

Case Study 01_Home for the Elderly in Rochestown, Dun Laoghaire EuroPHit



Presented by Mariana Moreira



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

www.europhit.eu



EuroPHit Project Overview

Introduction to Passive House Principles

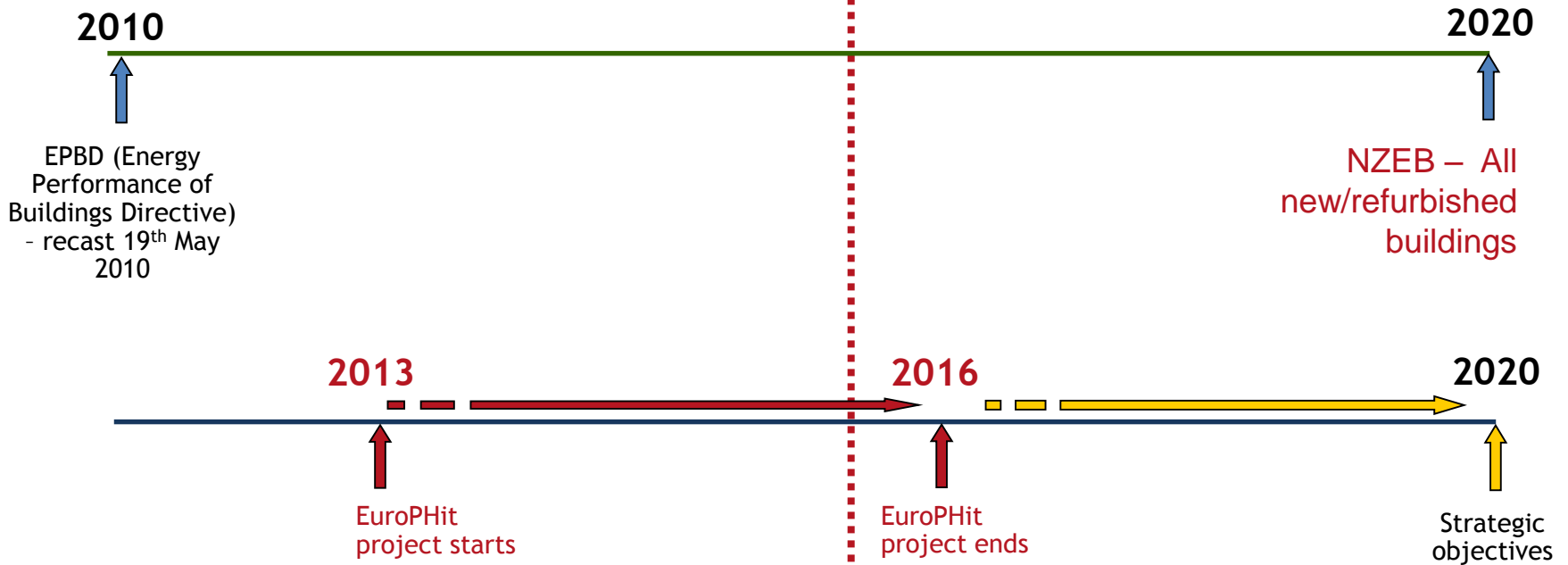
Case Study



EuroPHit Project Overview



We are here



how to get there?

High efficiency

EU's 2020 objective:

All new/refurbished buildings as NZEBs (Nearly Zero Energy Buildings)

Low efficiency



- Based on Passive House methodology, with 20 years of experience
- Detailed planning and modelling, using PHPP software
- Airtight construction, ventilation with heat recovery, avoidance of thermal bridging
- High quality building components
- Low and predictable energy usage (80-90% reductions possible)
- “Quality-approved energy retrofit with Passive House components”

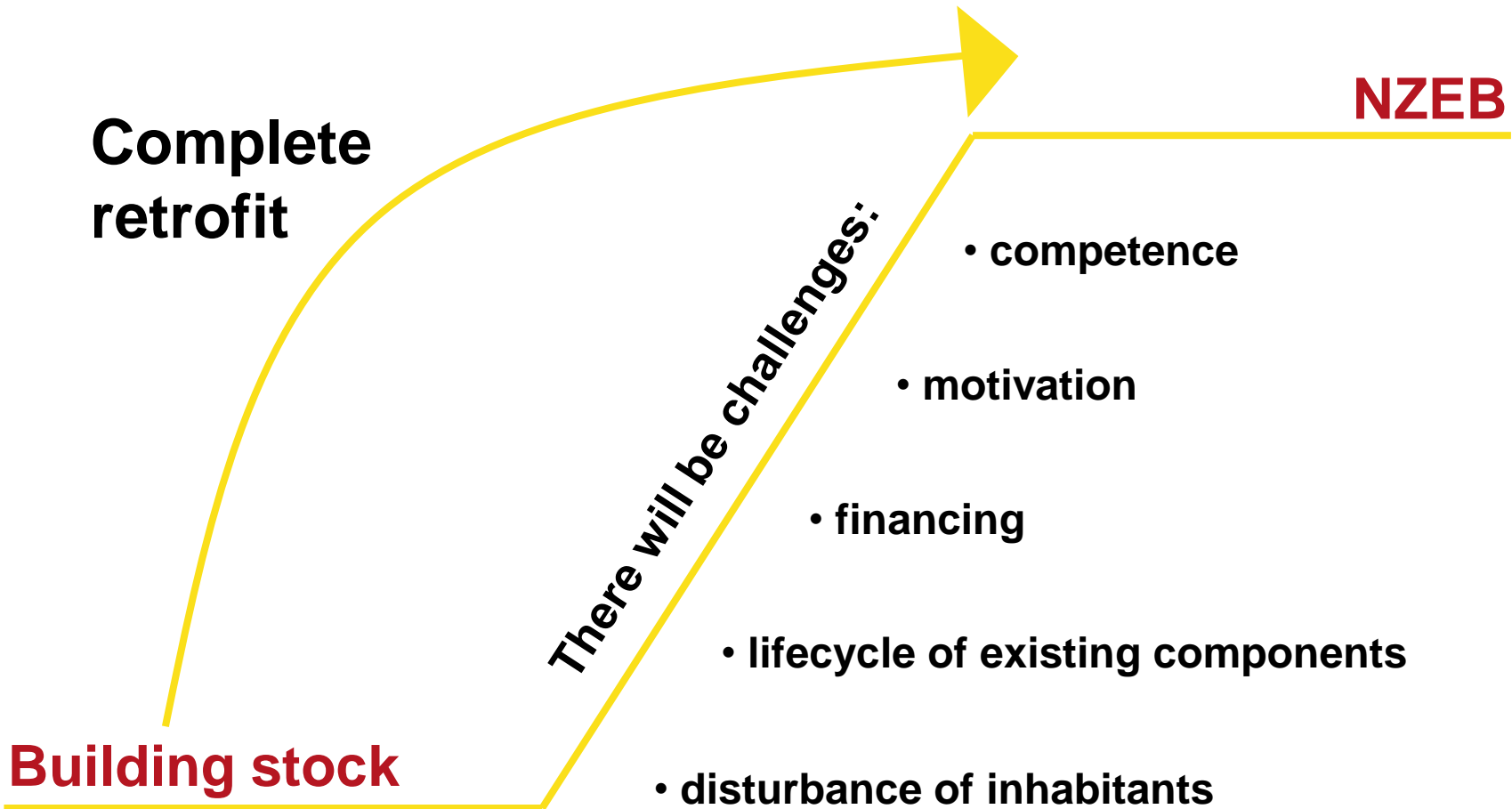
Criteria	Passive House	EnerPHit
Specific Heat Demand	$\leq 15 \text{ kWh/m}^2.\text{yr}$	$\leq 25 \text{ kWh/m}^2.\text{yr}$
Primary Energy Demand	$\leq 120 \text{ kWh/m}^2.\text{yr}$	$\leq 120 \text{ kWh/m}^2.\text{yr}^*$
Airtightness	$n_{50} \leq 0.6^{-1}$	$n_{50} \leq 1.0^{-1}$

* $PE \leq 120 \text{ kWh/m}^2.\text{yr} + ((SHD - 15 \text{ kWh/m}^2.\text{yr}) \times 1.2)$



All at once...

