Tepsli

Helicopter view of market-based energy saving measures in Estonian commercial buildings

Delta E
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- EPBD and EED discussions need input
- National Renovation Strategy has a view from space, helicopter view was needed

- Method:
  - Use actual results from energy audits/energy efficiency reports to develop generalisations on energy savings potential, make assumptions on the energy efficiency measures and their cost + energy use impact
  - Use the Estonian Building Registry data on the purpose of use, create groups of buildings and apply the generalisations on energy efficiency measures

Group	Final net floor area, m²	Initial net floor area, m²	How much of the area was reduced in the analysis
Commerce	4 954 772	5 300 480	7%
Bureau	5 404 106	5 590 648	3%
Entertainment	2 599 496	2 599 496	0%
Industrial buildings	6 930 249	11 693 794	41%
Hospitals	1 251 194	1 251 194	0%
Accommodation	2 075 016	2 075 016	0%
Transportation	1 432 125	5 116 636	72%
Logistics	4 356 818	7 152 567	39%
Total	**29 003 776**	**40 779 829**	**29%**

Given the degree of generalization of the study, the impacts of energy efficiency measures were accounted for as packages, and the contribution of individual measures was not calculated separately.

Two renovation packages were developed for the buildings:

- technical system improvements
- deep renovation

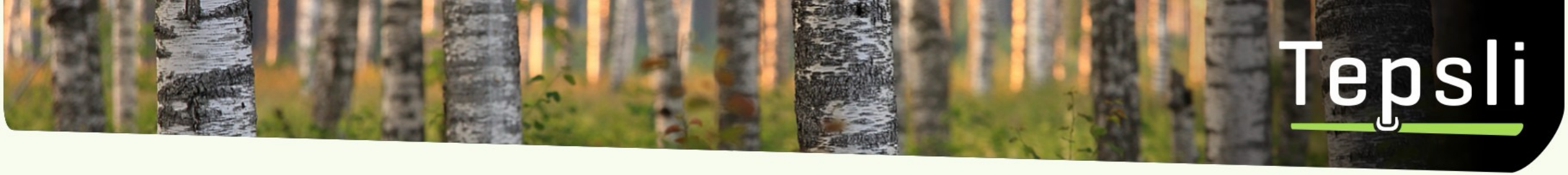
Variation in the cost and energy savings of the measures across groups were sufficiently similar, considering the level of generalization of the entire analysis.

- Construction or modernisation of building automation systems
- Installation of room climate control
- Renovation and automation of lighting
- Replacement of circulation pumps
- Installation of a Virtual Power Plant/Demand-side Response
- Water-saving measures
- Controller replacement and more efficient control of heating plants
- Replacement of controllers and improvign programming of AHUs
- Replacement or installation of improved automation of cooling and heating units
- Installation and automation of ceiling fans
- Construction of solar power plants (on a few sites)
- Change of primary energy source (on few objects)
- Optimization of compressed air systems (on industrial sites)
- Establishment of measurement and monitoring systems
- Reactive energy compensation
- Improving the quality of maintenance and electrical operation

