EuroPHit

D3.9_Overall Refurbishment Plan

DRAFT

CS12

Stockholm

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]

Contract N°: SI2.645928

Co-funded by the Intelligent Energy Europe Programme of the European Union

IG PH INTRESSEGRUPP PASSIVHUS

Technical References

Project Acronym	EuroPHit
Project Title	Improving the energy performance of step-by-step refurbishment and integration of renewable energies
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Abstract

This overall refurbishment plan provides an overview of the retrofit steps of a step-by-step refurbishment to EnerPHit standard to be undertaken for the project *Svartbäcksvägen 11, Stockholm* (CS12).

First, the existing building will shortly be described, including building component and component conditions. In addition, the existing energy efficiency performance of the building will be described.

In a second step, the overall refurbishment plan will describe the retrofit steps to be undertaken until the refurbishment will finally be completed. The steps

Short description how EnerPHit standard will be achieved.

Figure 1: Svartbäcksvägen 11 – view from the South

General Project description

1.1 Motivation

The renovation will lift the value of the building, make it more energy efficient and more comfortable. It will also have more useable space after the upgrade.

1.2 Existing Building

The building is a typical detached villa from the 1950's. It is serviceable, but not energy efficient and parts of the building are not efficiently used either. As in many places in Sweden, radon gas is here an issue which needs to be addressed. Excessive moisture from the bathroom adds to the lack of comfort typical for the houses of this aera.

There is a Tax-reduction scheme called ROT-avdrag[1] – which is done yearly and therefore step-by-step has an additional benefit since the reduction can be applied over several years (tax-reduction up to 50 000 SEK/year on work carried out at the building by professional craftsmen).

Figure 2: Aerial view

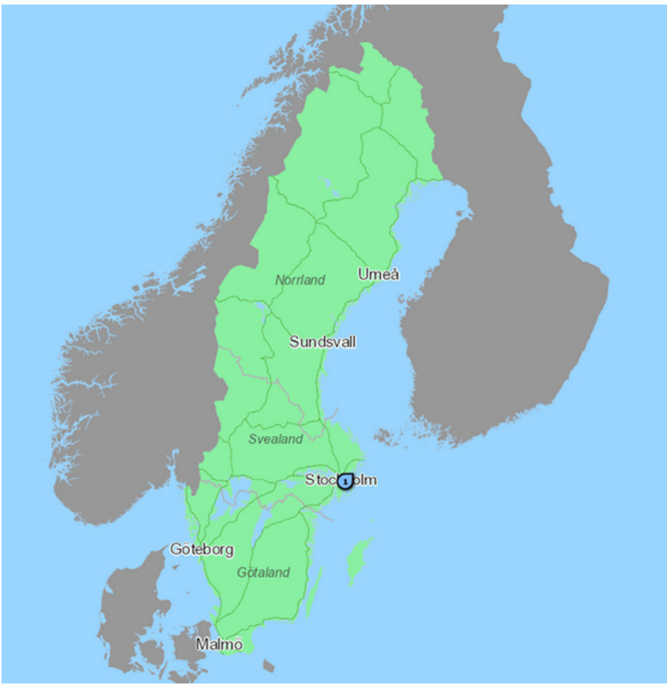

Figure 3: Location on the map

[1] More information on http://www.rotavdrag.se/

1.3 Refurbishment steps

1st step: Insulating lower floor level (walls & new floor slab). Include radon-shielding. Exchange lower floor entrance door. Insulate on top of upper floor level ceiling (cold loft), applying airtightness materials between upper floor ceiling and loft space. The existing windows will preliminarily be upgraded with sealing tapes. Ventilation will be done manually and via the existing extract fans.

2nd step: Change of windows and doors plus the installation of the MVHR system. At the same time, airtightness will be ensured to reach enerPHit-niveau.

3rd step: Insulation of the façade.

4th step: At the time of writing, 1kWp of PV (including inverter etc.) cost approx. between 2300 € and 3200 € (installed) – depending on the size of the system and supplier. Should the Swedish government by then have decided to make PV more attractive (as in some other EU countries)[2], a PV-system might be installed as well. At the moment, *Vattenfall* e.g. pays 1 SEK/kWh over spotprice for PV-electricity fed into the grid – but this only runs until 31st May 2015, so it is not really a tempting offer[3]...

Since district heating charges are in the progress of rising, it might be useful to consider a solar thermal system as well. In some places, the prices on district heat also depend on the return flow temperature coming from the user – i.e. it might be beneficial to have only a few radiators left in action which will do the room heating.

1.3.1 Retrofit steps within EuroPHit

Works to be carried out until March 2016:

Step 1 & (depending on finances) step 2.

1.3.2 Further retrofit steps

Obviously step 3 (and possibly step 4).

1.4 EnerPHit standard

Final retrofit step to EnerPHit standard

After step 3 has been completed, a pressure test will be done to make sure the airtightness is at EnerPHit-niveau. PHPP calculations show that it is possible to reach the 25 kWh/(m2a) heating demand criteria – so it is not planned at this stage to go the *individual component* route.