EuroPHit

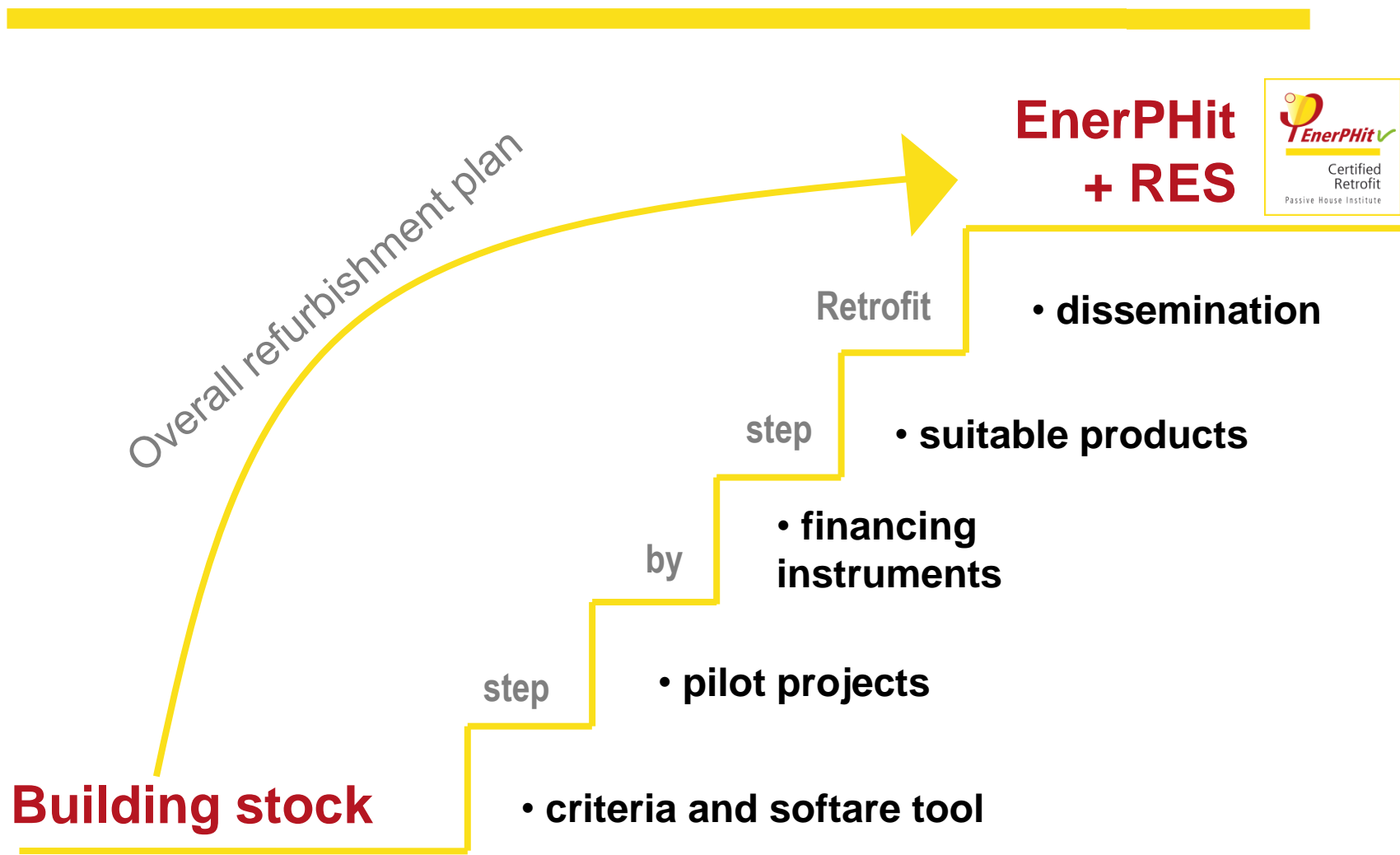


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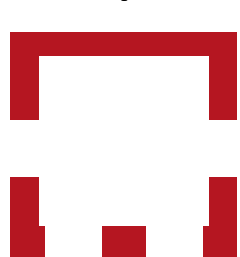


...or Step-by-Step

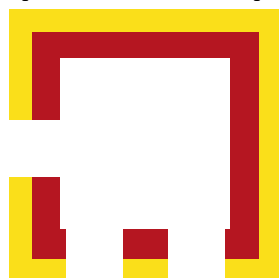


What is step-by-step retrofit?

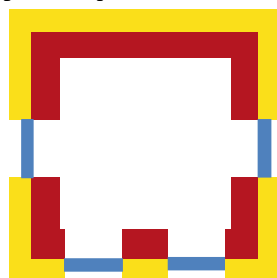
Example - Components step-by-step



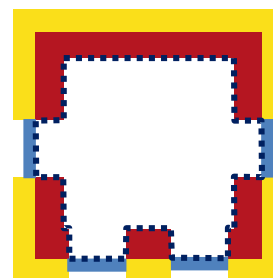
Building stock



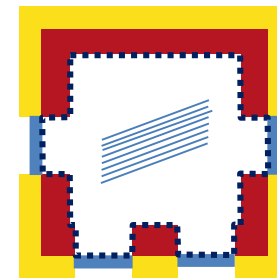
Insulation



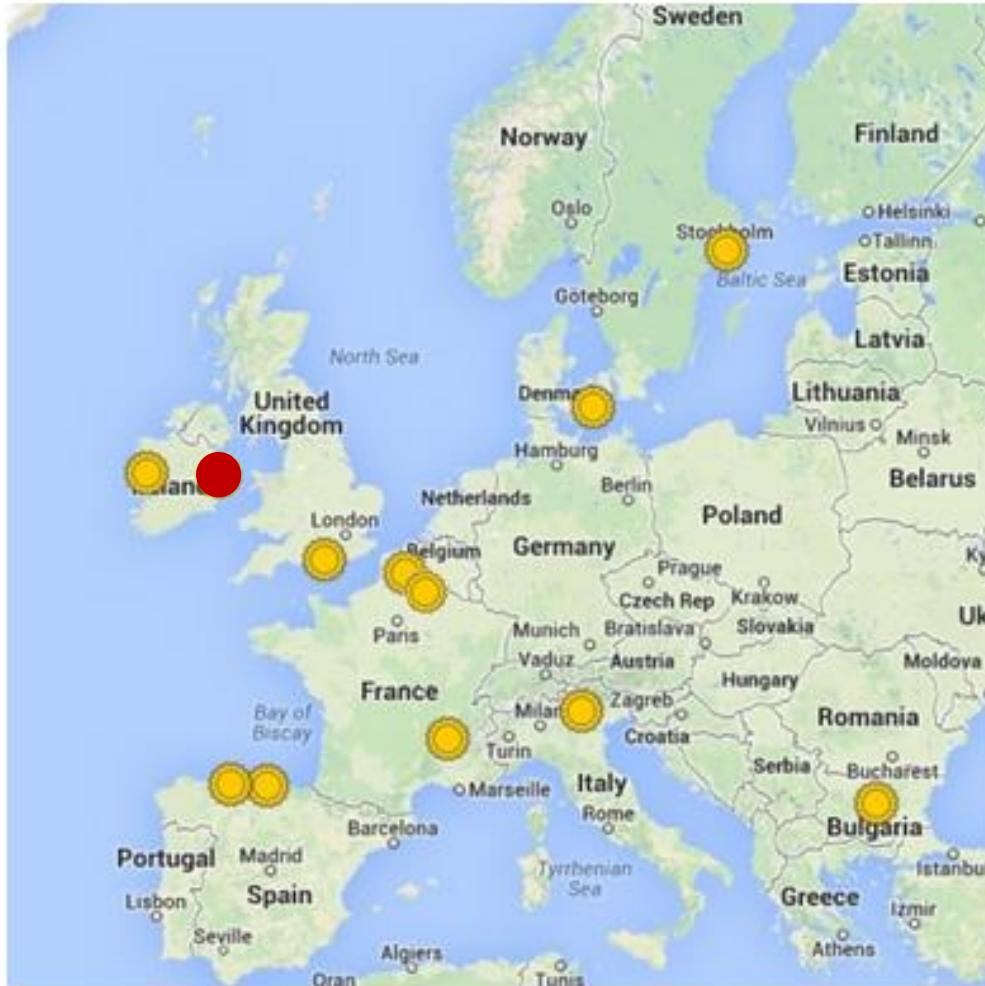
Windows



Airtightness & ventilation



Renewable Energy Systems

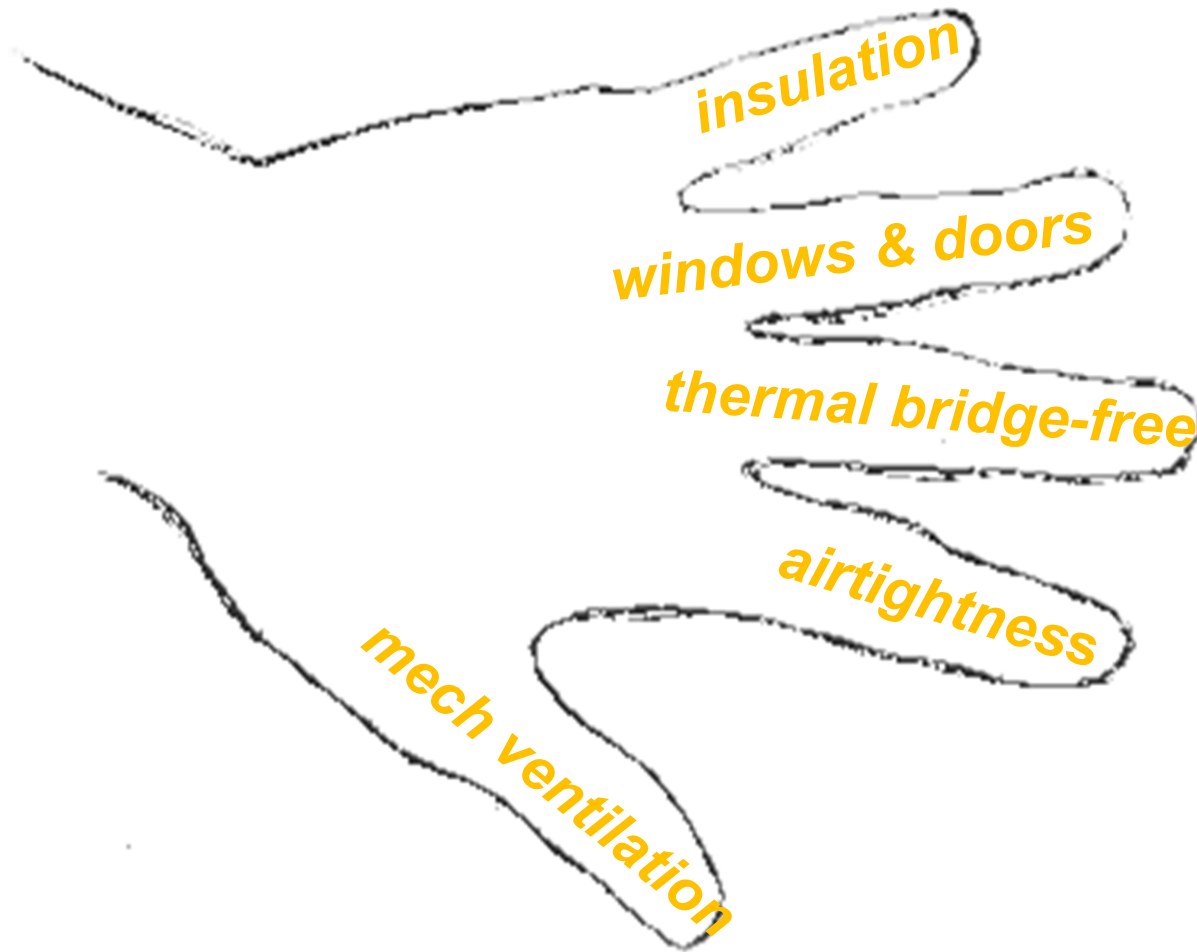


Within the **EuroPHit** project, a selection of **residential** and **non-residential buildings** across **Europe** are being **retrofitted according to Passive House principles.**



Introduction to Passive House Principles





PHPP (Passive House Planning Package)

EuroPHit

The screenshot displays the PHPP software interface. At the top left, a 3D model of a house is shown with labels for 'terrain from google maps' and 'thermal envelope'. A curved arrow indicates 'easy change of orientation'. To the right, a 'Thermal Bridge Analysis' diagram shows a cross-section of a wall with a vertical thermal bridge, color-coded from red (high temperature) to blue (low temperature). Below the 3D model, two graphs are shown: 'Hygrothermic Analysis' with 'Temperature [°C]' and 'Water Content [kg/m³]' on the y-axis, and 'WUFI®' with 'Rel. Humidity [%]' on the y-axis. The bottom right shows the 'Passive House' settings panel with various input fields and a table of energy demands.