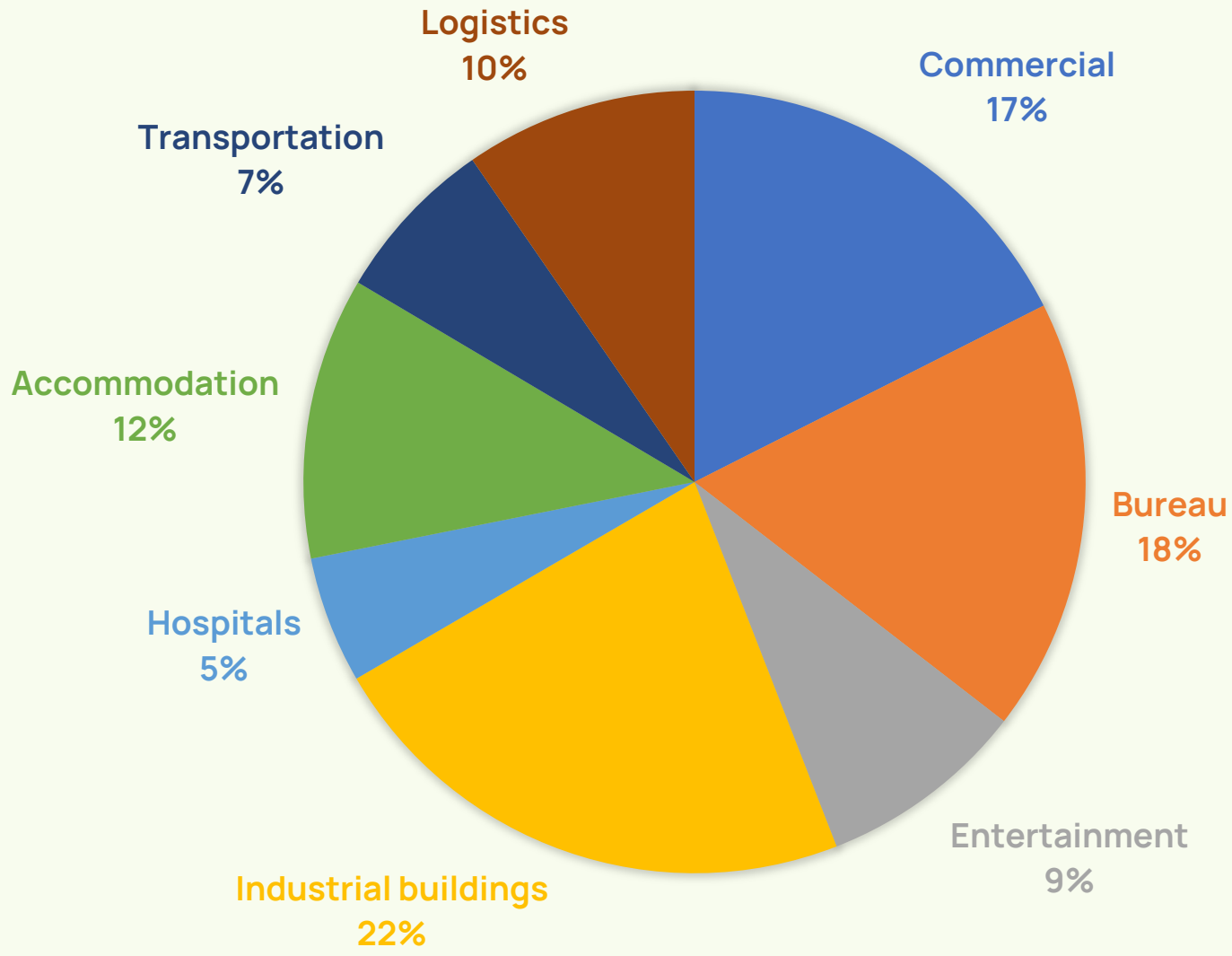
Parameter	Unit	Commercial	Bureau	Entertainment	Industrial buildings	Hospitals	Accommodation	Transportation	Logistics	Total	Total (actual area in use)
Net floor area	m^2	4 954 772	5 404 106	2 599 496	6 930 249	1 251 194	2 075 016	1 432 125	4 356 818	29 003 776	17 000 000
Energy use per floor area	kWh/m^2*a	201	188	188	185	238	319	272	125	203	203
Energy savings potential	kWh/m^2*a	47	43	66	56	64	77	103	33	55	55
Total energy use of group	GWh	997	1 017	489	1 279	298	662	390	546	5 892	3 454
Total energy savings of group	GWh	231	230	172	387	80	159	148	145	1 589	932
Energy savings potential	%	23%	23%	35%	30%	27%	24%	38%	27%	27%	27%
Total investment cost	M€	210	215	88	282	59	136	54	112	1171	687
Investment cost per floor area	€/m^2	42	40	34	41	47	66	38	26	40	40
Group CO_2 savings	t/a	149 307	110 512	73 190	195 553	27 106	72 847	30 070	84 336	698 210	409 242
CO_2 savings per m^2	kg*m^2/a	30	20	28	28	22	35	21	19	24	24
Payback time	a	4,25	5,25	4,50	4,73	5,44	4,95	3,67	5,33	4,76	4,76
End user savings per year	M€/a	41	40	17	65	9	29	16	22	239	138