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[2] The subvention system in action just now runs out on 31st December 2014. See http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Forordning-2009689-om-statl_sfs-2009-689/

[3] http://www.vattenfall.se/sv/solceller.htm?icmp=301#sa-fungerar-solceller

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1.5 Pictures

Figure 4: Lower floor dug up/concrete removed

Figure 5: New district heat station

Figure 6: Thermal picture, view from SE

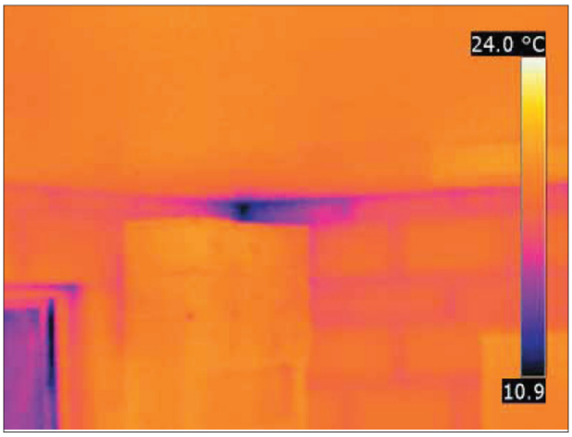

Figure 7: Thermal picture, living room ceiling corner

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2 Existing building

2.1 General description

2.1.1 Building data

- Construction Time: 1954
- Last retrofit: - (fairly recent change to district heat)
- Building use: Domestic
- General condition: Serviceable, but not energy efficient
- Occupancy: Family of 6
- Treated floor Area: 150sqm (according to drawings, 140sqm on estate agent's ad)
- Other: District heat already installed

2.1.2 Client

- Name: Ville & Andrea Mäkinen
- Address: Svartbäcksvägen 11, Bagarmosse (Stockholm)
- Email: zorase@yahoo.com

2.2 Envelope of the existing Building

2.2.1 Floor slab

- Description: Uninsulated concrete slab on rock.
- U-Value: 3.9 W/(m^2·K)
- Installation date: 1954
- Condition: In the process of being taken out
- Next replacement: Within the next months
- Other: The rock underneath is partially chisled out as well in order to allow for the addition of insulation and installation of radon-gas-shielding.

2.2.2 External walls

- Description: Upper floor level: Light concrete block with render on both sides
- U-Value: 0.90 W/(m^2·K)
- Installation date: 1954
- Condition: Good
- Next replacement: Additional external insulation during step 3.
- Other: The external render can most likely stay in place when external insulation is applied.

- Description: Lower floor level: Hollow concrete block with render on both sides
- U-Value: 1.40 W/(m^2·K)
- Installation date: 1954
- Condition: Good
- Next replacement: Additional external insulation during step 1.
- Other: The drainage will also be improved at the same time

2.2.3 External walls to ground

See under 2.2.2.

2.2.4 Windows

- Description: Old-style box frame double glazing
- U-Value: ∅ 2.30 W/(m^2·K)
- Installation date: 1954
- Condition: Serviceable, but not energy efficient
- Next replacement: During step 2
- G-value: approx 0.72
- $\Psi_{instal,s}$ = 0.109 W/(m·K)

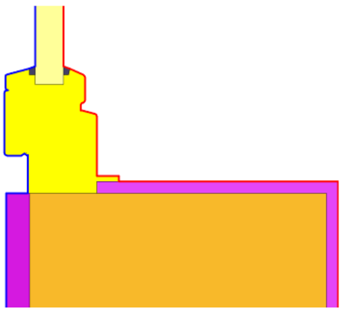

Figure 8: Existing Window detail

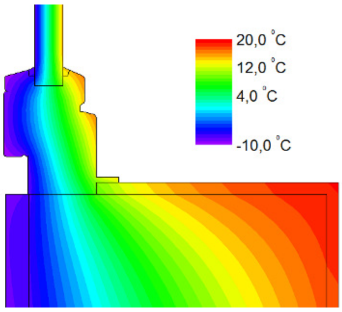

Figure 9: Thermal graphic

2.2.5 Roof / Top floor ceiling

- Description: Cold loft; joists, spaces filled with wood shavings
- U-Value: 0.34 W/(m^2·K)
- Installation date: 1954
- Condition: Serviceable, but not energy efficient
- Next replacement: Additional insulation during step 1
- Other: The roof tiles are in acceptable condition

2.3 Technical equipment of the existing building

2.3.1 Heating

- Description: District heat; x-station in lower floor level; central heating
- Efficiency: approx. 95%
- Installation date: Station recently, radiators 1954 (?)
- Condition: As-new, serviceable.
- Next replacement: Not planned
- Other: Since the heating load will be reduced, some of the radiators might be removed

2.3.2 Domestic hot water

See above (2.3.1).

2.3.3 Ventilation

Natural draw; extractor fan in kitchen & bathroom

2.4 Energy efficiency of the existing building

2.4.1 Modelled efficiency parameters

- Modelled specific heating demand: 235 kWh/(m^2·a)
- Modelled specific heating load: 77 W/m^2 (with PH dim. amb. temperature)
- Modelled specific cooling demand / overheating frequency: 0%
- Modelled specific primary energy demand: 256 kWh/(m^2·a)
- Air change rate @ pressure test: n_{50} = 4.41/h

2.4.2 Available consumption parameters

Average annual Gas/Oil bills (if available): tbc.

Average annual Electricity bills (if available): tbc.

For an overview of the energy efficiency of the existing building, see the verification spreadsheet of the PHPP 9 beta version [PHI 2013] below.

