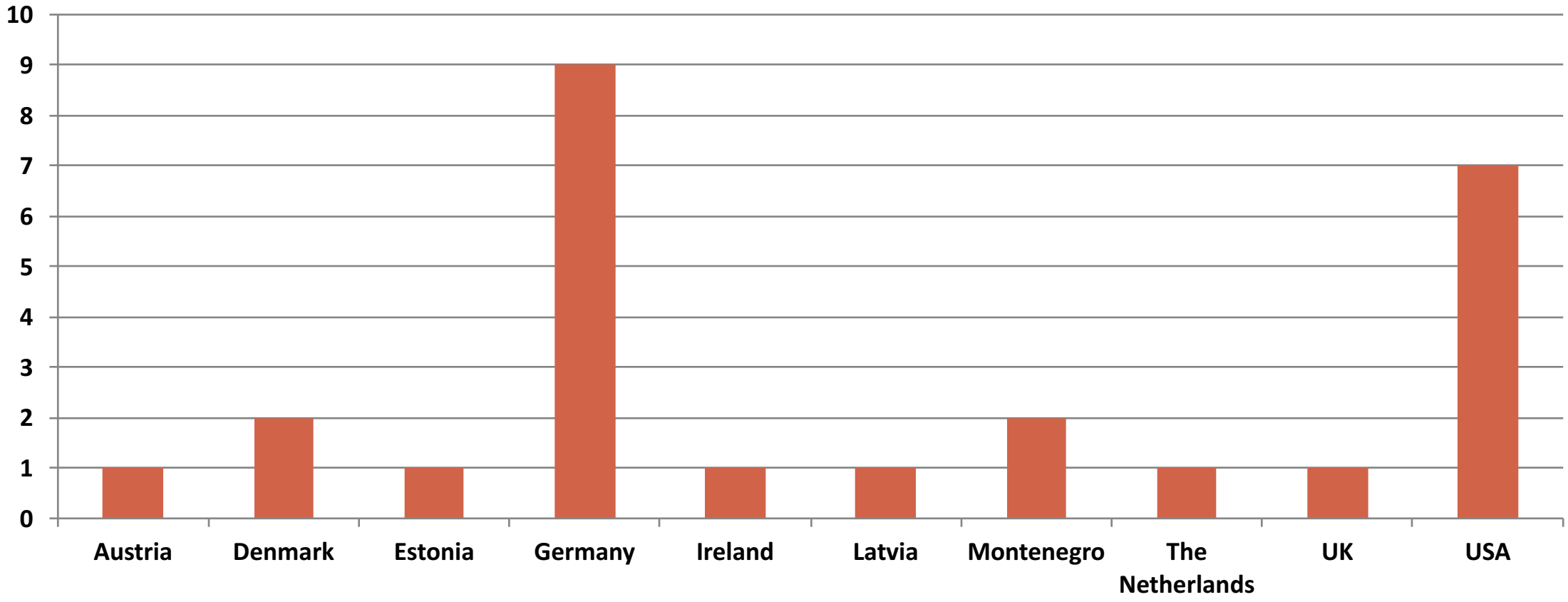
SCOPE OF THE WORK

- To support decision makers and experts with profound information for their future decisions by:
  - showing successful renovation projects as inspirations in order to motivate decision makers and stimulate the market
  - learning from these forerunner projects by analysing the presented information

OVERVIEW OF CASE STUDIES

A total of 26 case studies were collected and documented:



20 schools and offices and 6 multifamily houses

ANALYSES UNDERTAKEN

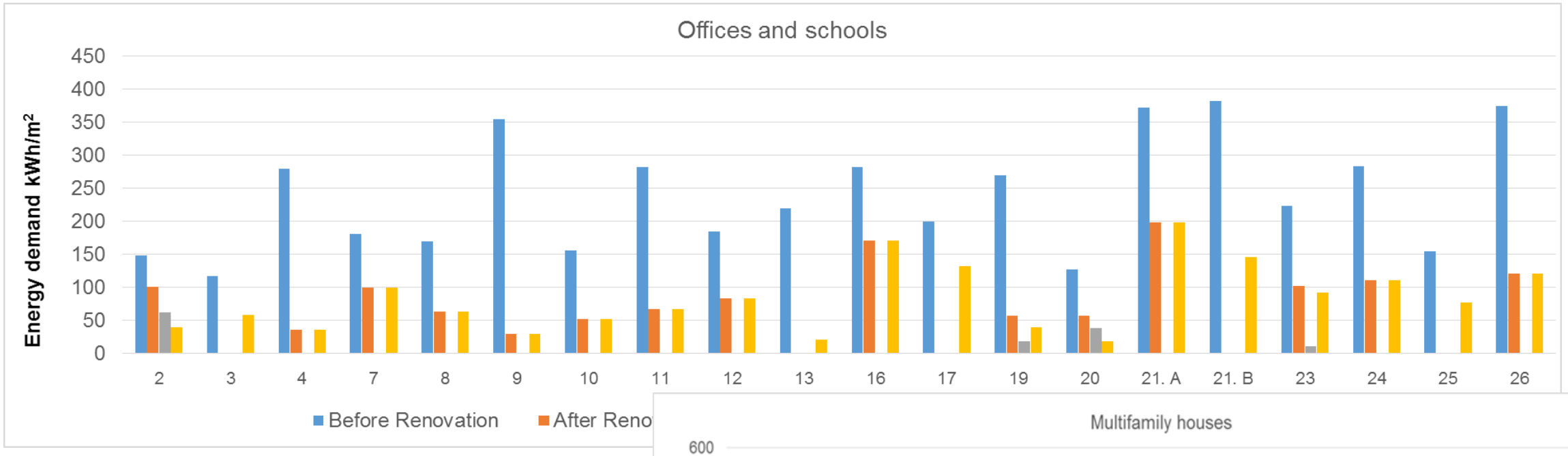
- Energy saving strategies
- Energy savings/reduction
- Reasons for renovation/anyway measures
- Co-benefits
- Business models and funding sources
- Cost effectiveness
- Experiences/lessons learned