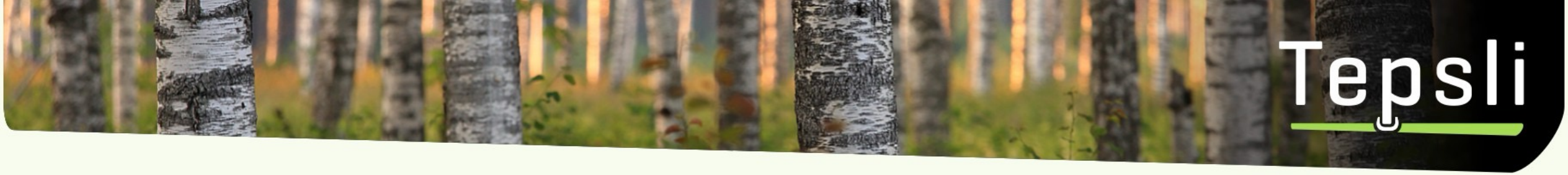
Payback time		Self-consumption rate										
Grid electricity costs, €/MWh	Electricity sold to the grid, €/MWh	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
20	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
40	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24
60	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25	25	18
70	20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24	20	17	15
80	30	N/A	N/A	N/A	N/A	N/A	N/A	25	20	17	15	13
90	40	N/A	N/A	N/A	N/A	N/A	N/A	25	17	15	13	12
100	50	N/A	N/A	N/A	N/A	N/A	24	18	16	13	12	10
110	60	N/A	N/A	N/A	N/A	N/A	21	16	14	12	10	9

- It is estimated that the total energy consumption of buildings in use with reconstruction potential is about 3.5 TWh per year, and the **potential energy saving potential when implementing the reconstruction package of technical systems is 0.9 TWh per year, or about 27%**, and the reduction in greenhouse gas emissions is 84,366 tons per year.
- **It is estimated that the implementation of the energy-saving potential of the technical systems reconstruction package would require an investment of ca 700 million euros** in 2023 prices.
- **The users of the analysed non-residential buildings would save about 140 million euros per year** in energy cost savings in today's energy prices by implementing the utility systems package.
- **The payback periods for the reconstruction of utility systems are relatively short**, about 5 years, and it is theoretically possible to finance projects from companies' own resources or with the help of banks. The annual return on these investments is approximately 20%.



