EuroPHit

D3.4_PHPP Result Sheets

CS13

Næstved

INTELLIGENT ENERGY – EUROPE II

Energy efficiency and renewable energy in buildings

IEE/12/070

EuroPHit

[Improving the energy performance of step-by-step refurbishment and integration of renewable energies]

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Technical References

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Abstract

This document provides a short overview of the efficiency improvement of a step-by-step refurbishment to EnerPHit standard to be undertaken for the project CS13, rehab workshop in Næstved.

First, the result sheet of the project´ s current status will present the calculated energy consumption of the existing building.

The PHPP result sheet of the completed EnerPHit retrofit will present the energy demand estimated for the completion of the project according to the overall refurbishment plan

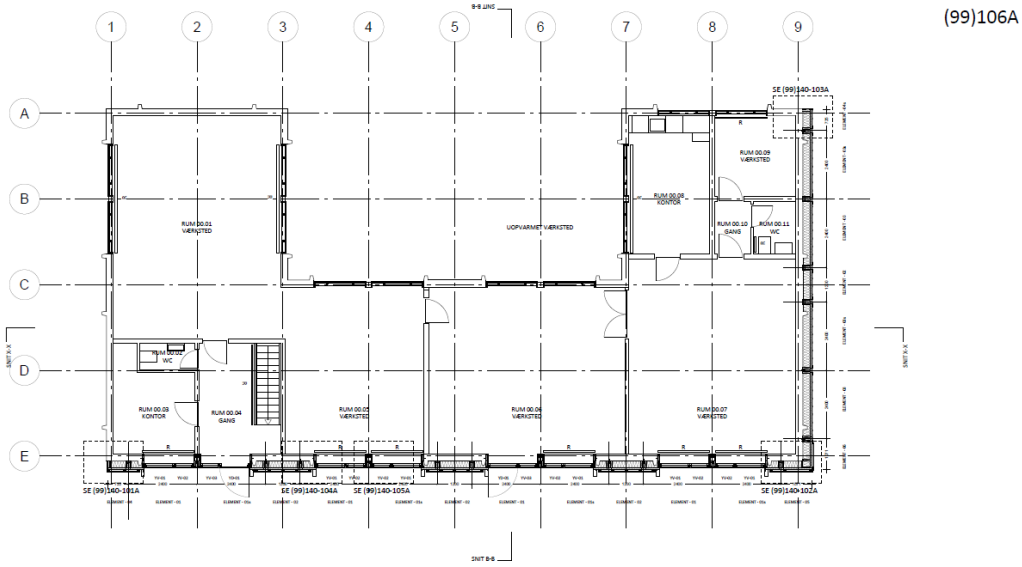

Figure 1: Floor plans [Ole Kjærulffs Tegnestue, 2013]