Applied	Heating Method	PH Certification	Fulfilled?
9	kWh/(m²a)	15 kWh/(m²a)	Yes
0.5	h ⁻¹	0.6 h ⁻¹	Yes
61	kWh/(m²a)	100 kWh/(m²a)	Yes
34	kWh/(m²a)		
7	kWh/(m²a)		
1	kWh/(m²a)		

Hygrothermic Analysis

Thermal Bridge Analysis

Source: PHI



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Case Study 01_Home for the Elderly

Rochestown, Dun Laoghaire



Dún Laoghaire-Rathdown
County Council Comhairle Contae
Dhún Laoghaire-Ráth an Dúin



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Case Study Overview – Original Situation

EuroPHit



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Case Study Overview – Original Situation

EuroPHit

Northwest view



Two-storey block of 34 apartments with modest common facilities (kitchen and dining room)

Built during the early 1970's

Floors, walls and roof - poured concrete with little or no insulation incorporated (walls – concrete panels with pebble dash finish)

Southeast view



Solar gains with heavy shading to the Northwest and quite open to the Southeast

Plant room on the roof accommodating a low efficiency oil-fired boiler

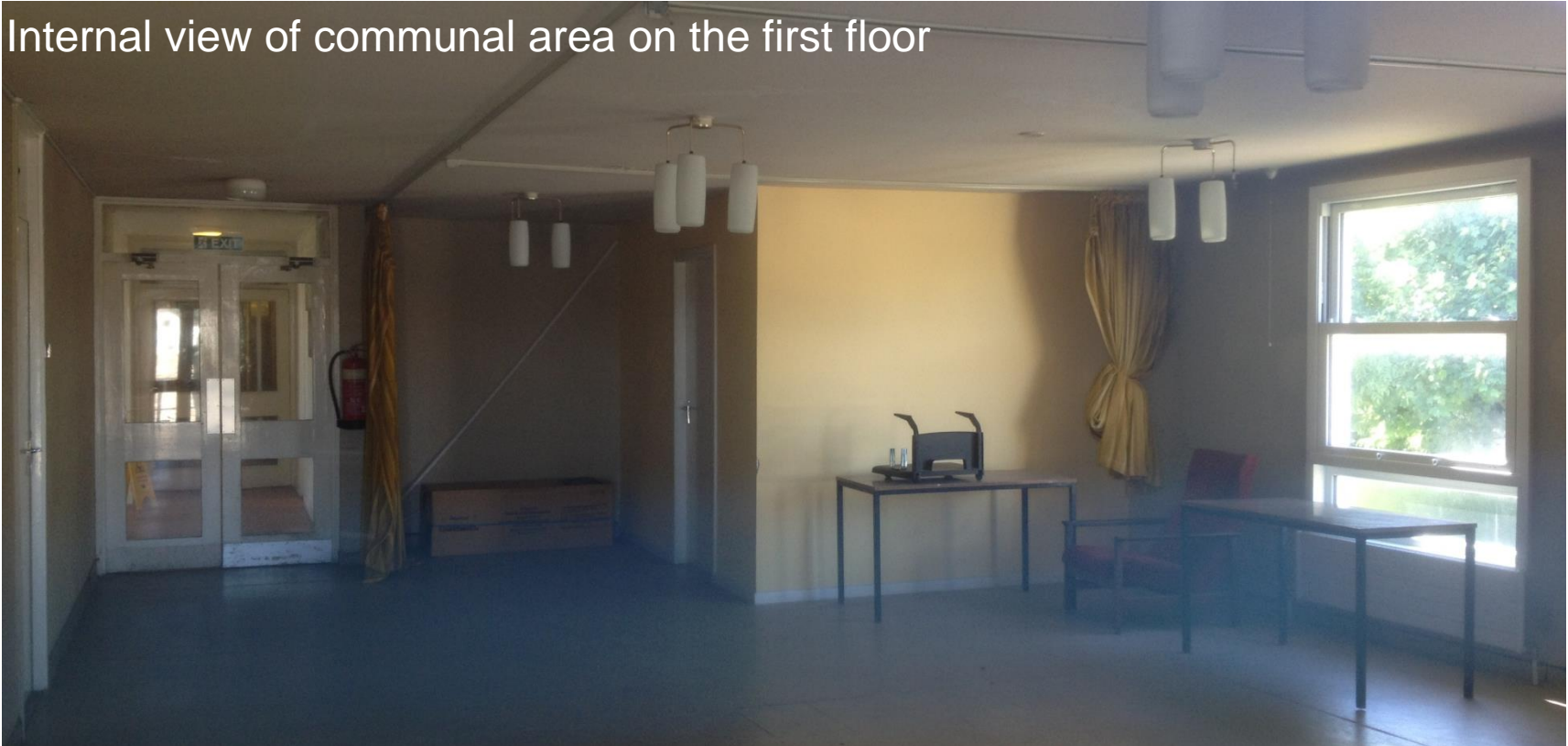


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Internal view of communal area on the first floor



Relatively low floor to ceiling height (challenge - ventilation ducting for the retrofitting proposal)