EnerPHit verification

Building:	Ville & Andrea Mäkinen
Street:	Svartbäcksvägen 11
Postcode/City:	Stockholm
Country:	Sweden
Building type:	Villa
Climate:	[SE] - Stockholm
Altitude of building site (in [m] above sea level):	50
Home owner/client:	Ville
Street:	Svartbäcksvägen 11
Postcode/City:	Stockholm

Architecture:		Mechanical System:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	

Year of Construction:	1955	Interior temperature winter [C°]	20.0	Interior temp. summer [C°]	25.0
Number of dwelling units:	1	Internal heat gains winter [W/m²]	2.1	IHG summer [W/m²]	3.1
Number of Occupants:	4.3			Spec. capacity [Wh/K per m² TFA]	204
Exterior vol. V_e:	408.0 m³			Mechanical cooling:	

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	150.1	m²		
Space heating	Annual heating demand	**235**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**77**	**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...	**256**	**kWh/(m²a)**	384 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	194	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**4.4**	**1/h**	1 1/h	**no**

EnerPHit (Modernisierung): Bauteilkennwerte

Gebäudehülle	Außendämmung zu Außenluft	**0.76**	**W/(m²K)**	-	**-**
mittlere U-Werte	Außendämmung zu Erdreich	**3.34**	**W/(m²K)**	-	**-**
	Innendämmung zu Außenluft		**W/(m²K)**	-	**-**
	Innendämmung zu Erdreich		**W/(m²K)**	-	**-**
	Wärmebrücken ΔU	0.00	W/(m²K)	-	-
	Fenster	**2.26**	**W/(m²K)**	-	**-**
	Außentüren	**2.00**	**W/(m²K)**	-	**-**
Lüftungsanlage	eff. Wärmebereitstellungsgrad		**%**	-	**-**

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

Figure 10: Specific energy efficiency values of the existing building modelled with PHPP 9 Beta

2.5 Pictures / Drawings

These pictures or drawings illustrate the existing building.