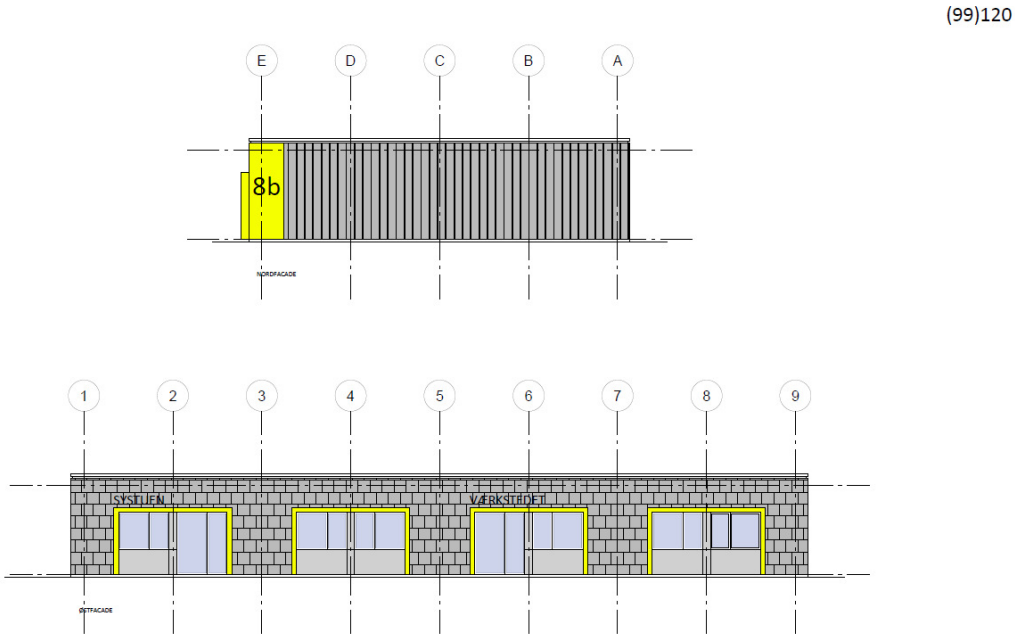

Figure 2: North and East façades [Ole Kjærulffs Tegnestue, 2013]

1 Existing building: PHPP Result Sheet

1.1 PHPP Result sheet of the existing building

EnerPHit verification

Building:	Værksted		
Street:	Tommerupvej 8B		
Postcode/City:	4700		
Country:	Næstved		
Building type:	Workshop/office		
Climate:	[DK] – København		
Altitude of building site (in [m] above sea level):	–		
Home owner/client:	Næstved Kommune		
Street:	Rådmandshaven 20		
Postcode/City:	4700 Næstved		
Architecture:	Ole Kjærulffs Tegnestue	Mechanical System:	Passivhus.dk ApS
Street:	Fælledvej 21, Rønnebæk	Street:	Heksehøjen 5B
Postcode/City:	4700 Næstved	Postcode/City:	4700 Næstved
Energy consulting:	Passivhus.dk ApS	Certification:	
Street:	Heksehøjen 5B	Street:	
Postcode/City:	4700 Næstved	Postcode/City:	

Year of Construction:	2014	Interior temperature winter [C°]	20,0	Interior temp. summer [C°]	25,0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	3,5	IHG summer [W/m²]	3,5
Number of Occupants:	12,0			Spec. capacity [Wh/K per m² TFA]	204
Exterior vol. V_e:	731,5 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	243,8	m²		
Space heating	Annual heating demand	**276**	**kWh/(m²a)**	-	-
	Heating load	**76**	**W/m²**	-	-
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	0,0	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, elect.	**277**	**kWh/(m²a)**	433 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	249	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1,3**	**1/h**	1 1/h	**no**

EnerPHit (Modernisierung): Bauteilkennwerte

Gebäudehülle	Außendämmung zu Außenluft	**0,72**	**W/(m²K)**	0,15 W/(m²K)	**nein**
mittlere U-Werte	Außendämmung zu Erdreich	**3,09**	**W/(m²K)**	1,15 W/(m²K)	**nein**
	Innendämmung zu Außenluft		**W/(m²K)**	-	-
	Innendämmung zu Erdreich		**W/(m²K)**	-	-
	Wärmebrücken ΔU	0,00	W/(m²K)	-	-
	Fenster	**2,62**	**W/(m²K)**	0,85 W/(m²K)	**nein**
	Außentüren		**W/(m²K)**	-	-
Lüftungsanlage	eff. Wärmebereitstellungsgrad	**0**	**%**	75 %	**nein**

* empty field: data missing; '-': no requirement

Figure 3: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta

2 Retrofit steps

2.1 Overall refurbishment Plan

2.1.1 Retrofit steps:

In order to settle the draught and minimize heat consumption, we recommended the following solution:

1. Establish balanced ventilation with heat recovery.
2. Exchange the original, leaky windows with highly energy efficient windows with low U-value
3. Mend the remaining, small, leakages
4. Insulate the basement walls (at that stage we had not realized that they already hat 50 mm mineral wool, which might have changed the conclusion)
5. Insulate the facades externally
6. Insulate the crawl space floor
7. Insulate the roof (tar roofing felt) in 2026-2036, when its service life ends

Steps 1-3 are necessary in order to deal with the immediate complaints about draught, but the building owner also intends with time to insulate the facades. In order to integrate the new windows with the façade insulation in a simple way, the building owner decided to include also the façade insulation (step 5) now. This conditions the insulation of the basement walls first (step 4), as it can hardly be performed later.