Ventilation is mostly natural, using opening window sections and room-based fans



EnerPHit Proposal – Floor Plans



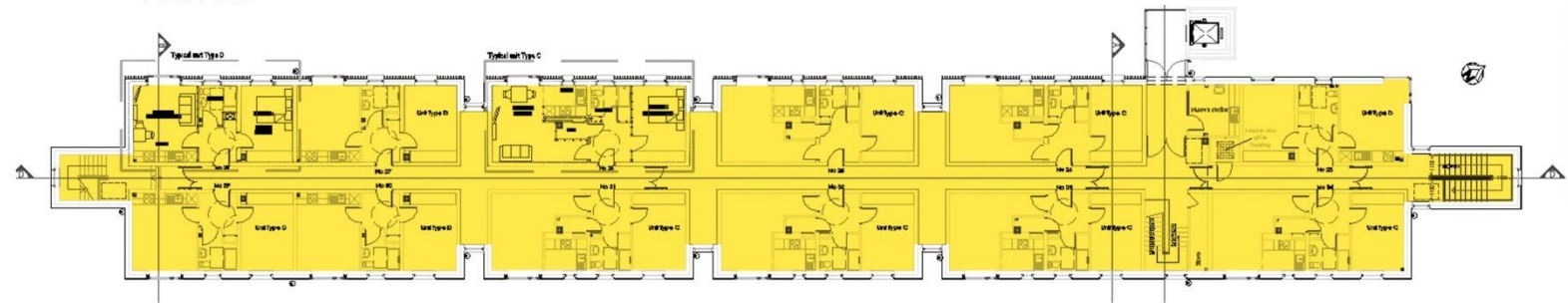
Ground Floor



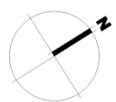
■ new areas within the thermal envelope



First Floor

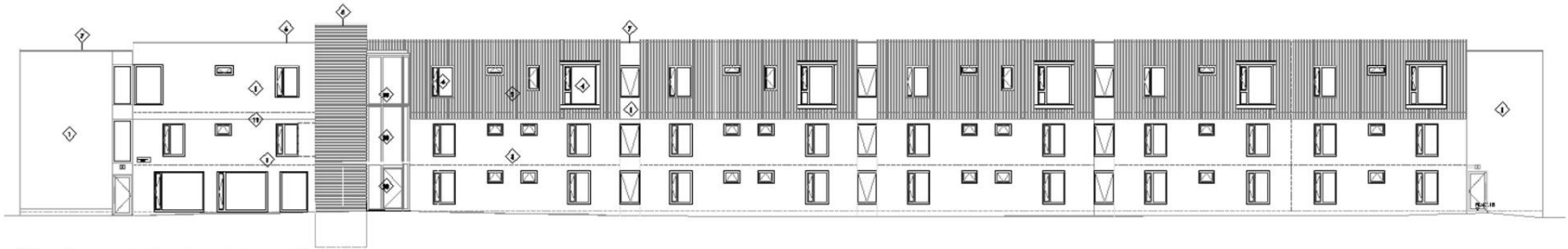


Second Floor

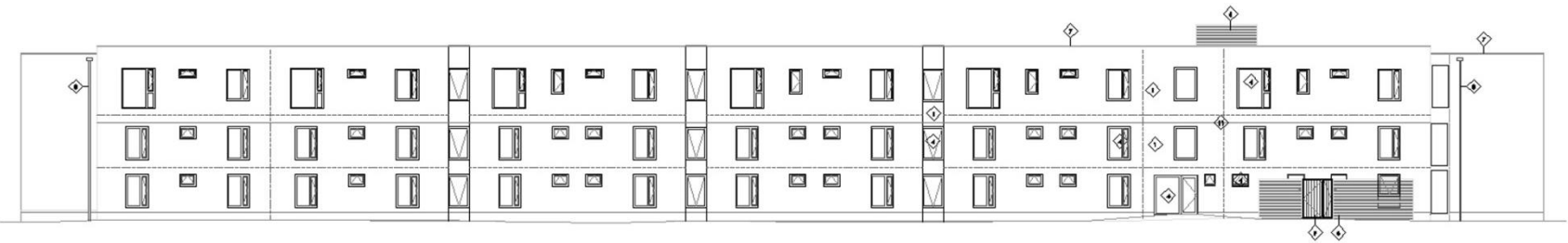


EnerPHit Proposal - Elevations

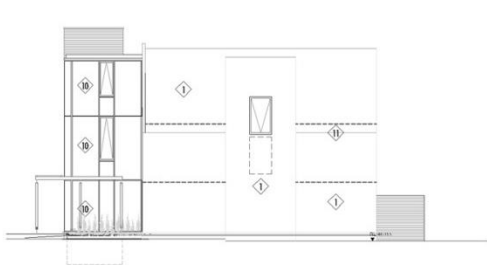
EuroPHit



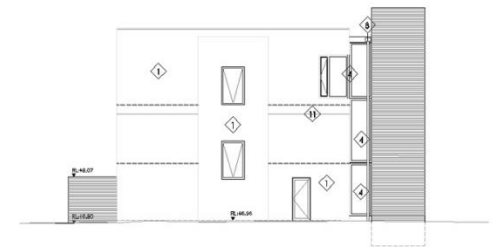
Northwest Facing Elevation



Southeast Facing Elevation



Southwest Facing Elevation



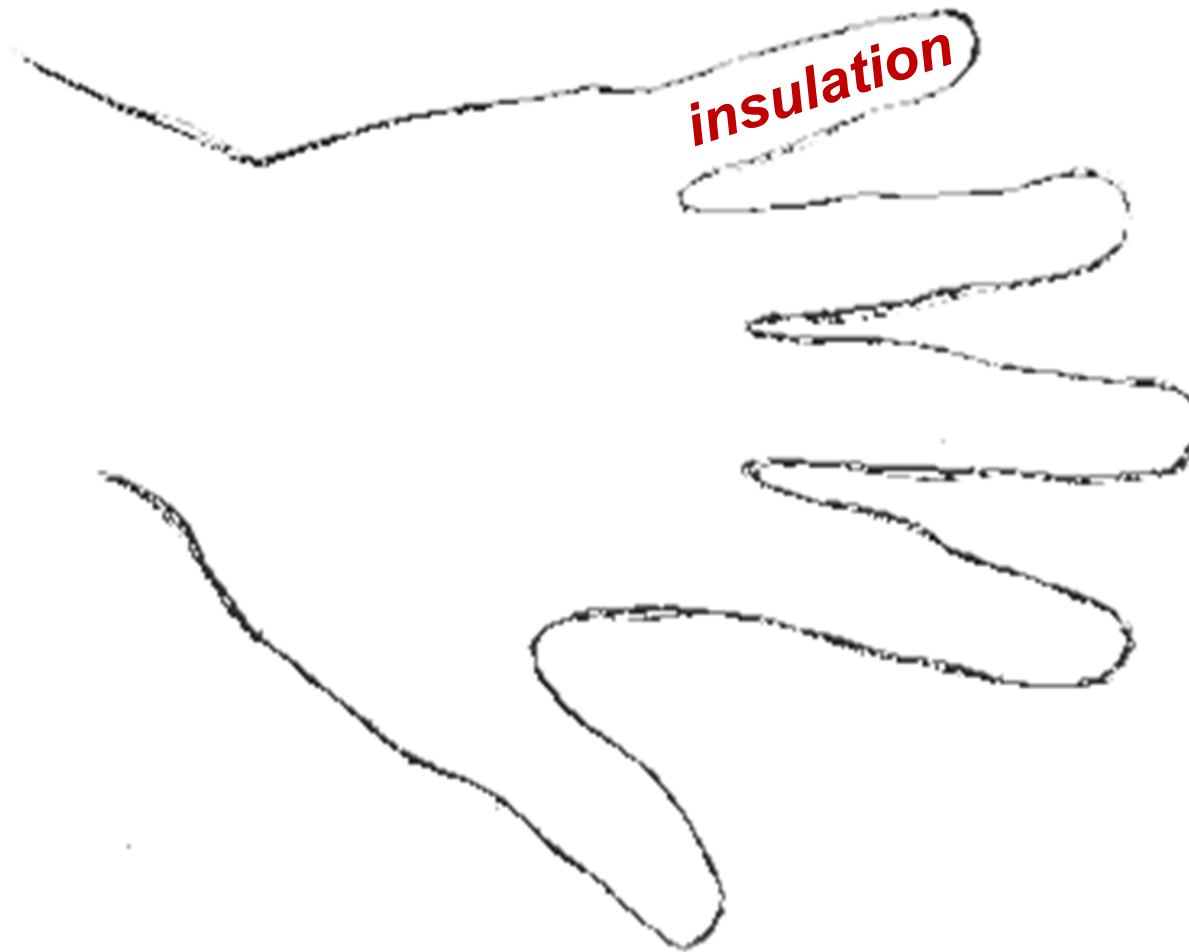
Northeast Facing Elevation



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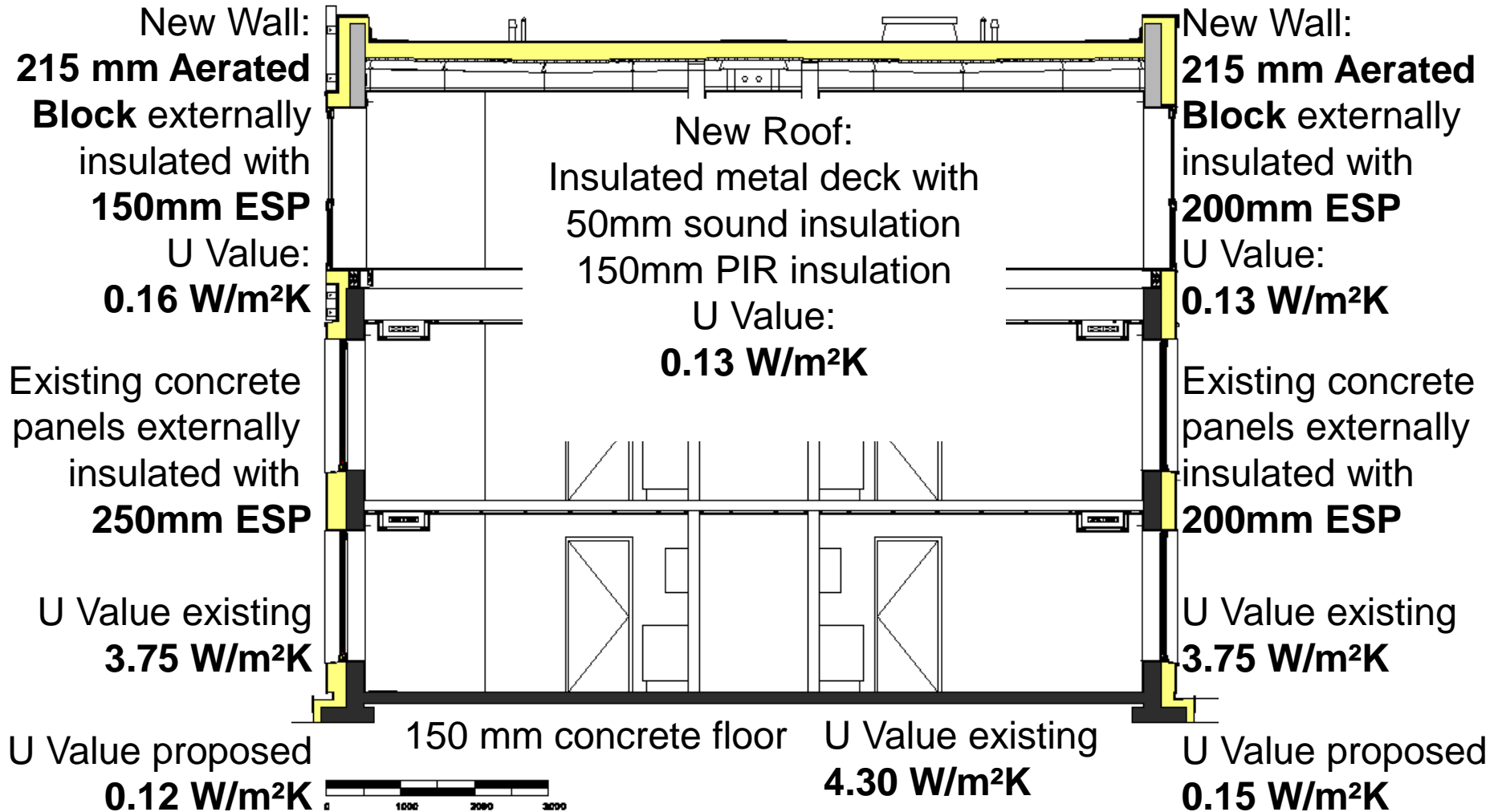
www.europhit.eu