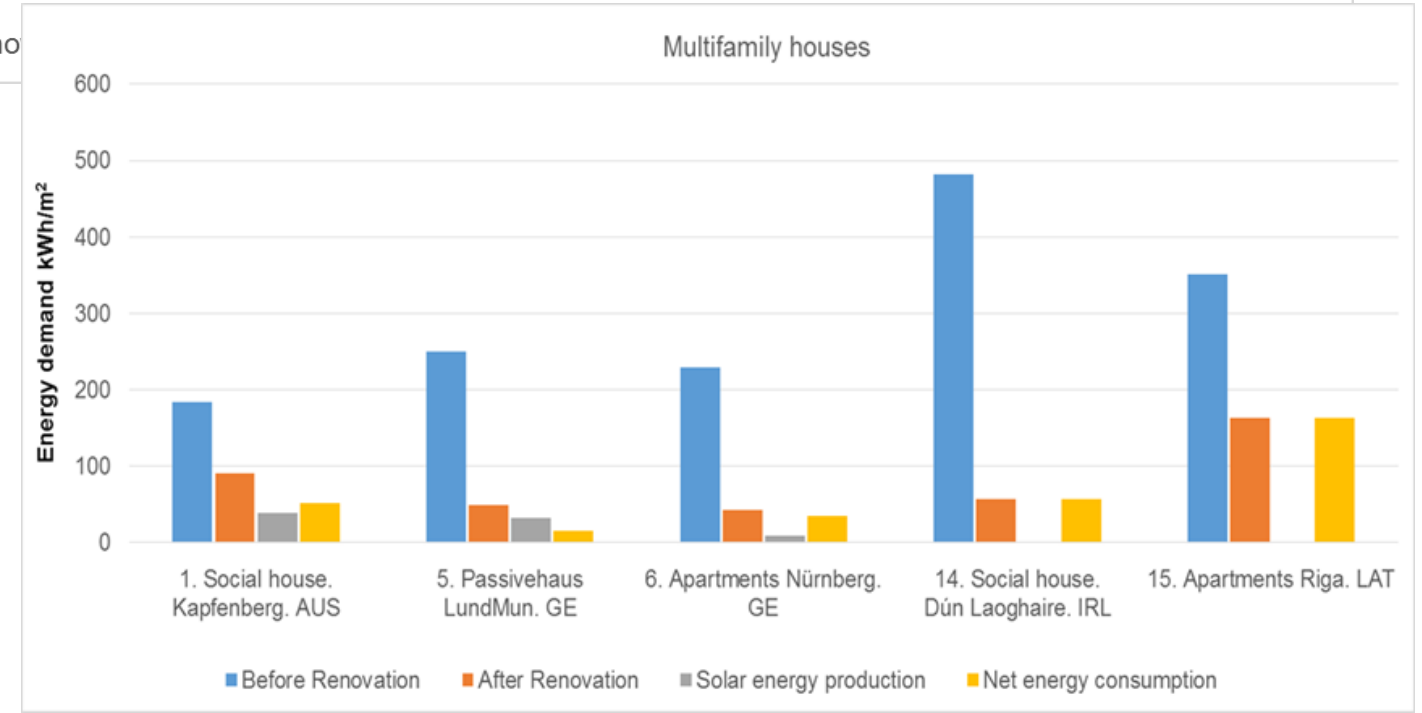
ENERGY SAVING STRATEGIES

>13

	Core bundles of technologies															
	Building Envelope						Lighting & Electrical systems		HVAC					Renewable energy systems		
	Wall insulation	Roof insulation	Floor insulation	New window/ door	Roof lights	Daylight Strategy/external shading	Efficiency lighting/control	BEMS	MVHR	New ventilation system	New heat–cooling supplier/distribution system	New heat supply: radiators, floor heating	Air source heat pump	Ground coupled heat pump	Solar thermal system	Photovoltaic panels
1. Social house Kapfenberg. AT	√	√	√	√					√		√				√	√
2. School Egedal. DK	√						√	√	√	√	√					√
3. OfficeVester Voldgade. DK	√			√		√	√		√		√			√	√	
4. Kindergarten Valga. EE	√	√	√			√	√		√		√				√	
5. Passivehaus LudMun. GE	√	√	√	√						√		√				√
6. Apartments Nûrnberg. GE	√	√	√	√					√		√				√	
7. Gym Ostildern. GE	√	√		√	√		√		√							
8. School BaWû. GE	√	√		√			√			√	√					√
9. School Osnabrueck. GE	√	√	√	√			√		√	√	√			√		
10. School Olbersdorf. GE	√	√	√	√	√	√	√			√				√		
11. Passivehaus Office Darmstadt. GE	√	√	√	√			√		√	√						
12. Town Hall- Baviera. GE	√	√	√	√	√		√		√		√					
13. Passivehaus High school NordWest. GE	√	√	√	√		√	√		√					√		√
14. Social housing Dún Laoghaire. IE	√	√	√	√					√		√					
15. Apartments.Riga. LV	√	√	√	√			√		√		√	√				
16. Primary school Plevlja. MON	√			√			√	√			√					
17. Student Dormitory Kontor. MON	√	√		√			√				√	√			√	
18. Shelter home. Leeuwarden. NL	√	√	√	√		√	√		√	√	√				√	
19. Mildmay Center London. UK		√	√	√		√	√		√	√				√	√	√
20. Federal building Grand Junction. USA	√	√			√		√			√	√	√		√		√
21. Office/Federal building Maryland. USA		√		√			√	√	√	√	√	√	√	√	√	√
22. Intelligence Community Maryland. USA	√	√	√	√		√	√		√	√					√	
23. Office.Seattle WA. USA				√		√	√		√				√			√
24. Beardmore Priest River. USA	√	√		√	√		√			√			√			
25. Office/Warehouse Indio. USA	√	√		√	√	√	√		√	√	√		√			√
26. Federal building Denver-Colorado. USA	√	√	√	√			√				√		√		√	