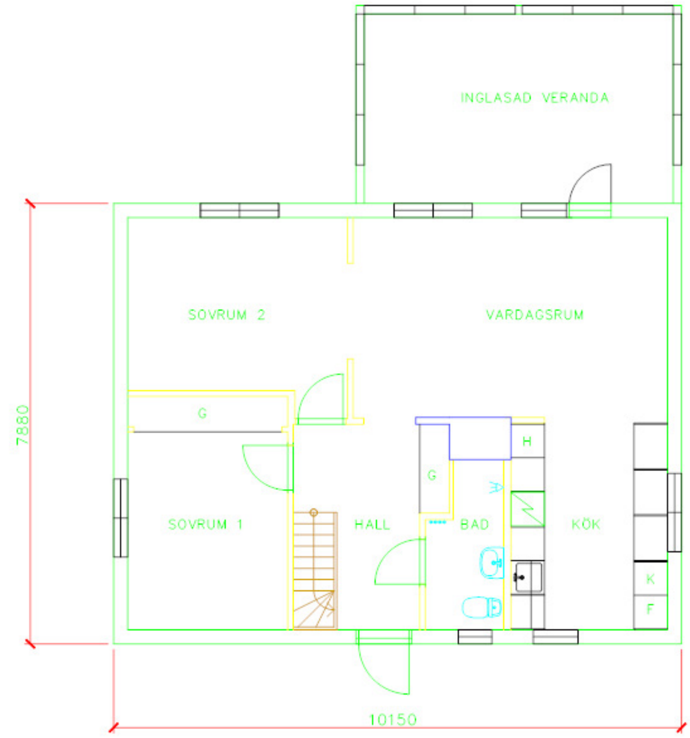

Figure 11: Upper floor plan

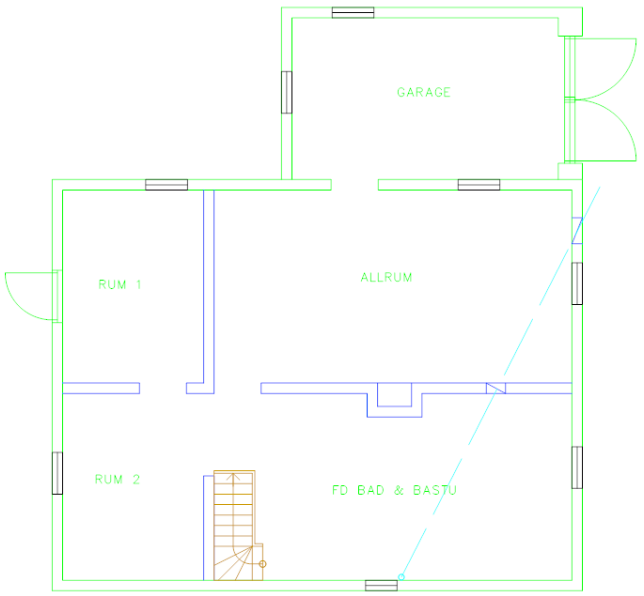

Figure 12: Lower floor plan

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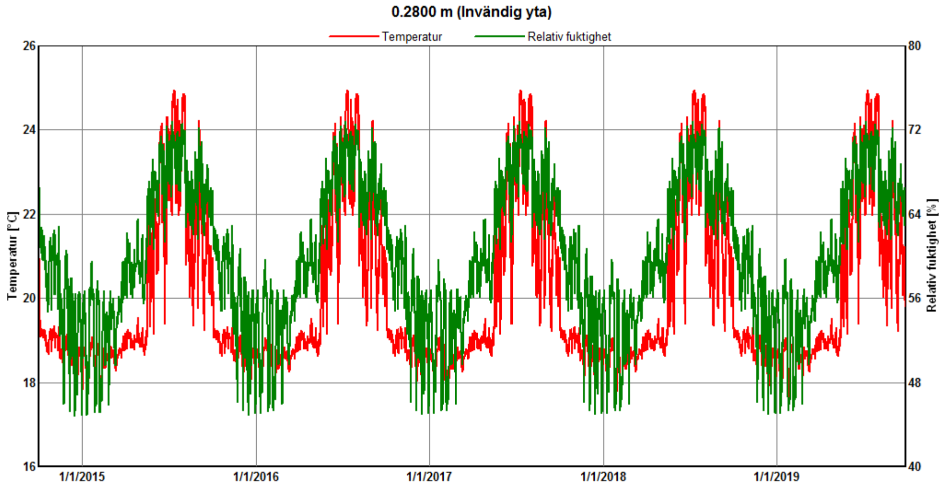

Figure 13: Hygro-thermal analysis - existing wall towards NE

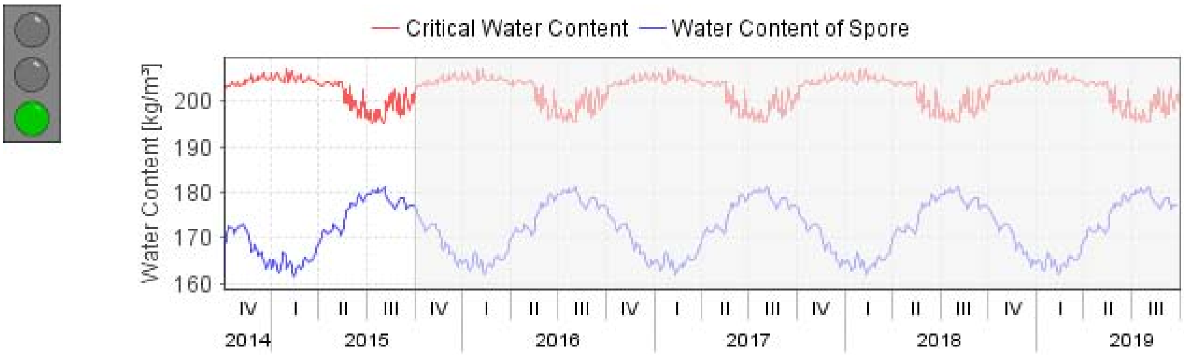

Figure 14: "WUFI BIO" result of the existing wall towards NE (= no mold growth)

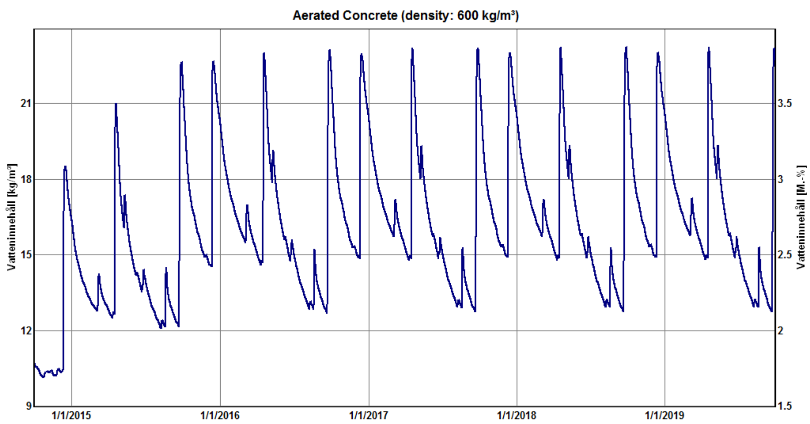

Figure 15: Water content in the LWC-block of the existing wall towards NE

3 Retrofit steps

3.1 Overall refurbishment Plan

3.1.1 Retrofit steps:

Short description of the overall refurbishment plan. Include information of the components to be exchanged or the building parts to be retrofitted and the estimated dates for the measures according to the plan.

Step No.	Year	Measures	Specific Heating demand [kWh/(m²K)]	Specific PE demand [kWh/(m²K)]	Additional PV Gains [kWh/(m²)]
0	1954	Existing building	235	256	-
1	2014	Replace lower floor & roof insulation; insulate lower floor walls	111	153	-
2	2016 (tbc)	Windows exchange & MVHR instal.	71	124	-
3	2020 (tbc)	Upper floor facade insulation	17*)	85	-
4	2020 (tbc)	Possible addition of PV and/or solar thermal system	-	-	20**)

*) EnerPhit-certification via components not necessary **)Approx. estimate e.g. with a 3.3 kWp PV system

Figure 16: Overview refurbishment steps

3.1.2 Efficiency Improvements

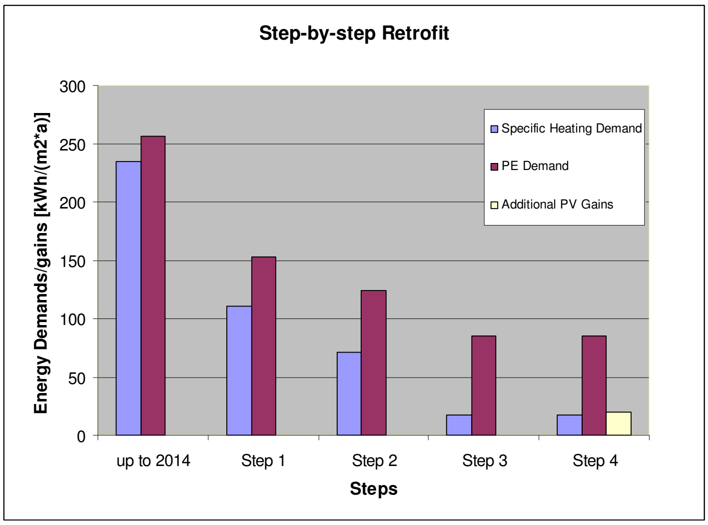

Figure 17: Overview energy efficiency improvement according to the overall refurbishment plan