EnerPHit Proposal - Insulation

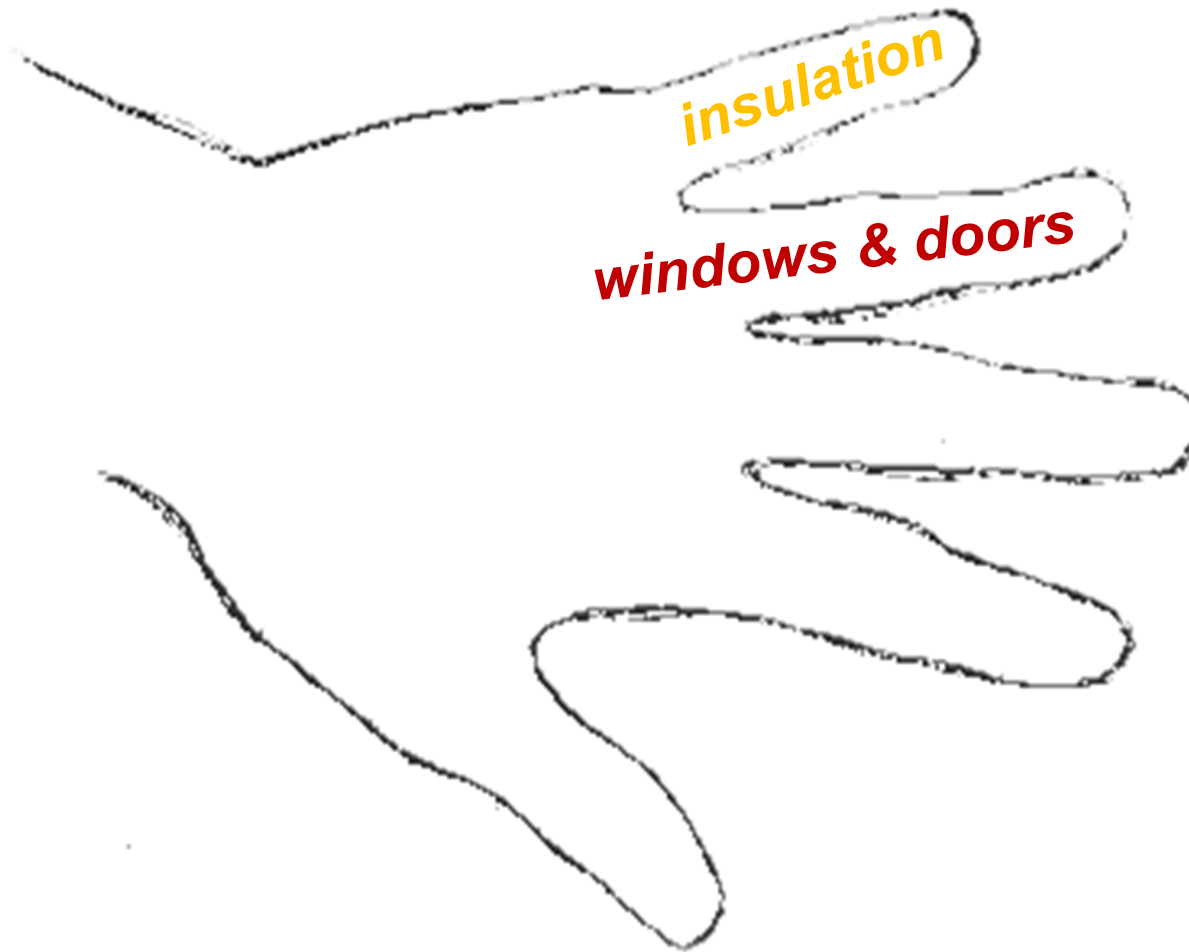
EuroPHit

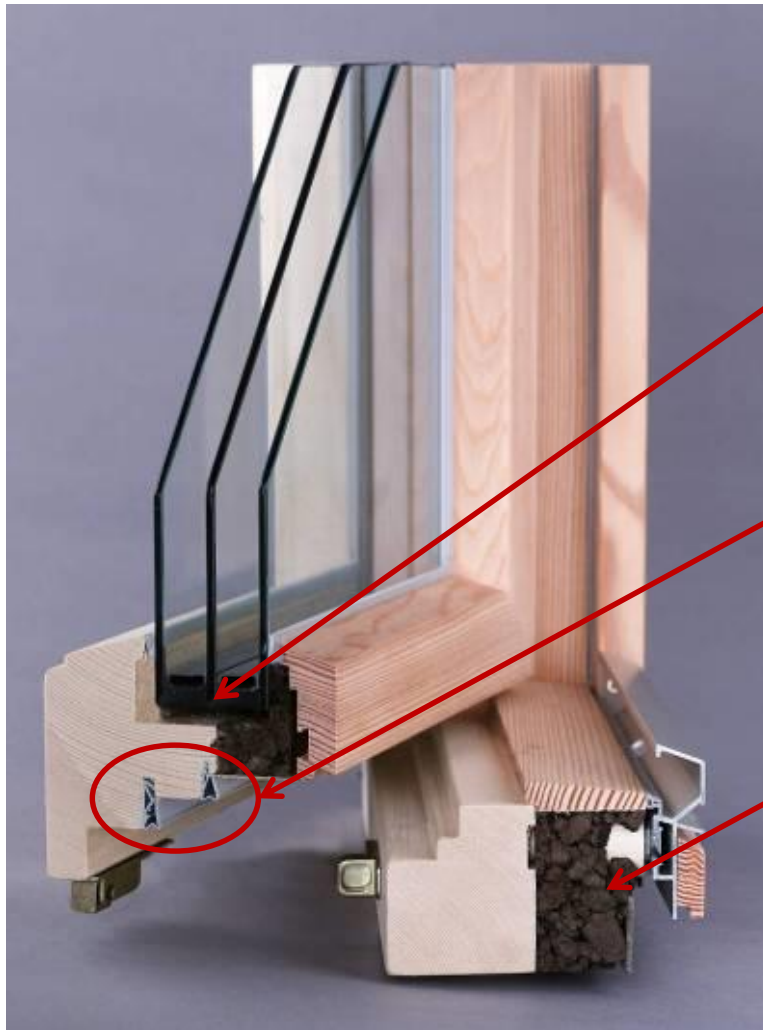


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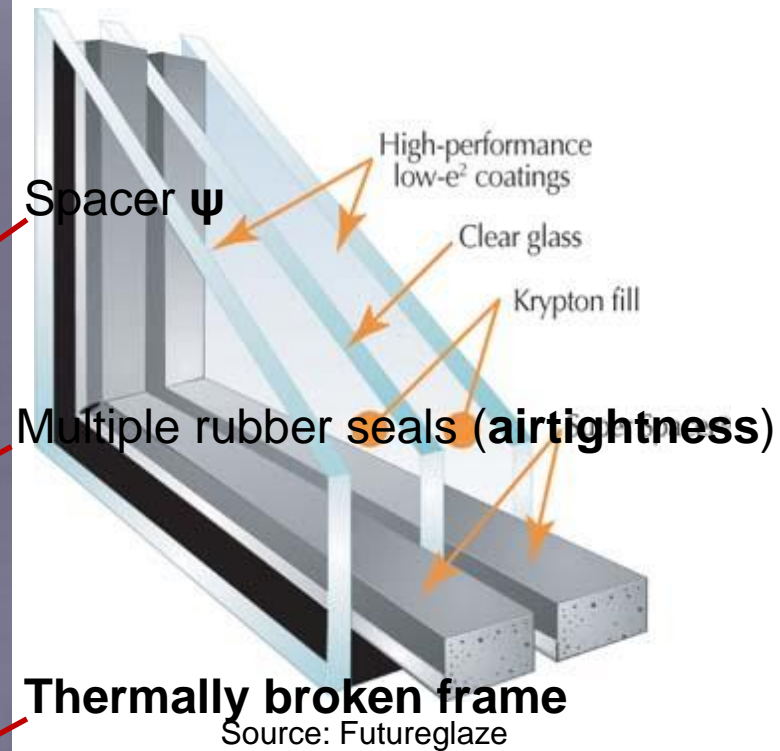
www.europhit.eu







Triple Glazing – U_g & g Values



If at all possible use **PH certified window**



Certificate

Certified Passive House Component
for cool, temperate climates; valid until 31.12.2013

Category:

Manufacturer:

Product name:

This certificate was awarded based on the following criteria:

Given a U_g value of $0.70 \text{ W/(m}^2\text{K)}$ and a window size of 1.23 m by 1.48 m ,

$U_w = 0.78 \text{ W/(m}^2\text{K)} \leq 0.80 \text{ W/(m}^2\text{K)}$

Taking into account the installation based thermal bridges and provided that the installation is, with regard to the thermal bridges, equal or better than shown in the data sheet, the window meets the following criterion.

$U_{w, \text{installed}} \leq 0.85 \text{ W/(m}^2\text{K)}$

Thermal data

	U_f -value [W/(m ² K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer				Swisspacer V*
Bottom	0.79	136	0.027	0.72
Side/top	0.73	136	0.027	

*Spacers of lower thermal quality, especially those made of aluminium, lead to significantly higher thermal losses and lower temperature factors.

For further information, please see the data sheet

www.passivehouse.com 0460wi03

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Passive House Efficiency Class