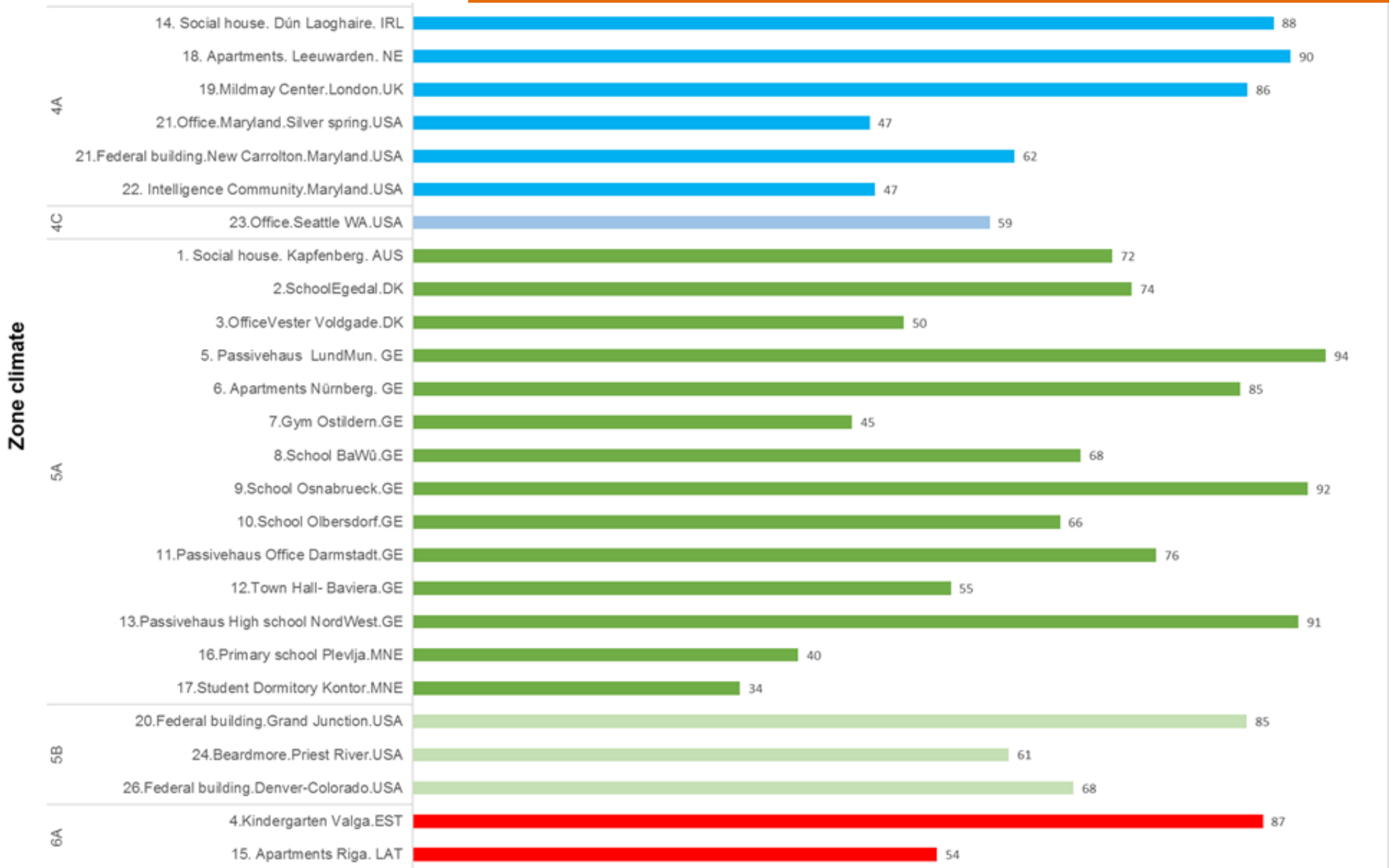
ENERGY BEFORE AND AFTER



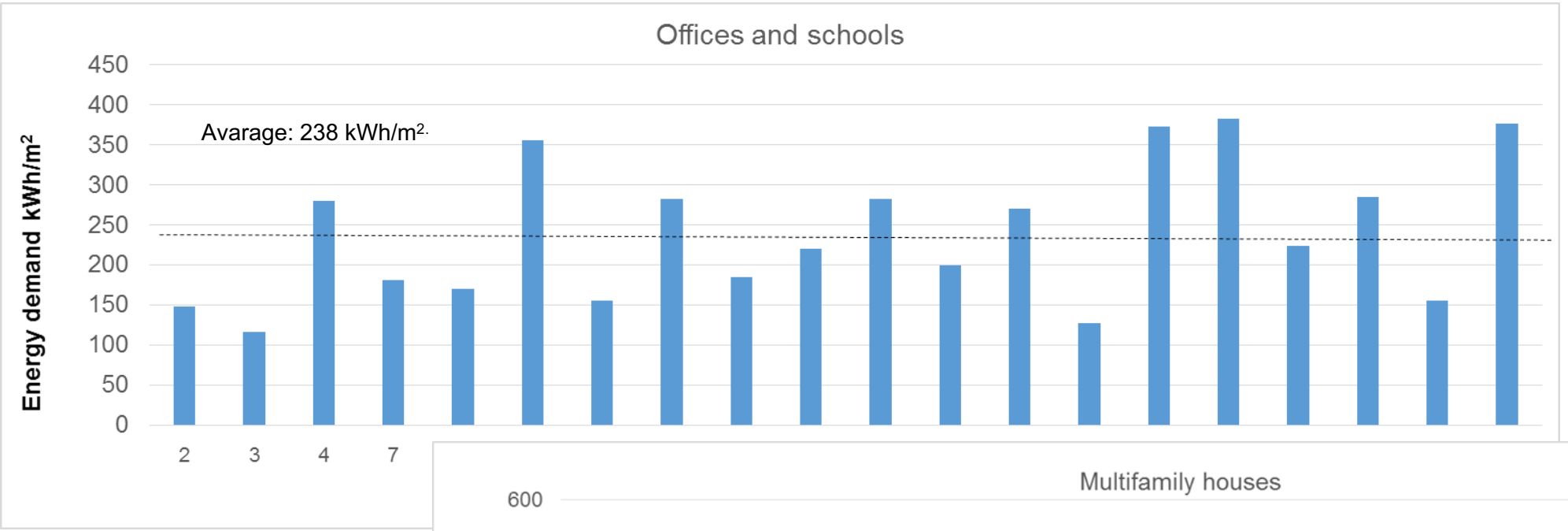


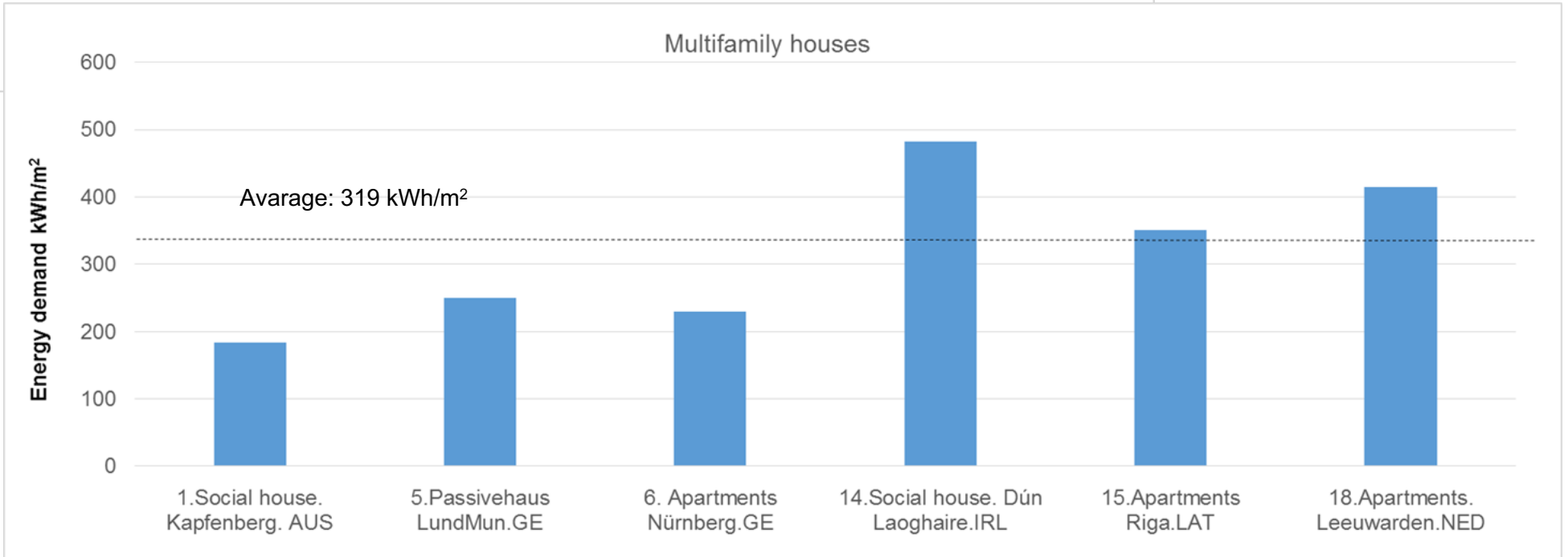
Climate zone - ASHRAE

ENERGY SAVINGS BY CLIMATE ZONE, %

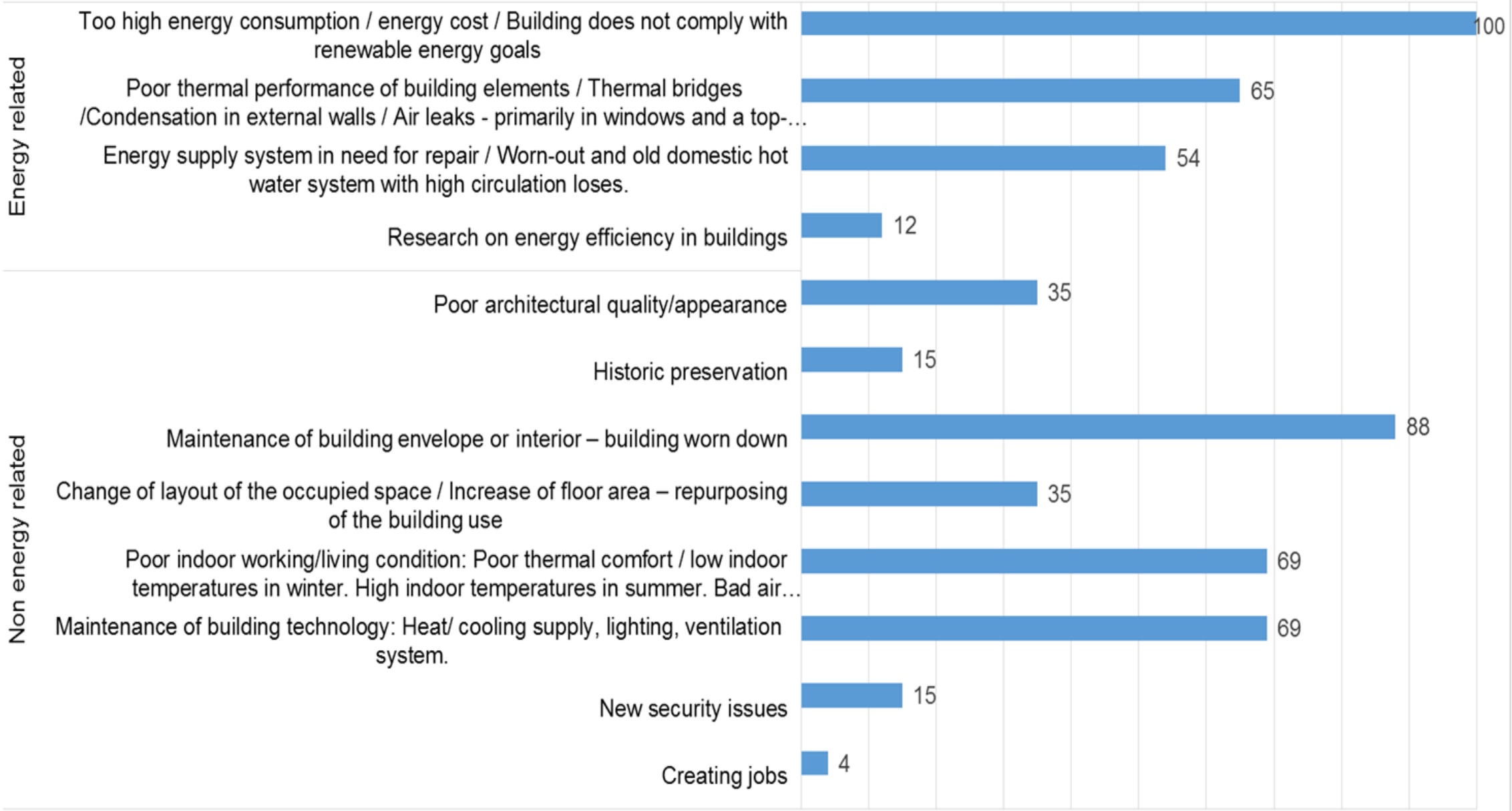


ENERGY USE INTENSITY PRE-DER

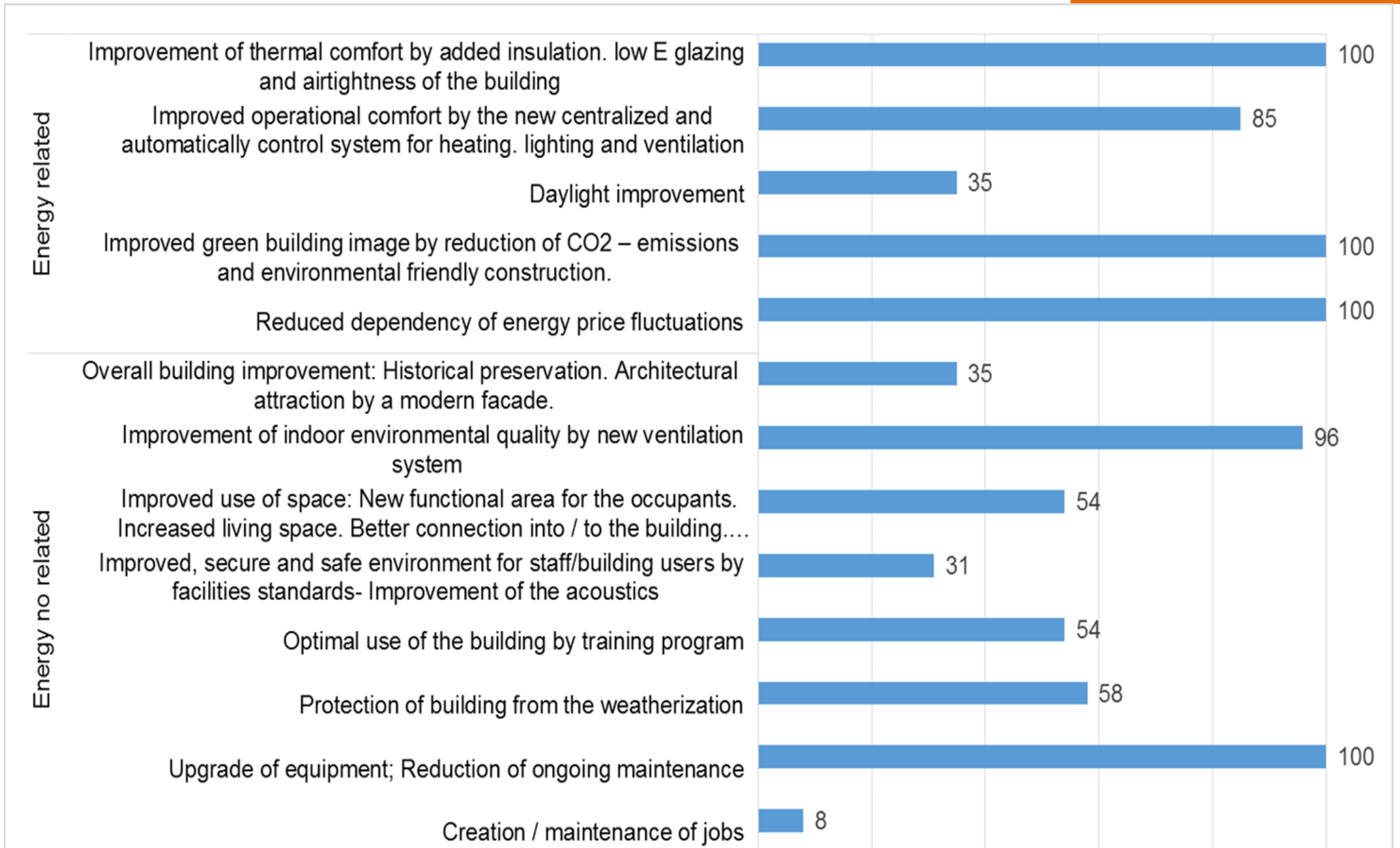




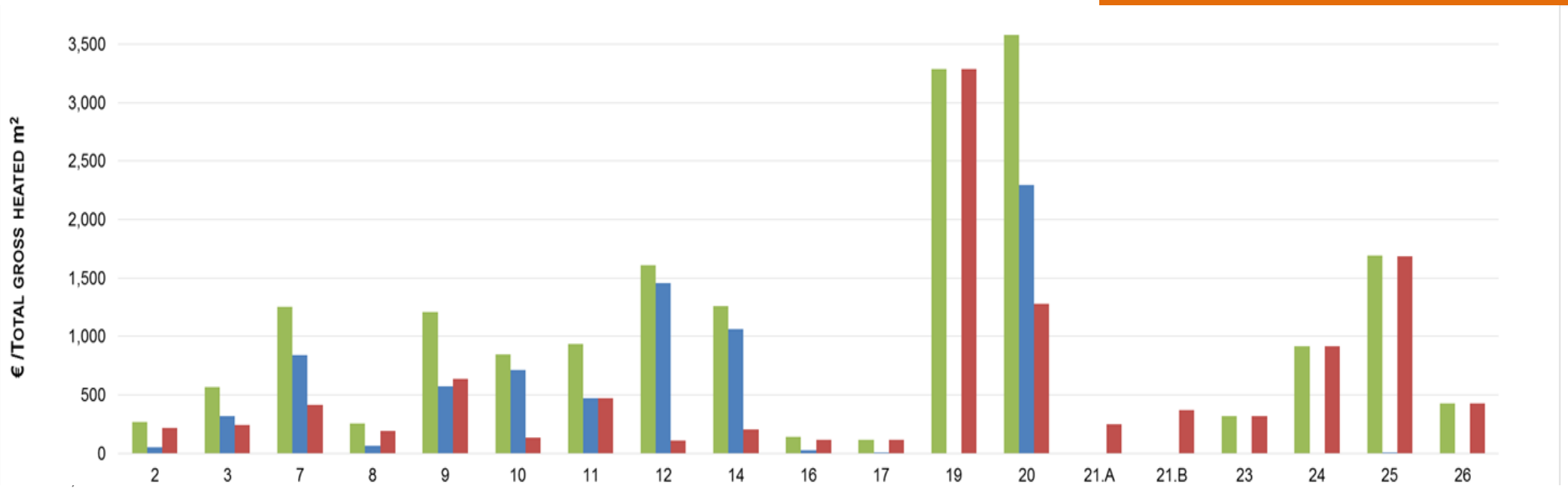
ANYWAY MEASURES/REASONS FOR RENOVATION

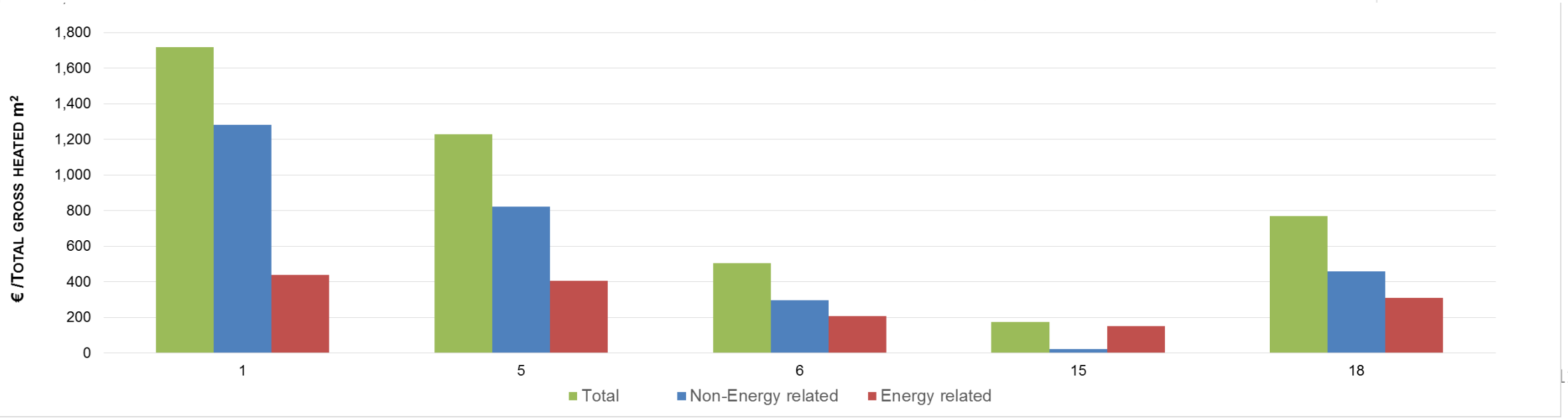