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3.2 Retrofit steps within EuroPHit

3.2.1 Retrofit step 1:

Replace & insulate floor slab and insulating lower floor walls. Insulate loft.

- Start date: Spring 2014
- Completion date: Summer/autumn 2014
- Budget: At the moment, the budget for the whole renovation is 400k SEK (approx. 44k €). Step-by-step allows adding to the budget over the course of time.
- Specific heating demand: 111 kWh/(m^2·a)
- Specific cooling demand / overheating frequency: 0%
- Specific primary energy demand: 153 kWh/(m^2·a)

3.2.1.1 New Envelope component

- New insulated floor slab (digging out concrete slab and rock and re-fill with foam glas (~400mm) and woodfibre-slabs (100mm) under parquet and tiles. Add radon gas barrier. Some TB will remain between basement wall and rock substrate…)
- U-Value: 0.100 W/(m^2·K)
- Installation date: 2014
- Condition: New
- Next replacement: -
- Other: Radon-shield will be included as well

3.2.1.2 New Envelope component

- Basement walls insulated (digging up around the house and adding external insulation (”Isodrän”) and re-filling with foam glas)
- U-Value: 0.09 W/(m^2·K)
- Installation date: 2014
- Condition: New insulation on existing walls
- Next replacement: -
- Other: Two different approaches over- and underground (like facade resp. drainage/insulation-combination)

3.2.1.3 New Envelope component

- Ceiling insulated (loose-fill cellulose (400-500mm). Air-tightness (ceiling-level) added.)
- U-Value: 0.077 W/(m^2·K)
- Installation date: 2014
- Condition: New insulation on existing ceiling
- Next replacement: -

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				Requirements	Fulfilled?*
	Treated floor area	150.1	m²		
Space heating	Annual heating demand	**111**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**40**	**W/m²**	-	**-**
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	**-**
	Cooling load		**W/m²**	-	**-**
	Frequency of overheating (> 25 °C)	0.2	%	-	**-**
Primary Energy	Heating, cooling, dehumidifying, DHW,	**153**	**kWh/(m²a)**	235 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	101	kWh/(m²a)	-	**-**
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	**-**
Airtightness	Pressurization test result n_{50}	**1.0**	**1/h**	1 1/h	**yes**
EnerPHit (Modernisierung): Bauteilkennwerte					
Gebäudehülle	Außendämmung zu Außenluft	**0.45**	**W/(m²K)**	-	**-**
mittlere U-Werte	Außendämmung zu Erdreich	**0.09**	**W/(m²K)**	-	**-**
	Innendämmung zu Außenluft		**W/(m²K)**	-	**-**
	Innendämmung zu Erdreich		**W/(m²K)**	-	**-**
	Wärmebrücken ΔU	0.00	W/(m²K)	-	**-**
	Fenster	**2.30**	**W/(m²K)**	-	**-**
	Außentüren	**0.80**	**W/(m²K)**	-	**-**
Lüftungsanlage	eff. Wärmebereitstellungsgrad	**0**	**%**	-	**-**

Figure 18: Specific energy efficiency values after measures within EuroPHit, step 1

Retrofit step 2:

Exchange of windows and doors and installing a MVHR system.

- Start date: tbc.
- Completion date: tbc.
- Budget: (See above)
- Specific heating demand: 71 kWh/(m^2·a)
- Specific cooling demand / overheating frequency: 0% (night ventilation applied)
- Specific primary energy demand: 124 kWh/(m^2·a)

3.2.1.4 New Envelope component

- Windows (smartwin is planned at the moment)
- U-Value: < 0.8 W/(m^2·K) installed for standard size
- Installation date: tbc.
- Condition: New
- Next replacement: 30-50 years
- Other: If budget permits, the windows will be set out on the façade – otherwise, they will be at the same position as the old ones, resulting in a $\Psi_{install}$ of 0.040 W/(m·K).

3.2.1.5 New building equipment component

- MVHR (most likely in the loft – using the old chimney which has 6 separate ducts to distribute the air to the different levels)
- Efficiency: 85% or more; 0.45 Wh/m^3 or less (Paul Novus is planned at the moment)
- Installation date: tbc.
- Condition: New
- Next replacement: 30-50 years
- Other: The a/m result of 71 kWh/(m^2·a) for the heating demand is based on the use of a *Paul Novus 300DC* MVHR.