The roofing felt is from 2006. It is expected to have a service life span of 20 years, thus the insulation of the roof is postponed.

Step No.	Year	Measures	Specific Heating Demand	Specific Primary Energy Demand	Additional Specific PV Gains
	1975		276	277	
1	>2014	Install MVHR	224	242	
2		Exchange windows	194	221	
3		Improve air tightness to 0,6/h	190	218	
4		Insulate basement walls	170	204	
5		Insulate facades	92	148	
6		Insulate crawl space floor	78	139	
7	2026	Insulate roof	76	137	

Figure 4: Overview refurbishment steps

2.1.2 Efficiency Improvements

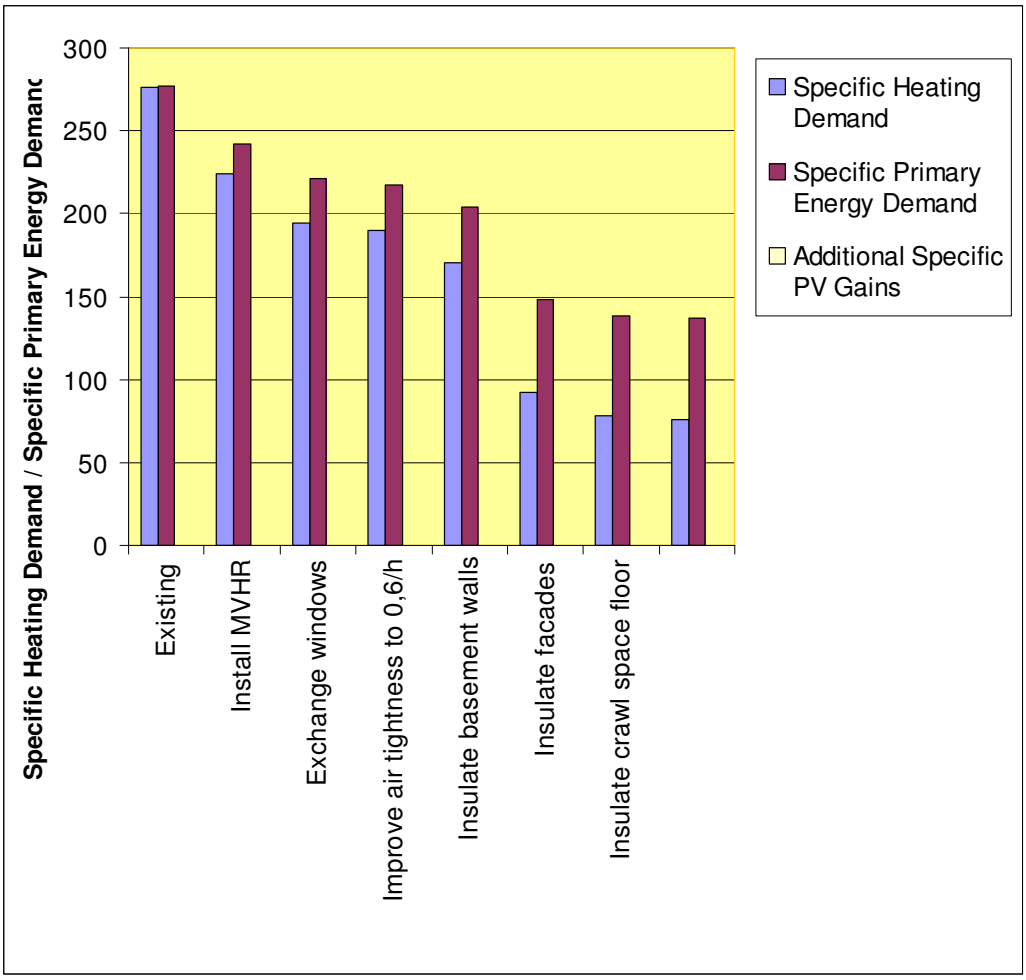

Figure 5: Overview energy efficiency improvement according to the overall refurbishment plan