CO-BENEFITS

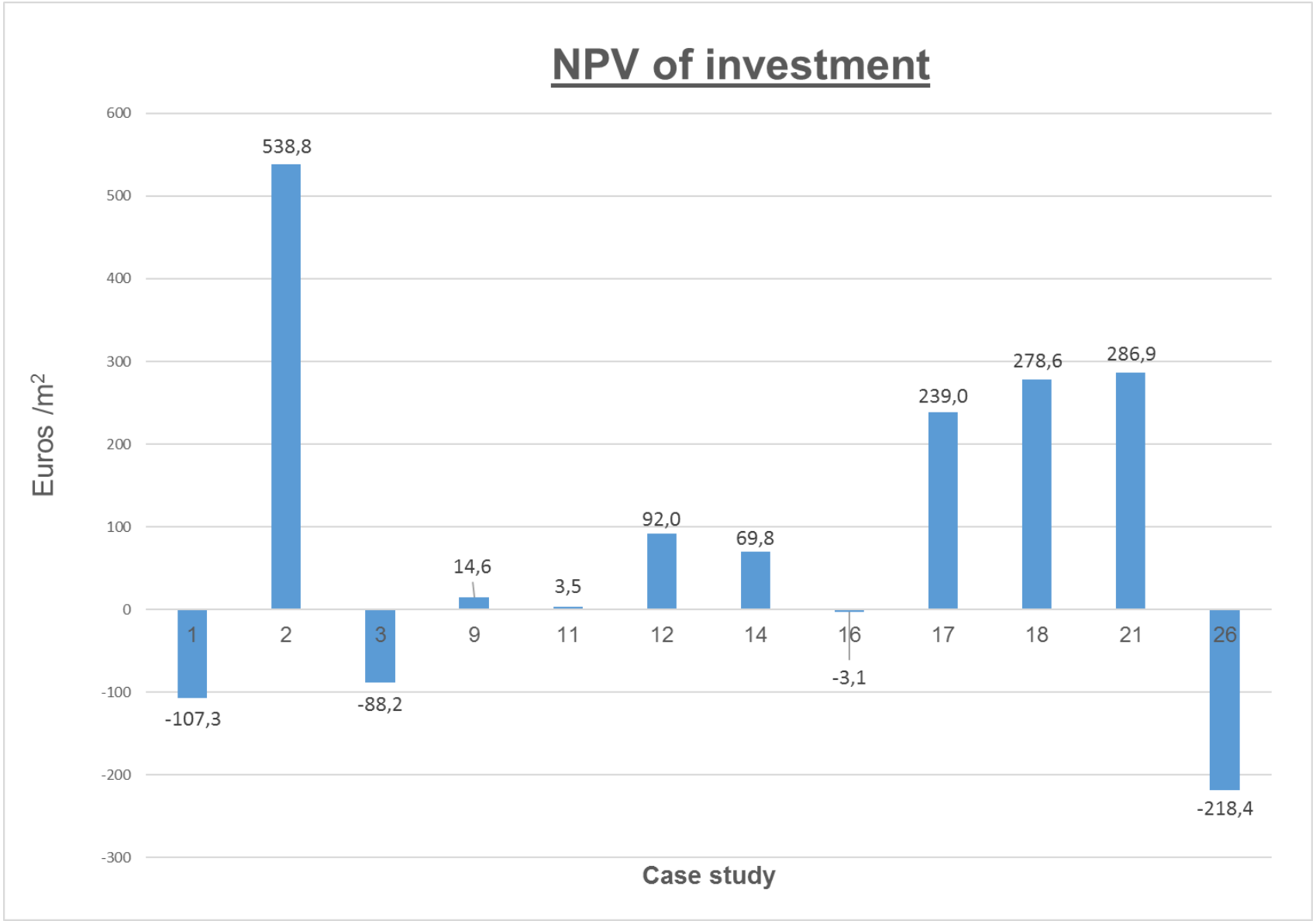

Energy related
Improvement of thermal comfort by added insulation. low E glazing and airtightness of the building
100
Improved operational comfort by the new centralized and automatically control system for heating. lighting and ventilation
85
Daylight improvement
35
Improved green building image by reduction of CO2 – emissions and environmental friendly construction.
100