				Requirements	Fulfilled?*
	Treated floor area	150.1	m²		
Space heating	Annual heating demand	**71**	**kWh/(m²a)**	25 kWh/(m²a)	**no**
	Heating load	**27**	**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...	**124**	**kWh/(m²a)**	188 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	72	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1.0**	**1/h**	1 1/h	**yes**
EnerPHit (Modernisierung): Bauteilkennwerte					
Gebäudehülle	Außendämmung zu Außenluft	**0.45**	**W/(m²K)**	-	**-**
mittlere U-Werte	Außendämmung zu Erdreich	**0.09**	**W/(m²K)**	-	**-**
	Innendämmung zu Außenluft		**W/(m²K)**	-	**-**
	Innendämmung zu Erdreich		**W/(m²K)**	-	**-**
	Wärmebrücken ΔU	0.00	W/(m²K)	-	-
	Fenster	**0.89**	**W/(m²K)**	-	**-**
	Außentüren	**0.80**	**W/(m²K)**	-	**-**
Lüftungsanlage	eff. Wärmebereitstellungsgrad	**83**	**%**	-	**-**

Figure 19: Specific energy efficiency values after measures within EuroPHit, step 2

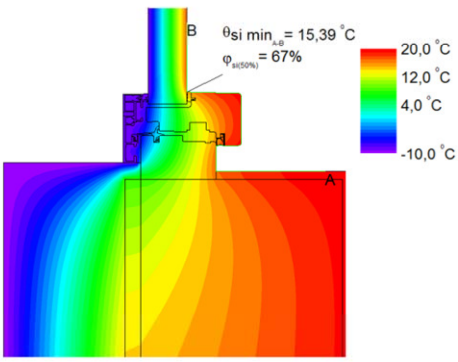


Figure 20: Thermal diagram of new window installed at the old position; $\Psi_{install}$ of 0.040 W/(m·K).

3.2.2 Retrofit step 3:

Insulating façade.

- Start date: tbc.
- Completion date: tbc.
- Budget: see above
- Specific heating demand: 17 kWh/(m^2·a)
- Specific cooling demand / overheating frequency: 8% (can be lowered by additional ventilation)
- Specific primary energy demand: 85 kWh/(m^2·a)

3.2.2.1 New Envelope component

- Externally insulated wall, either by the use of rendered PIR or mineral wool slab system. PIR is slimmer and might help avoid having to extend the roof overhang.
- U-Value: 0.09 W/(m^2·K)
- Installation date: tbc.
- Condition: New
- Next replacement: -
- Other: The $\Psi_{install}$ of 0.040 W/(m·K) mentioned above is based on PIR insulation.

	Treated floor area	150.1	m²	**Requirements**	**Fulfilled?***
Space heating	Annual heating demand	**17**	**kWh/(m²a)**	25 kWh/(m²a)	**yes**
	Heating load	**11**	**W/m²**	-	**-**
Space cooling	Overall specific space cooling demand		**kWh/(m²a)**	-	**-**
	Cooling load		**W/m²**	-	**-**
	Frequency of overheating (> 25 °C)	8.0	%	-	-
Primary Energy	Heating, cooling, dehumidifying, DHW,	**85**	**kWh/(m²a)**	122 kWh/(m²a)	**yes**
	DHW, space heating and auxiliary electricity	32	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1.0**	**1/h**	1 1/h	**yes**
EnerPHit (Modernisierung): Bauteilkennwerte					
Gebäudehülle	Außendämmung zu Außenluft	**0.09**	**W/(m²K)**	-	**-**
mittlere U-Werte	Außendämmung zu Erdreich	**0.09**	**W/(m²K)**	-	**-**
	Innendämmung zu Außenluft		**W/(m²K)**	-	**-**
	Innendämmung zu Erdreich		**W/(m²K)**	-	**-**
	Wärmebrücken ΔU	0.00	W/(m²K)	-	-
	Fenster	**0.89**	**W/(m²K)**	-	**-**
	Außentüren	**0.80**	**W/(m²K)**	-	**-**
Lüftungsanlage	eff. Wärmebereitstellungsgrad	**83**	**%**	-	**-**

Figure 21: Specific energy efficiency values after measures within EuroPHit, step 3

WUFI-analysis SE wall (highest driving rain) plus 150mm PU & thin render:

