

### **Renovation in Cold Climate**

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#### **Task 37:**

#### **Advanced Housing Renovation with Solar and Conservation**





# TASK 37 Advanced Housing Renovation by Solar and Conservation

Whole building concepts for Advanced Housing Renovation with Solar and Conservation in Nordic countries.

Subtask C - Internal working document

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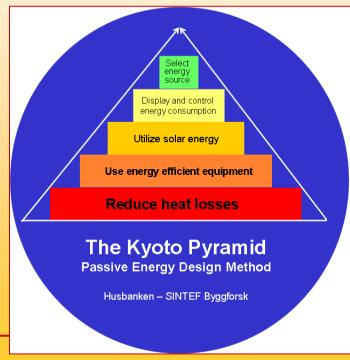


### **Basic strategies for renovation**

The passive design principles includes five steps:

 Reduce the heat loss as much as possible by insulating walls, floor and ceiling, new passive house windows, introducing a continuous air tight layer to achieve an air tight building envelope and installing balanced ventilation with high heat recovery efficiency (η > 75 %).

- Minimize the electricity demand, by using very efficient fans, pumps, appliances and lighting systems..
- Utilize solar energy,
- Control energy use and energy behaviour
- Choose energy source





#### Task 37

#### **Advanced Housing Renovation with Solar and Conservation**



### Ambition levels for renovation

- In a lot of renovation projects it is practical or economical hard to achieve the "passive house" renovation level, due to:
  - different façade restrictions limits the insulation in the external wall
  - difficulties to achieve the passive house air tightness,
  - restriction on windows design so passive house windows can not be used,
  - the roof construction gives limitation for the insulation thickness

Proposed ambition level for ambitious energy renovation.

Ambition level for renovation	Space heating demand		
Level I: Low energy renovation	45 kWh/m²a		
Level II: Passive house renovation	25 kWh/m²a		



Components:		Typical	Renovation level	Renovation level	
		standard	I	П	
	U-value external walls	0.43 W/m <sup>2</sup> K	0.21 W/m <sup>2</sup> K	0.15 W/m <sup>2</sup> K	SOLAR HEATING & COOLING PROGRAMME
	Example	10 cm	Up to 20 cm	Up to 30 cm	INTERNATIONAL ENERGY AGENCY
		insulation	insulation	insulation	Maria and the same for a
	U-value slab on ground	0.35 W/m <sup>2</sup> K	0.35 W/m <sup>2</sup> K	0,35 W/m <sup>2</sup> K	Key numbers for
Щ	or basement ceiling	(equiv. 0.22)	(equivalent 0.22)	(equivalent 0.19)	small houses
		5 cm	Unchanged	10 cm added insul.	before and after
		insulation		on foundation wall	
M	U-value roof or attic	0.35 W/m <sup>2</sup> K	0.12 W/m <sup>2</sup> K	0.10 W/m <sup>2</sup> K	renovation with
		12-13 cm	Up to 30 cm	Up to 35 cm	different ambition
		insulation	insulation	insulation	levels
	U-value windows and	2.8 W/m <sup>2</sup> K	1.2 W/m <sup>2</sup> K	0.80 W/m <sup>2</sup> K	
	doors				
	Heat recovery (η)	-	80 %	80 %	
	Specific fan power	1.5 kW/m³/s	2.0 kW/m³/s	1.5 kW/m³/s	
		Exhaust	Balanced	Balanced	
		system	ventilation	ventilation	
	Air leakage rate (N50)	5.0 <b>h</b> -1	2.0 h <sup>-1</sup>	1.0 h <sup>-1</sup>	
			Measures around	Additional	
			windows and	measures to	
			doors	improve	
Ψ"	Thermal bridges	0.08 W/m <sup>2</sup> K	0.07 W/m <sup>2</sup> K	0.05 W/m <sup>2</sup> K	
			As air leakage	As air leakage	
11	Net space heating	145 – 155	≤ 45 kWh/m²år	≤ 25 kWh/m²år	
	demand	kWh/m²år			
*	Local renewables	0 kWh/m²år	0 kWh/m²år	15 kWh/m²år	
				Solar collectors	5
				cover 50 % DHW	, J