phA advanced component

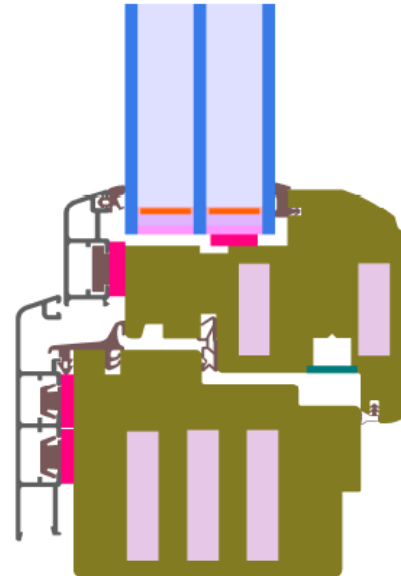
phB basic component

phC certifiable component

not suitable for Passive Houses

CERTIFIED COMPONENT

Passive House Institute



Triple glazing

$$U_g = 0.50 \text{ W/m}^2\text{K}$$

$$g = 45.2\%$$

Multiple seals _ 3

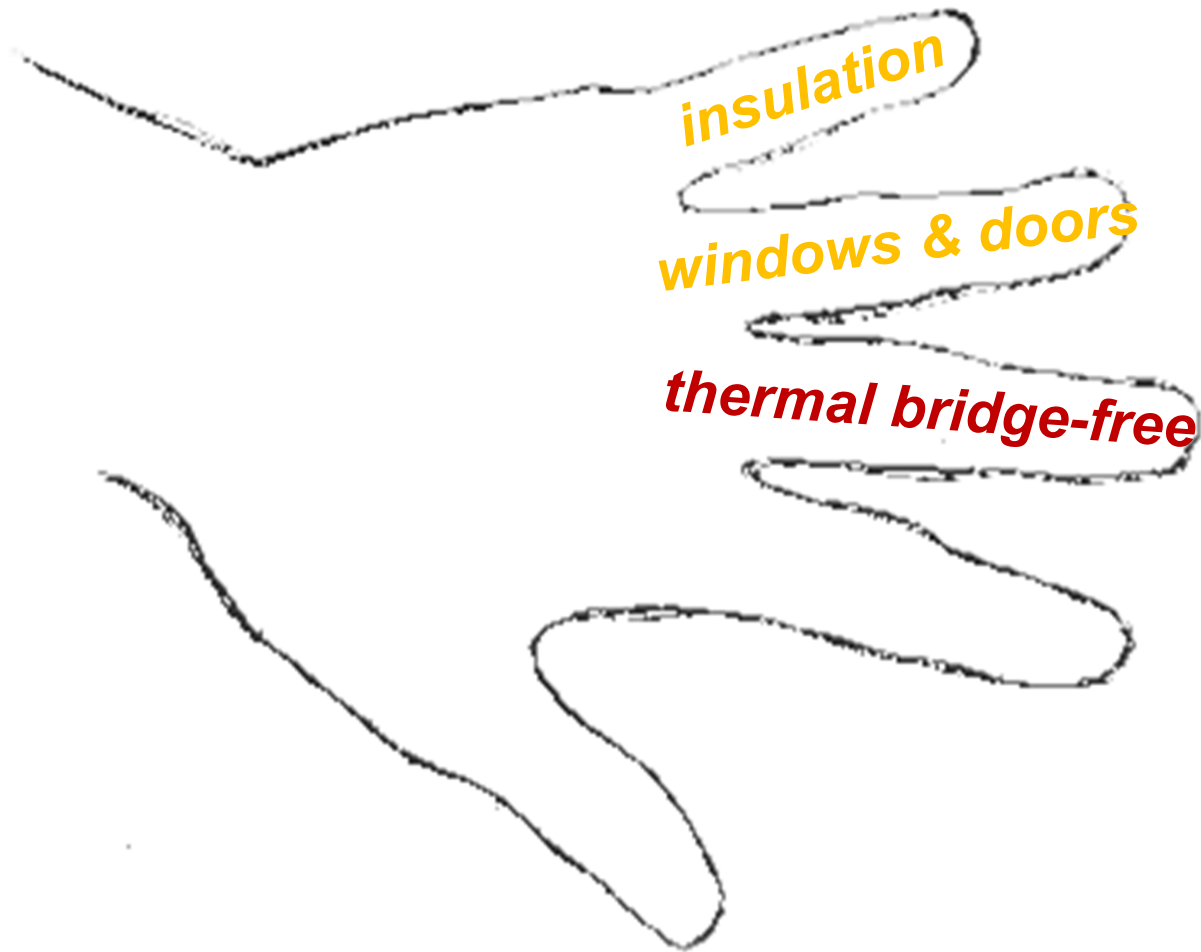
$$\text{Spacer } \psi = 0.027 \text{ W/mK}$$

Thermally broken frame

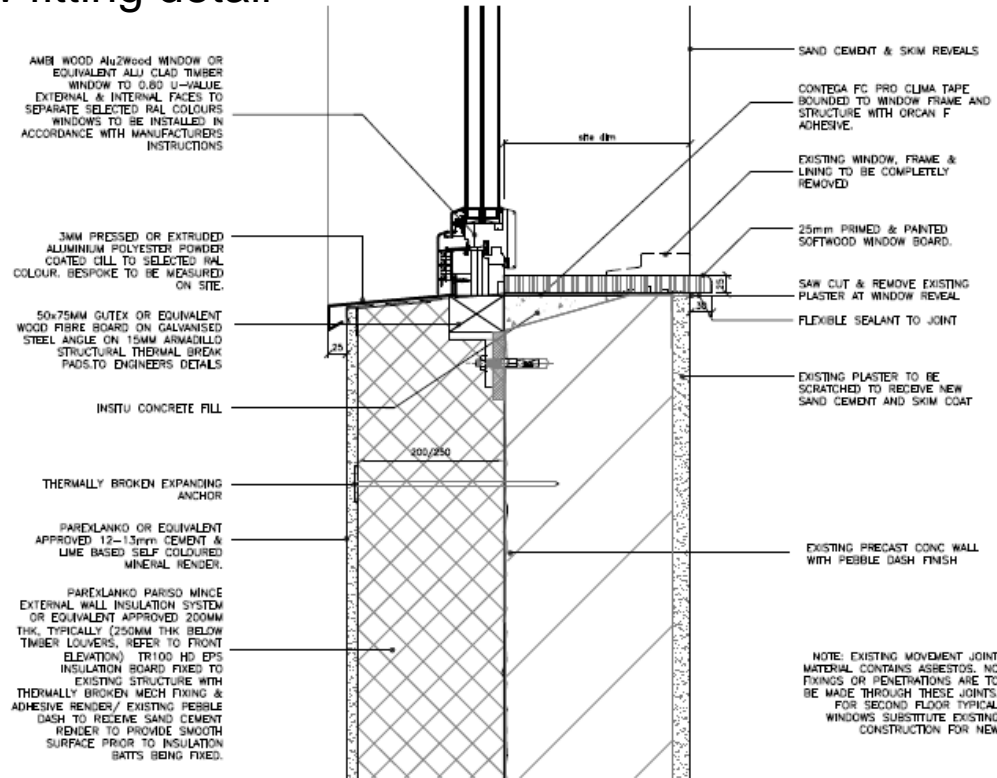
Thermal data

	U_f -value [W/(m ² K)]	Width [mm]	Ψ_g [W/(mK)]	$f_{Rsi=0.25}$ [-]
Spacer				Swisspacer V*
Bottom	0.79	136	0.027	0.72
Side/top	0.73	136	0.027	





Window fitting detail



at design stage

Rev.	Date	Drawn	Description

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Job	REFURBISHMENT OF BLOCK 1		Scale • 1:5	Status • Tender
	ROCHESTOWN HOUSE		Date - 19/05/2014	CAD Ref - H1000/0001
Dwg	TYPICAL WINDOW CILL		Job No • 1750	Drawing No •
			Drm. Chd.	1750/1/200/07 Rev • 00
Architects Department County Hall, High Street, Dan Loughlin, Ch. Dullif. Phone (01206)4700 Fax (01206)6081				

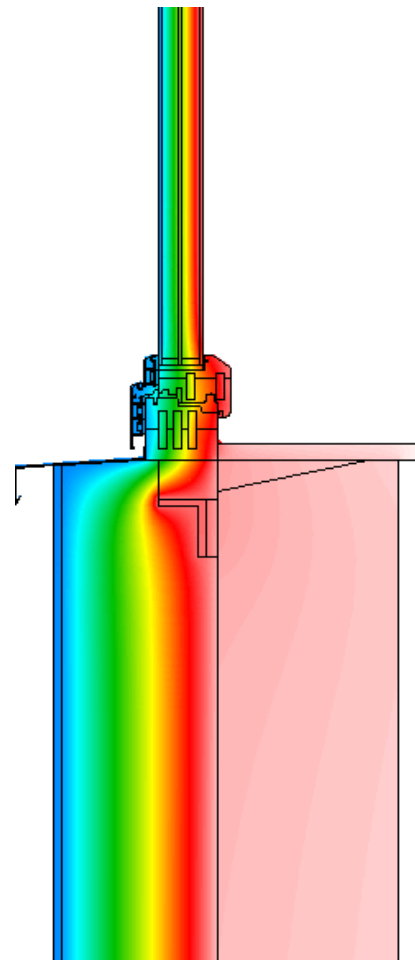
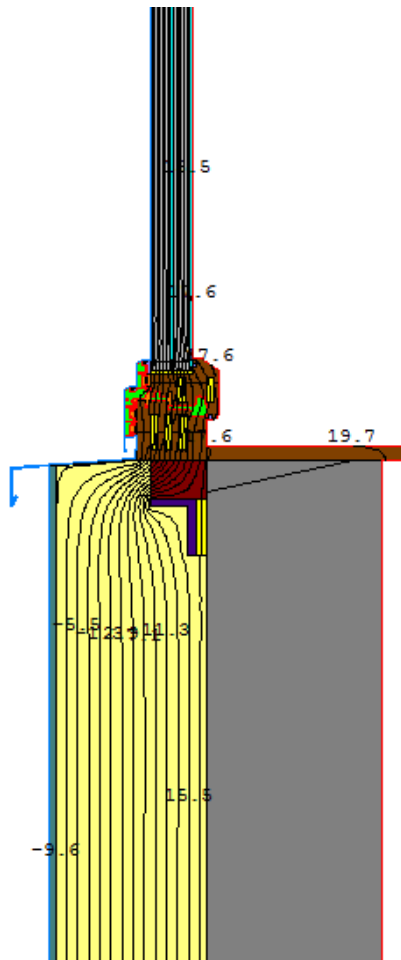


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Window Sill detail in Therm



Ψ_e (for PHPP)