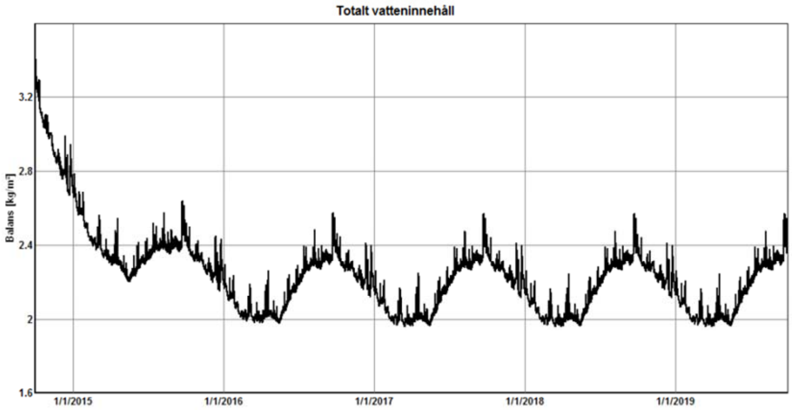


Figure 22: Total water content in wall – drying out over time

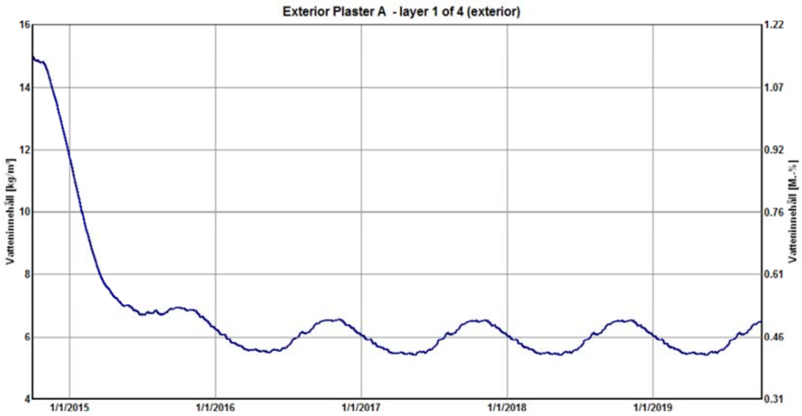


Figure 23: Water contents of inner render layer – drying out over time

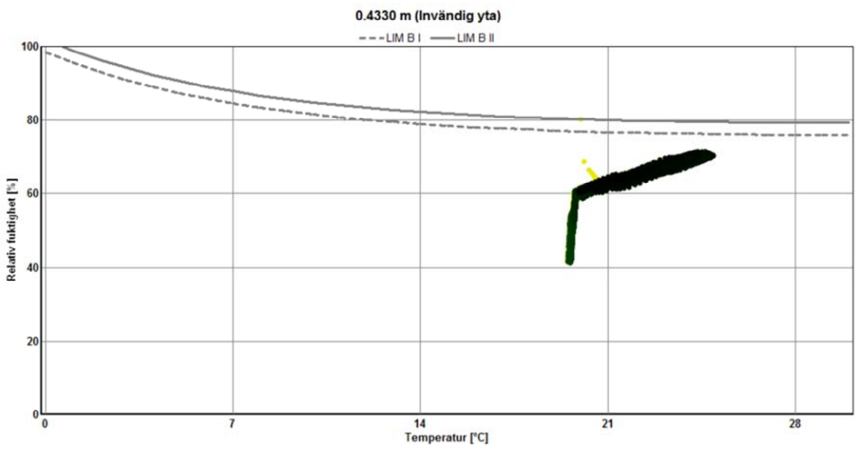


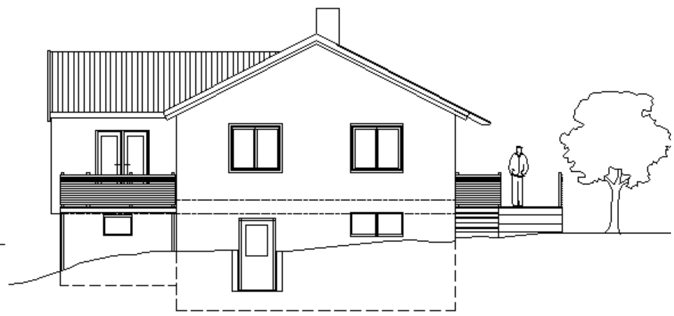
Figure 24: Isoplet inner wall surface – no danger for mold growth

Retrofit step 4:

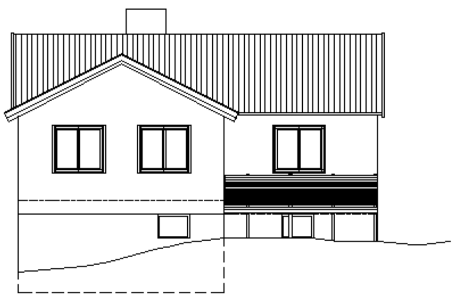
Possibly adding a PV and/or solar thermal system.

- Start date: tbc.
- Completion date: tbc.
- Budget: tbc.
- Specific heating demand: Unchanged
- Specific cooling demand / overheating frequency: Unchanged
- Specific primary energy demand: Reduction by whatever is supplied by the PV and/ or solar thermal system.

FASAD MOT NORDOST



FASAD MOT SYDOST



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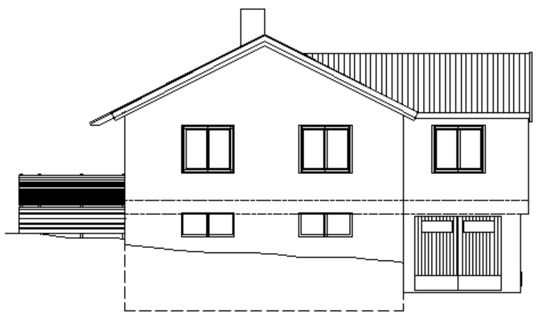