Components:		Typical	Renovation level	Renovation level	
		standard	Ι	II	
	U-value external walls	$0.41 \text{ W/m}^2\text{K}$	$0.17 \text{ W/m}^2\text{K}$	$0.10 \text{ W/m}^2\text{K}$	
	Example	10 cm insulation	Up to 20 cm insulation	Up to 35 cm insulation	K
	U-value slab on ground or basement	Approx 0.4 W/m <sup>2</sup> K	0.4 W/m <sup>2</sup> K	U <sub>basementwall</sub> : 0.09 W/m²K U <sub>slah</sub> : 0.3 W/m²K	n h
		3 cm insulation	Unchanged	28 cm added insul. on basement wall	b re
S	U-value roof or attic	$0.23 W/m^2 K$	0.17 W/m <sup>2</sup> K	0.08 W/m <sup>2</sup> K	di
		15 cm insulation	Up to 25 cm insulation	Up to <u>50 cm</u> insulation	le
	U-value windows and doors	2.1 W/m <sup>2</sup> K	1.2 W/m <sup>2</sup> K	0.85 W/m <sup>2</sup> K	
	Heat recovery (η) Specific fan power	- 1.5 kW/m³/s	80 % 2.0 kW/m³/s	80 % 1.5 kW/m³/s	
		Exhaust system	Balanced ventilation	Balanced ventilation	
	Air leakage rate (N50)	-	1 1/s m <sup>2</sup>	0.3 1/s m <sup>2</sup>	
			Additional measures to improve	Additional measures to improve	
	Net space heating demand	150 kWh/m²år	< 45 kWh/m²år	< 25 kWh/m²år	



Key numbers for multi-family nouses

pefore and after renovation with different ambition evels





## Different concepts for economical analysis described

- Simple payoff
  - Very easy to use

- $PBT = \frac{Capex}{Savings}$
- Method does not take into account increased value of the product, inflation, interest rates
- Life cycle cost LCC
  - All future costs are discounted to a present value
  - Can be used to optimize replacement cycles
  - Good method to compare two or more options
- Life cycle profit, LCP

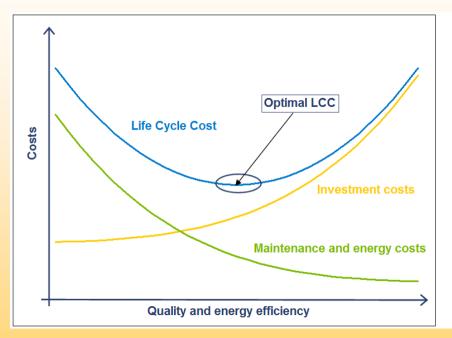
$$LCP_n = \sum_{t=0}^{n} \left( RI_t - E \cdot \alpha (1+\beta)^t - M_t \right) + \frac{RV}{(1+R)^n} - Capex$$

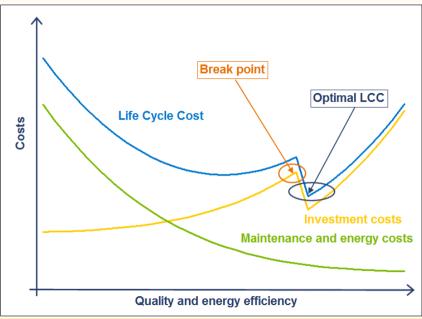
 $LCC_n = \sum_{r=0}^{n} \frac{C_r}{(1+R)^t} + Capex$ 

- All future costs discuounted to apresent value
- Takes the rest value into account



### **COSTS AND PROFITABILITY ASSESSMENTS**





- LCC of renovation standards, traditional thinking to the left
- Right figure; building envelope so effective that the heating system can be simplified or eliminated
- => Whole building evaluations are important to find the optimal solution





### The report

# Whole building concepts for Advanced Housing Renovation in Nordic countries

will be available for downloading early autumn from

www.iea-shc.org/task37





# Thank you for your attention

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