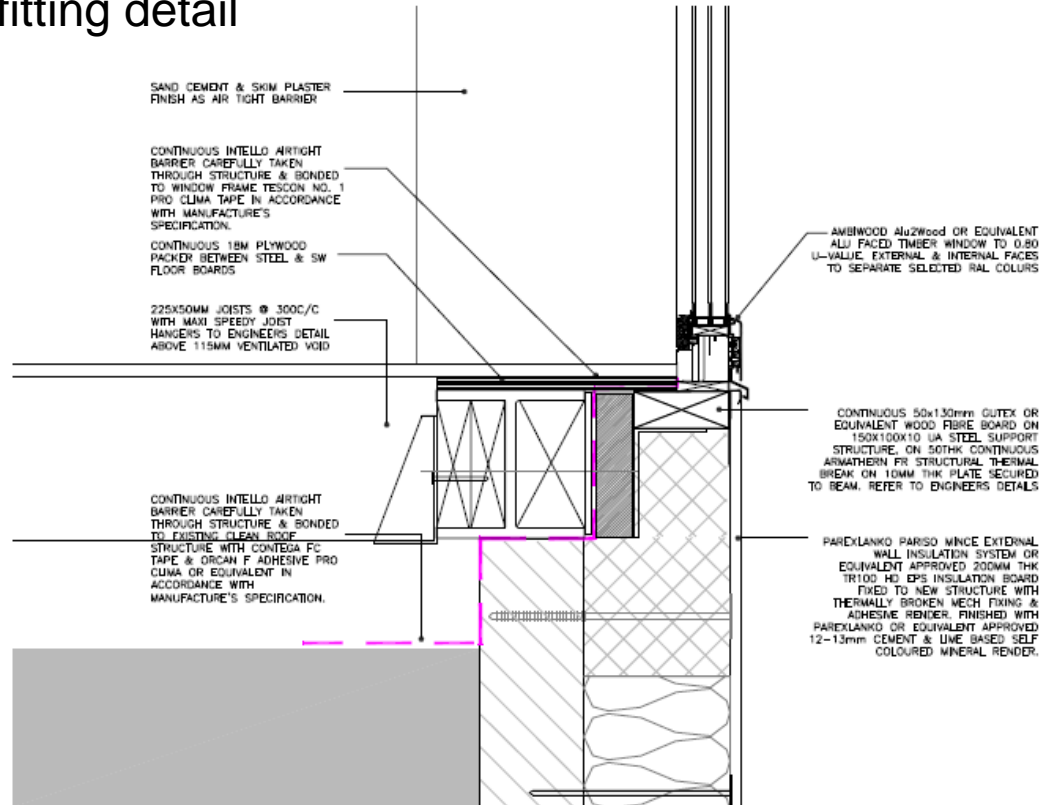
0.031 W/mK



EnerPHit Proposal – Thermal Bridge Analysis

EuroPHit

Window fitting detail



at design stage

Rev	Date	Drawn	Description

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Job
REFURBISHMENT OF BLOCK 1
ROCHESTOWN HOUSE

Dwg
Window Sill, second floor
without louver

Scale -	1:15	Status -	Tender
Date -	19/05/2014	CAD Ref -	200007/0001
Job No -	1750	Drawing No -	Rev -
Drawn -	Chd.	1750/T/200/13	00

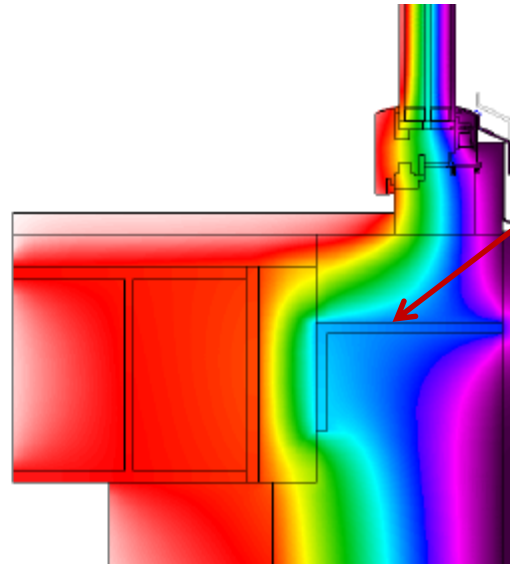
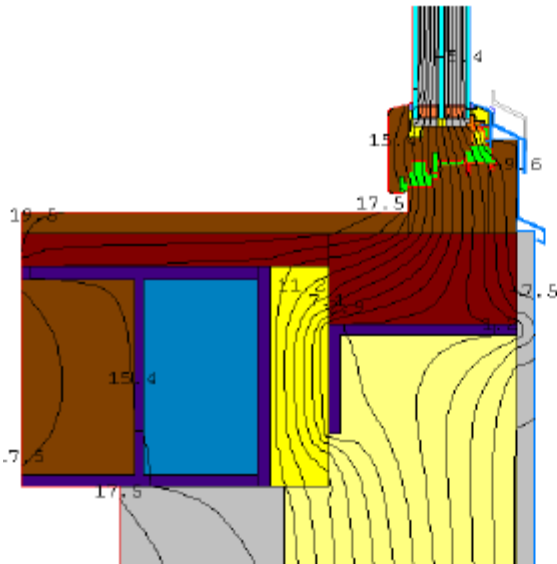
Architects Department
County Hall Marine Road, Dun Loughlin, Co. Donegal
Phone: 01 22644700 Fax: 01 22639391



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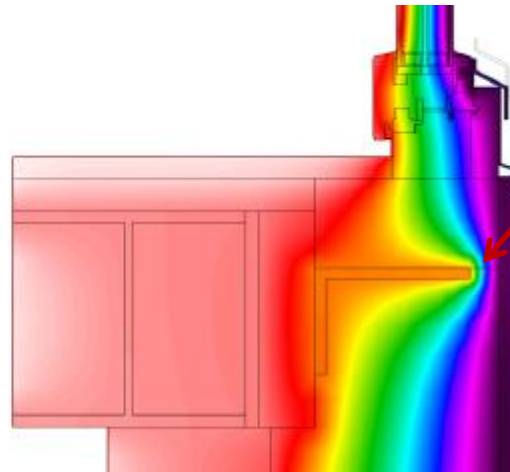
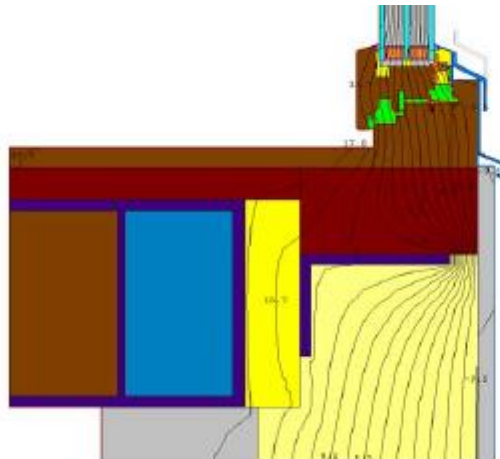
www.europhit.eu





Still angle
causing a massive
thermal bridge

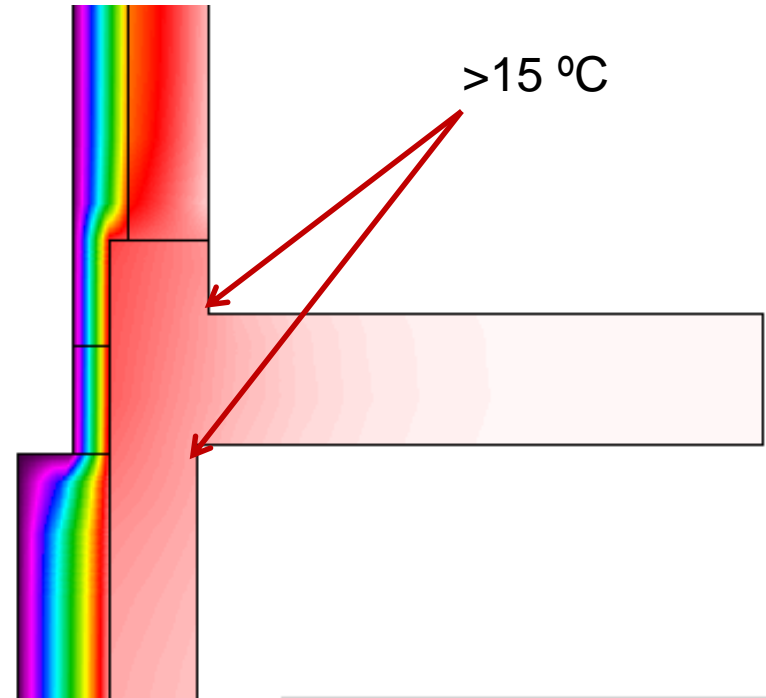
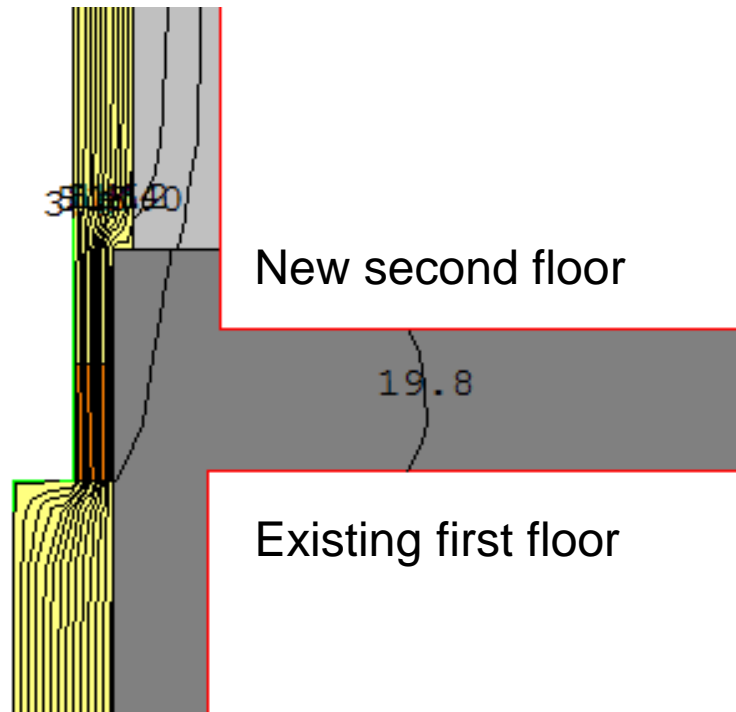
Ψ Value = **0.262** W/mK