DIVISON OF SAVINGS BETWEEN GROUPS

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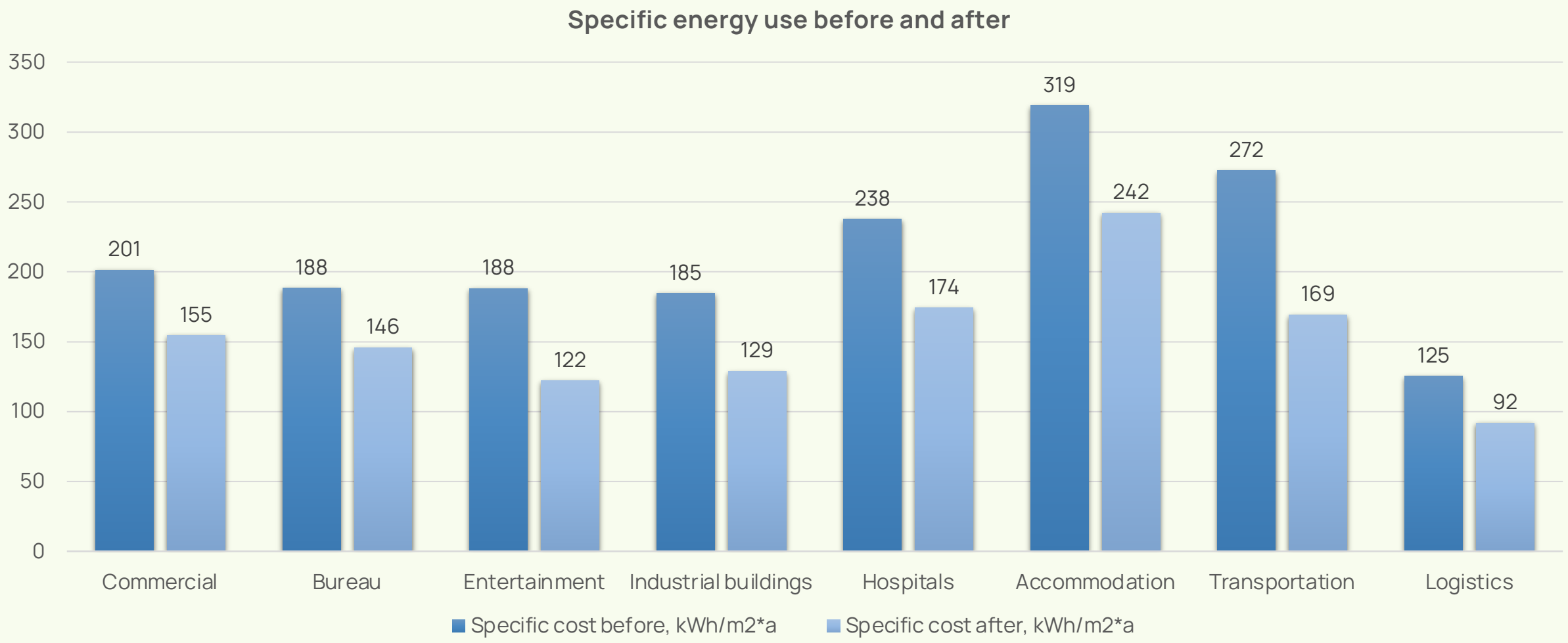
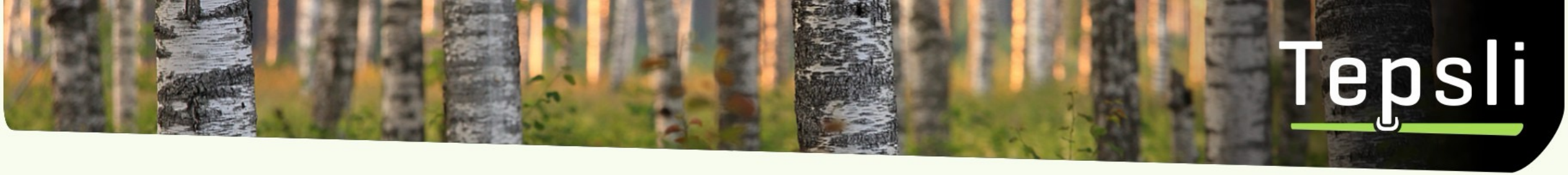
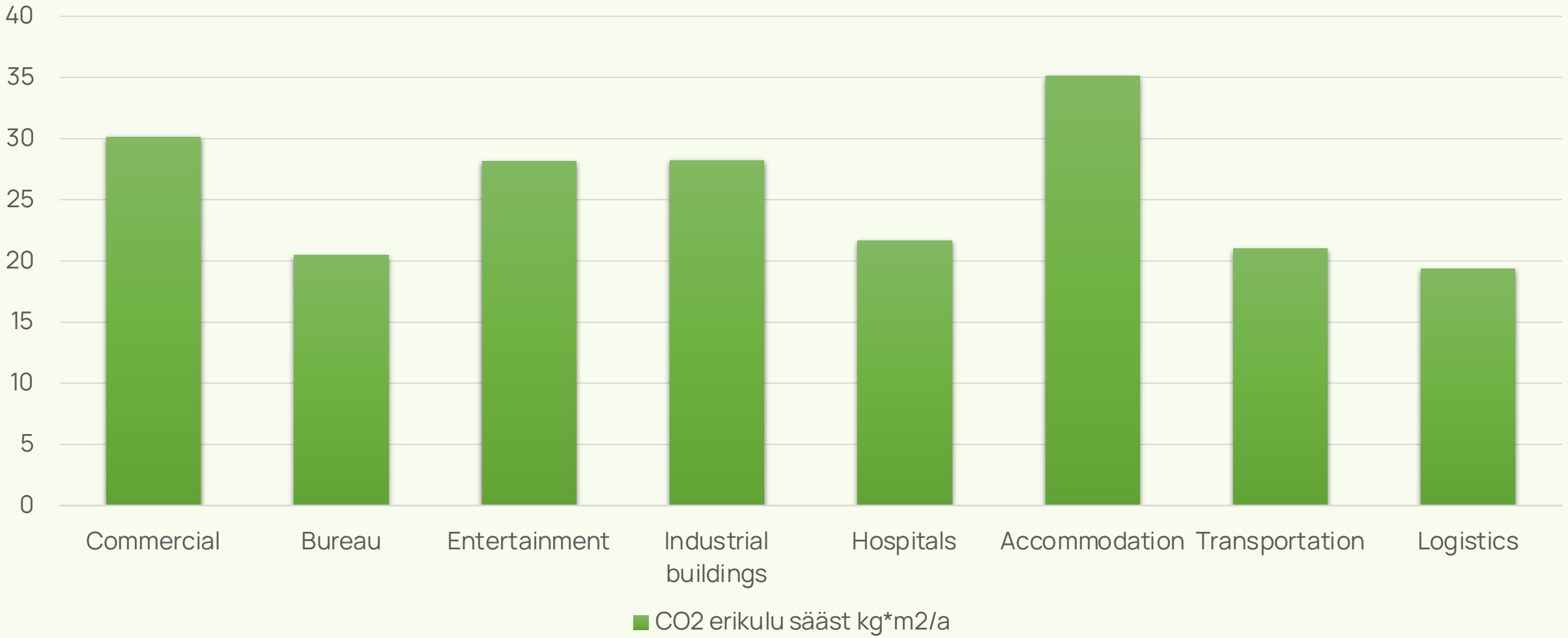
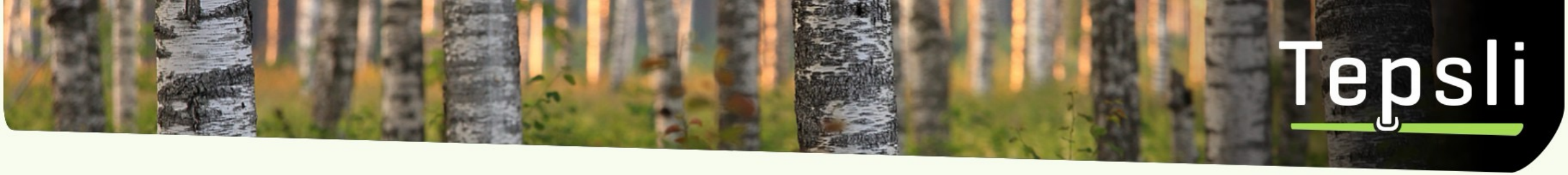