Reduced dependency of energy price fluctuations
100
Energy no related
Overall building improvement: Historical preservation. Architectural attraction by a modern facade.
35
Improvement of indoor environmental quality by new ventilation system
96
Improved use of space: New functional area for the occupants. Increased living space. Better connection into / to the building....
54
Improved, secure and safe environment for staff/building users by facilities standards- Improvement of the acoustics
31
Optimal use of the building by training program
54
Protection of building from the weatherization
58
Upgrade of equipment; Reduction of ongoing maintenance
100
Creation / maintenance of jobs
8

RENOVATION COST





COST EFFECTIVENESS



CONCLUSIONS

1. Average savings of 66.4% were achieved for these case studies
2. Cost-effective DER can be obtained by implementing bundles of technologies (envelope + mechanical and supply systems) - independent of building use, climate and energy prices (e.g. energy savings >50% for three buildings in USA by EPC)
3. Most often the reasons for renovation were not energy related – anyway renovation - but these go well hand-in-hand with energy reasons
4. Co-benefits resulting from the energy saving renovation should be noted and to the degree possible given an economical value – which is often higher than that of the energy saving itself
5. Based on “3 and 4” it is tempting to say that the energy savings in reality is a co-benefit of the anyway renovation!

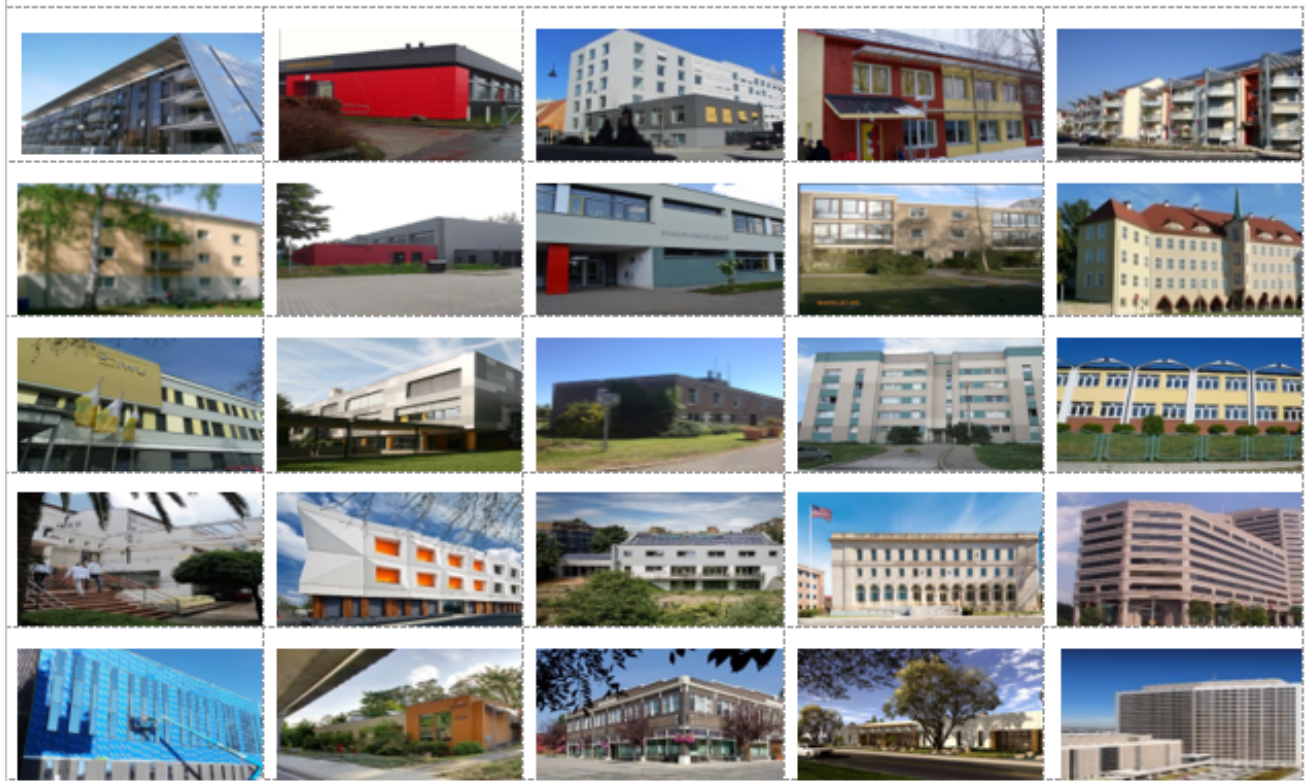
International Energy Agency

Deep Energy Retrofit - Case Studies

Business and Technical Concepts for Deep Energy Retrofit of Public Buildings - Annex 61

Energy in Buildings and Communities Programme

January 2016



http://iea-annex61.org/