Budget cuts

In the meanwhile the municipality has cut the budget for the project, and only parts of the plan are being carried out:

- Insulation of all basement walls to 1,87 meters below terrain, which is bottom of the foundation of the crawl space (going deeper, to the bottom of the full basement, is un-proportionally more expensive due to work safety regulations)
- Insulation of half the façade and exchange of the corresponding windows (coincidentally not the ones, which caused complaints about draught)

Step No.	Year	Measures	Specific Heating Demand	Specific Primary Energy Demand	Additional Specific PV Gains
	1975		276	277	
	2014	Actually implemented steps 2014	218	236	
7	2026	Insulate roof	76	137	

Figure 6: Effect of the in 2014 actually implemented steps compared to start end end state

So far the date for the continuation of the refurbishment is not planned.

3 Completion of step-by-step refurbishment

3.1 PHPP Result Sheet of the completed refurbishment (2014)

EnerPHit verification

Building:	Værksted
Street:	Tommerupvej 8B
Postcode/City:	4700
Country:	Næstved
Building type:	Workshop/office
Climate:	[DK] – København
Altitude of building site (in [m] above sea level):	–
Home owner/client:	Næstved Kommune
Street:	Rådmandshaven 20
Postcode/City:	4700 Næstved

Architecture:	Ole Kjærulffs Tegnestue
Street:	Fælledvej 21, Rønnebæk
Postcode/City:	4700 Næstved
Energy consulting:	Passivhus.dk ApS
Street:	Heksehøjen 5B
Postcode/City:	4700 Næstved

Mechanical System:	Passivhus.dk ApS
Street:	Heksehøjen 5B
Postcode/City:	4700 Næstved
Certification:	
Street:	
Postcode/City:	

Year of Construction:	2014	Interior temperature winter [C°]	20,0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	3,5
Number of Occupants:	12,0		
Exterior vol. V_e:	731,5 m³		

Interior temp. summer [C°]	25,0
IHG summer [W/m²]	3,5
Spec. capacity [Wh/K per m² TFA]	204
Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	243,8	m²		
Space heating	Annual heating demand	**218**	**kWh/(m²a)**	-	-
	Heating load	**62**	**W/m²**	-	-
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	0,0	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW, auxiliary electricity, lighting, plug	**236**	**kWh/(m²a)**	364 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	208	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1,3**	**1/h**	1 1/h	**no**

EnerPHit (Modernisierung): Bauteilkennwerte

Gebäudehülle	Außendämmung zu Außenluft	**0,51**	**W/(m²K)**	0,15 W/(m²K)	**nein**
mittlere U-Werte	Außendämmung zu Erdreich	**2,97**	**W/(m²K)**	1,26 W/(m²K)	**nein**
	Innendämmung zu Außenluft		**W/(m²K)**	-	-
	Innendämmung zu Erdreich		**W/(m²K)**	-	-
	Wärmebrücken ΔU	0,00	W/(m²K)	-	-
	Fenster	**1,92**	**W/(m²K)**	0,85 W/(m²K)	**nein**
	Außentüren		**W/(m²K)**	-	-
Lüftungsanlage	eff. Wärmebereitstellungsgrad	**0**	**%**	75 %	**nein**

* empty field: data missing; '-': no requirement

Figure 7: Specific energy efficiency values of the completed project modelled with PHPP 9 Beta