Specific energy use before and after
350
300
250
200
150
100
50
0
201
155
188
146
188
122
185
129
238
174
319
242
272
169
125
92
Commercial
Bureau
Entertainment
Industrial buildings
Hospitals
Accommodation
Transportation
Logistics
Specific cost before, kWh/m2*a
Specific cost after, kWh/m2*a



CO2 specific savings





- **The most cost-optimal ways to improve energy efficiency are low-cost activities that renovate, upgrade and manage already existing technical systems**. The average **investment cost of such measures is 40 €/m2.**
- In the reconstruction of technical systems, the "**price" of GHG savings is approximately EUR 90-100 per tonne of CO2 equivalent, taking into account the lifetime of the measures alone and the cost of the investment**. Various studies have shown the net-positive impact of the reconstruction measures on the state budget, and considering the energy savings involved, these are probably comprehensively positive investments.
- **Energy efficiency measures in construction (windows/doors, foundations, envelope, other investments accompanying projects) have a very long payback period (from 50 years) and cannot be carried out solely against the energy savings to be achieved.**
- In attraction centres, in addition to energy savings, it is probably possible to take into account the competitiveness and profitability of real estate that will improve after reconstruction, especially if the building is also awarded the BREEAM or LEED quality label, for example, but **outside the attraction centres, the costs of reconstruction quite definitely exceed the value of the property after reconstruction, which is likely to make it difficult to finance projects from banks.**

Aitäh!

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