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RENOVATION OF BUILDINGS USING STEEL TECHNOLOGIES (ROBUST)

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WP1: Energy efficiency strategies for renovation of commercial and residential buildings
WP5: Economic and sustainability justification software tools and Case Studies

- parametric study: cooling energy demand -

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1 PARAMETRIC STUDY: INPUT DATA

The values for the parametric study are widely the same as for the heating energy demand, additionally a variation of the shading coefficient was taken into account. The effect of thermal bridging of the base plate and the (theoretical) option of a rotation of the building were skipped.

Table 1.1 *Matrix for parametric study, cooling energy demand*

Parameter	original	retrofit (starting point)	range min.	range max.
	W/m²K	W/m²K	W/m²K	W/m²K
U-Value exterior wall	0.82	0.265	0.15	0.3
U-Value roof	0.81	0.2	0.1	0.3
U-Value window (glazing and frame	2.6	1.4 (U_g: 1.2, U_f: 2)	0.7	2.0
	-	-	-	-
Shading coefficient	0.4	0.4	0.25	1.0 (no shading)
	mm concrete	mm concrete	mm concrete	mm concrete
Thermal inertia	100 (each, floor and ceiling)	100 (each, floor and ceiling)	0	100 (each, floor and ceiling)
	%	%	%	%
Window area (in practise: mostly not variable)	25	25	20	60

2 PARAMETRIC STUDY: RESULTS

The results show the net energy ("useful energy") demand for cooling, without considering generation of cold and electricity.

Table 2.1 *Comparison original state and retrofit "starting point"*

Var.		Helsinki	Berlin	London
Original	kWh/m²a	5.8	12.6	9.1
Retro	kWh/m²a	10.2	17.5	14.4

Table 2.2 *Retrofit, variation of U-Value exterior wall*

Var.	U-Value exterior wall		Helsinki	Berlin	London
UAW010	0.15	kWh/m²a	11.1	18.4	15.3
starting point	0.265	kWh/m²a	10.2	17.5	14.4
UAW082	0.82	kWh/m²a	7.7	14.8	11.6

Table 2.3 *Retrofit, variation U-Value Roof*

	U-Value roof		Helsinki	Berlin	London
UDA010	0.1	kWh/m²a	10.5	17.8	14.7
starting point	0.2	kWh/m²a	10.2	17.5	14.4
UDA082	0.81	kWh/m²a	5.0	11.5	8.2

Table 2.4 *Retrofit, variation glazing*

	U-Value window		Helsinki	Berlin	London
UGLA07	0.7	kWh/m²a	6.8	12.9	10.4
starting point	1.4	kWh/m²a	10.2	17.5	14.4
UGLA28	2.6	kWh/m²a	7.8	15.0	11.6

Table 2.5 *Retrofit, variation of thermal inertia*

Var.	mm concrete		Helsinki	Berlin	London
TT100	100	kWh/m²a	10.2	17.5	14.4
TT80	80	kWh/m²a	10.3	17.6	14.4
TT60	60	kWh/m²a	10.3	17.7	14.5
TT40	40	kWh/m²a	10.5	18.0	14.8
TT20	20	kWh/m²a	11.3	18.8	15.6
TT00	0	kWh/m²a	14.4	22.1	19.1

Table 2.6 *Retrofit, variation of solar shading*

Var.	Shading coeff.		Helsinki	Berlin	London
SS025	0.25	kWh/m²a	8.9	16.2	13.1
Retro	0.4	kWh/m²a	10.2	17.5	14.4
SS050	0.5	kWh/m²a	11.1	18.5	15.2
SS075	0.75	kWh/m²a	13.6	20.8	17.3
SS100	1	kWh/m²a	16.3	23.2	19.5

Table 2.7 *Vertical extension, including retrofit of existing building*

retrofit whole building			Helsinki	Berlin	London
4floors (starting point)		kWh/m²a	10.2	17.5	14.4
5floors		kWh/m²a	10.8	18.4	15.1
6floors		kWh/m²a	11.2	18.9	15.7
7floors		kWh/m²a	11.5	19.3	16.0

Table 2.8 *Vertical extension, original state of existing building*

original building with extension			Helsinki	Berlin	London
4floors (starting point)		kWh/m²a	5.8	12.6	9.1
5floors		kWh/m²a	6.2	13.3	9.7
6floors		kWh/m²a	6.5	13.7	10.1
7floors		kWh/m²a	6.7	14.0	10.3

The improving of the building envelope (minimizing U-value) does not reduce the cooling energy demand. For minimizing the cooling energy demand it is important to have a good shading. Further relevant aspects for cooling energy demand are given by building services and the operation of the building (use of night ventilation, efficient cold sources, efficient distribution of cold (by water, not by air, etc.).