FASAD MOT NORDVÄST

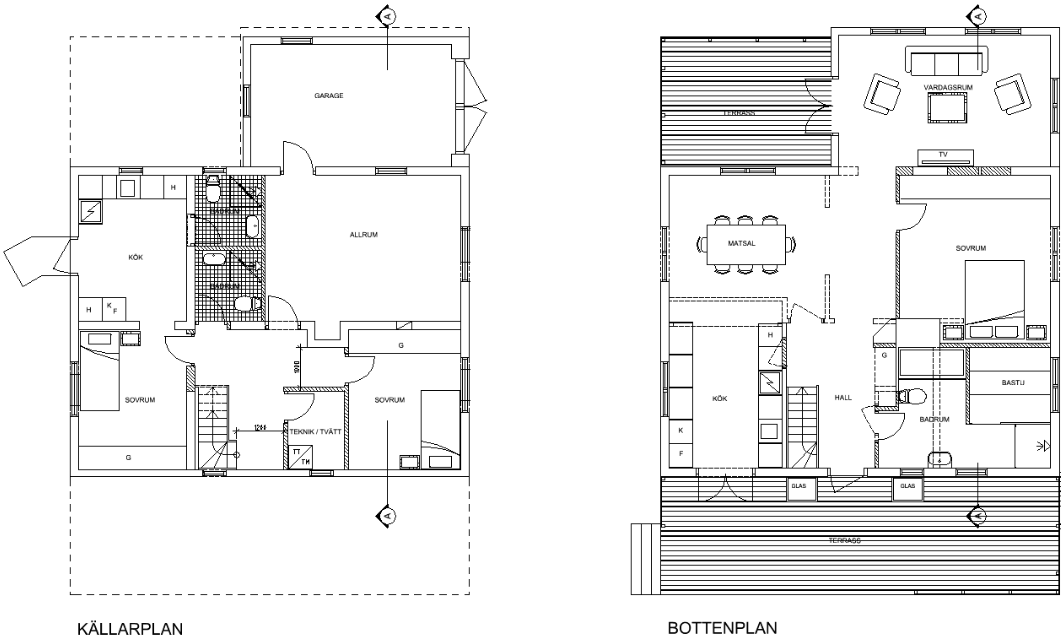

Figure 25: Drawings of the completed retrofit

4 Completion of step-by-step refurbishment to EnerPHit standard including RES

The step-by-step deep retrofit is planned as lined out and described under section 3. In Sweden are not many incentives for the use of RES in private households. Some are still using solar thermal systems and you will find PV installations to a very small extend – but at the moment this has low priority for CS12 (see section 5 below).

5 RES Strategy / PV potential Evaluation

5.1 Inhabitant's comfort and location concept

Evaluation still in process; some initial data see above.

5.2 Evaluation of potential BIPV systems

To be confirmed.

5.3 Production estimation

PV type	**:**	**Crystalline silicon**
Location	**:**	**Bagarmossen, Stockholm**
Installed PV area [m²]	**:**	**Tbc.**
Installed peak power [Wp]	**:**	**Tbc.**
Annual RES gains [kWh]	**:**	**Ca. 875kWh per kWp**
Other	**:**	**New (more efficient) solar cell models under examination**

5.4 Multifunctional behaviour of the BIPV systems: passive properties

5.5 Financial evaluation & taxes and incentives assessment

5.6 Conclusion

At the moment is not much or long-lasting incentive available for PV. Wind or hydro power are not suitable. The district heating is fairly new / recently installed and will be kept for the production of heat and DHW.

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6 Refurbishment to the current National Standards

6.1 General Description

Sweden has a relatively high standard for new-built dwellings – but as for now, no proof needs to be provided (pressure test etc.). If new windows are installed into a an existing building, they fro now on have to be to the same standard as for new build houses.

6.2 Efficiency results comparison table

	Existing building	National regulations (new-built)	EnerPHit standard	Differences [%]
Space heat demand [kWh/(m^2/a)]	235	55 ("köpt energi" – i.e. heating, DHW and auxiliary power)	17	Can not be compared directly
Primary energydemand [kWh/(m^2/a)]	256		85	
Heat Load [W/m^2]	77	4.5kW for heating	11	

Figure 26: Comparison of efficiency results

6.3 Building envelope comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Airtightness Pressure test n50 [1/h]	4.4	Not binding	1.0	20%
Building envelope				
Floor Slab [W/(m^2K)]	3.87	The overall U-value of the whole building is not to surpass 0.4 W/(m^2K	0.12	
Walls to ground [W/(m^2K)]	1.49		0.15	
Walls [W/(m^2K)]	0.91		0.13	
Roof / Attic ceilings [W/(m^2K)]	0.34			
Windows [W/(m^2K)]	2.3		1.1	
Doors [W/(m^2K)]	3		1.1	
Thermal bridging ΔU[W/(m^2K)]	0.15		0.01	

Figure 27:Comparison of building envelope components

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6.4 Building equipment comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Ventilation	**Natural**	**Natural**	**Paul Novus**	
HR Efficiency [%]			93	
Electric efficiency [Wh/m³]			0.24	
Ducting				
Heating	**Boiler**		**District heat**	
Energy source	Gas		CHP	
Performance ratio of heat generation [%]				
Thermal output kW				
Insulation of pipes				
Domestic hot water	**Gas**		**District heat**	
Energy source	Gas		CHP	
Performance ratio of heat generation [%]				
Thermal output kW				
Insulation of pipes				
Cooling	**Gas**		**Heat pump**	
Energy source	Gas		Electricity	
Performance ratio of cooling generation [%]				
Thermal output kW				
Insulation of pipes				

Figure 28:Comparison of building envelope components

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6.5 RES implementation comparison table

	Existing building	National regulations	EnerPHit standard	Differences [%]
Renewables	None	Either 10 kWh/m^2/yrof Domestic hot water heating or 4 kWh/m^2/yr of electrical energy – Baxi CHP meets target	Either 10 kWh/m^2/yrof Domestic hot water heating or 4 kWh/m^2/yr of electrical energy – Baxi CHP meets target	

Figure 29:Comparison of building envelope components

6.6 Conclusions

The high level of quality insurance typical for the EuroPHit standard is finding growing interest on the Swedish renovation/retrofit scene. Depending on future building regulations – which are increasingly stringent also for renovations – there is a high chance that this method will be used as it helps spreading the budget over a longer period.

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