Table 1. Envelope-related parameters employed for the optimization study.

	Envelope interventions	Economic Parameters		LCA Parameters (A and C Phases)		
		Investment + Labor Cost excluding VAT		Embodied Energy	Embodied GWP	Service Life
		[DKK / m]	[DKK]	[kWh]	[kg $CO_{2,eq}$]	[y]
Insulation	Exterior concrete wall insulation, mineral wool	1062.60	75.72	1563	3.90	80
	Exterior concrete wall insulation, cellulose	1649.20	54.65	2.56	0.35	60
	Exterior concrete wall insulation, EPS	778.04	68.91	22.31	5.78	80
	Roof/loft insulation, mineral wool	449.45	58.56	15.63	3.90	50
	Roof/loft insulation, cellulose	514.85	66.08	2.56	0.35	40
	Exterior basement wall insulation, EPS	778.04	68.91	22.31	5.78	80
Cladding	Exterior wall cladding, bricks	0.00	1085.99	294.36	58.19	80
	Exterior wall cladding, slate, supporting construction	0.00	804.78	108.90	17.95	120
	Exterior wall cladding, fiber cement board, supporting construction	0.00	690.64	55.14	9.77	60
	Exterior wall cladding, aluminum board, supporting construction	0.00	460.95	452.55	92.36	60
	Roof cladding, fiber cement board	0.00	489.29	85.39	11.69	40
	Roof cladding, ceramic roof tiles	0.00	642.16	123.00	23.04	60
	Roof cladding, bituminous membrane	0.00	587.54	308.09	46.45	20
	Roof cladding, zinc (double standing seam)	0.00	1577.73	324.62	28.11	50
	Exterior basement wall cladding, light weight concrete blocks	0.00	590.50	112.64	32.21	80
Windows frames and glazing	Windows, double-glazing	0.00	1411.54	132.97	37.79	25
	Windows, triple-glazing	0.00	1711.54	199.45	56.68	25
	Windows, PVC frame, double-glazing	0.00	2268.14	431.14	125.09	50 (frame)
	Windows, PVC frame, triple-glazing	0.00	2437.25	497.62	143.98	50 (frame)
	Windows, aluminum frame, double-glazing	0.00	4186.12	639.56	136.65	60 (frame)
	Windows, aluminum frame, triple-glazing	0.00	4494.01	706.05	155.54	60 (frame)
	Windows, wood frame, double-glazing	0.00	2899.61	659.94	69.93	50 (frame)
	Windows, wood frame, triple-glazing	0.00	4074.29	726.43	88.83	50 (frame)
Balcony glazing	New balconies, single-glazing	0.00	390.66	50.08	13.70	50
	New balconies, double-glazing	0.00	1411.54	132.97	37.79	25
	New balconies, triple-glazing	0.00	1711.54	199.45	56.68	25

Table S2. Service equipment-related parameters for the optimization.

Equipment	LCA Parameters			Economic Parameters			Service Life
	Embodied Energy	Embodied GWP	Functional Unit	Investment + Labor Cost excluding VAT		Functional Unit	
	[MJ]	[kg $CO_{2,eq}$]	-	[DKK / FU]	[DKK]	-	[years]
PV system	5,054.430	316.150	1 m^2	2,498.60	0	1 m^2	30
Solar thermal collector	1,841.178	105.492	1 m^2	6,645.19	7066.53	1 m^2	30
District heating heat exchanger	69.360	5.051	1 kW	1,781.94	0	1 kW	30
Natural gas boiler	18,802.320	1,330.570	1 unit	1,186.88	0	1 kW	30
Heat pump	4,780.435	341.070	1 kW	10,567.47	0	1 kW	30

Table S3. Energy vectors-related parameters for the optimization.

Service	LCA Parameters (A phase)				Economic Parameters	
	Embodied Energy	Embodied GWP	Lower Heating Value	Functional Unit	Supply Cost excluding VAT	
	[MJ]	[kg $CO_{2,eq}$]	[kWh/kg]	-	[DKK]	[DKK / kW]
Electricity from the grid - 2015	6.380	0.352	-	1 kWh	2.20	-
Electricity from the grid - 2020	6.060	0.201	-	1 kWh	-	-
Electricity from the grid - 2025	5.870	0.169	-	1 kWh	-	-
Electricity from the grid - 2035	5.170	0.031	-	1 kWh	-	-
Electricity from the grid - 2050	4.220	0.024	-	1 kWh	-	-
Electricity to the grid	0.000	0.000	-	1 kWh	0.26	
District heating from the grid - 2015	0.694	0.187	-	1 kWh	0.40	0.30
District heating from the grid - 2020	0.680	0.112	-	1 kWh	-	-
District heating from the grid - 2025	0.720	0.101	-	1 kWh	-	-
District heating from the grid - 2035	0.460	0.072	-	1 kWh	-	-
District heating from the grid - 2050	0.310	0.058	-	1 kWh	-	-
Natural gas from the grid	3.888	0.239	15.18	1 kWh	5.49	-

Table S4. Insulation materials physical and thermal properties.

Insulation	Physical and Thermal Properties	
	Thickness	Thermal Conductivity
	[m]	[W / (m·K)]
Exterior concrete wall insulation with mineral wool	0.050	0.034
Exterior concrete wall insulation with cellulose	0.050	0.040
Exterior concrete wall insulation with EPS	0.050	0.038
Roof/loft insulation with mineral wool	0.050	0.042
Roof/loft insulation with cellulose	0.050	0.040
Exterior basement wall insulation with EPS	0.050	0.038

Table S5. Glazing physical and thermal properties.

Windows and glazing	Physical and Thermal Properties	
	Thermal transmittance	Solar energy transmittance
	[W / (m²·K)]	-
Windows with double-glazing	1.1	0.44
Window with triple-glazing	0.8	0.38
New balconies with single-glazing	4.7	0.60
New balconies with double-glazing	1.1	0.44
New balconies with triple-glazing	0.8	0.38
Staircase window with single-glazing	4.7	0.60
Staircase window double-glazing	1.1	0.44
Staircase window triple-glazing	0.8	0.38