Still angle
25 mm set back
from the edge of
the insulation layer

Ψ Value = **0.067** W/mK

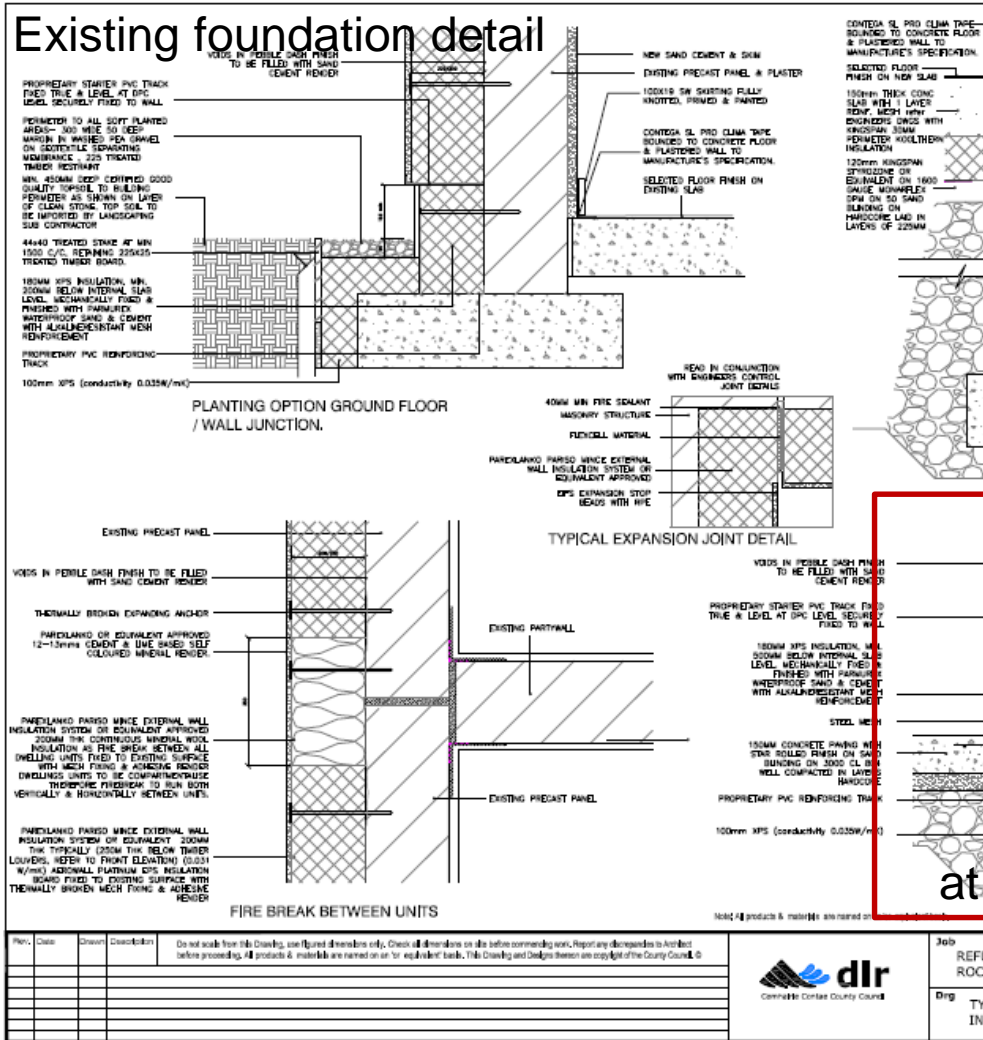
Existing parapet detail in Therm



at construction stage

Minimum internal surface temperature :15 °C (IBR)





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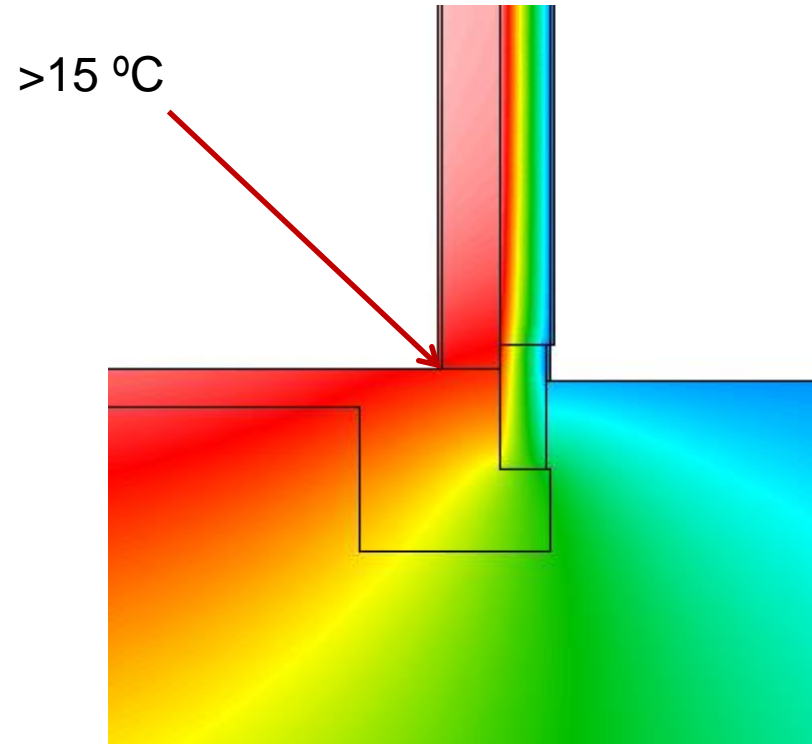
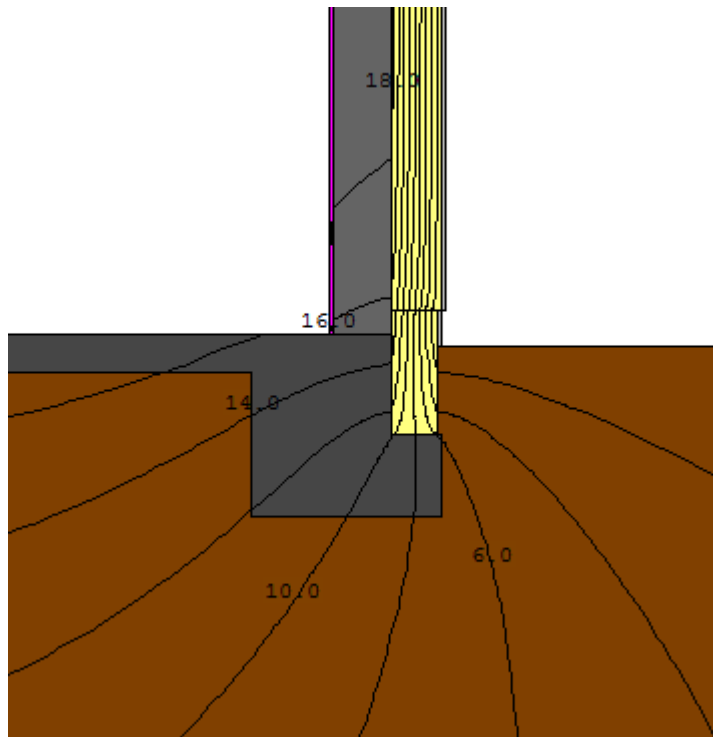
Rev	Date	Drawn	Description

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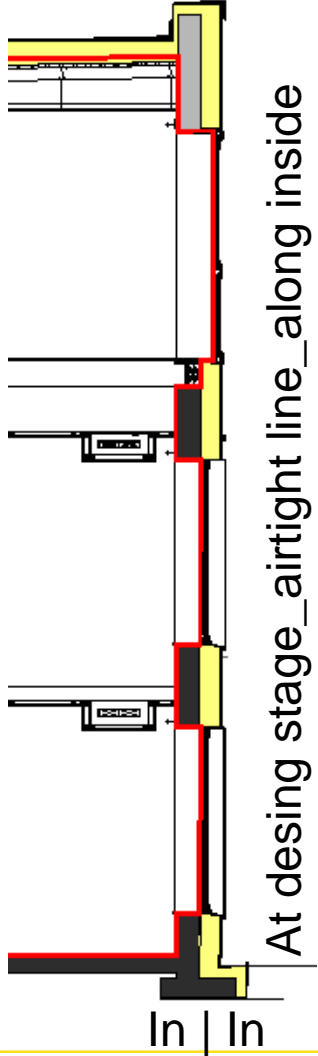
Job REFUR ROCH
 Dwg TYP INS

Existing foundation detail in Therm



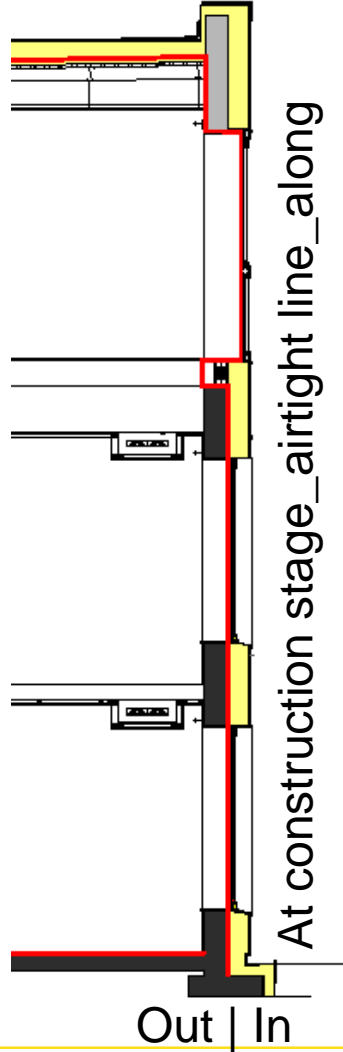
Minimum required height from top of foundation to top of floor slab: **290 mm**
To assure that at skirting level the surface temperature is above 15 °C





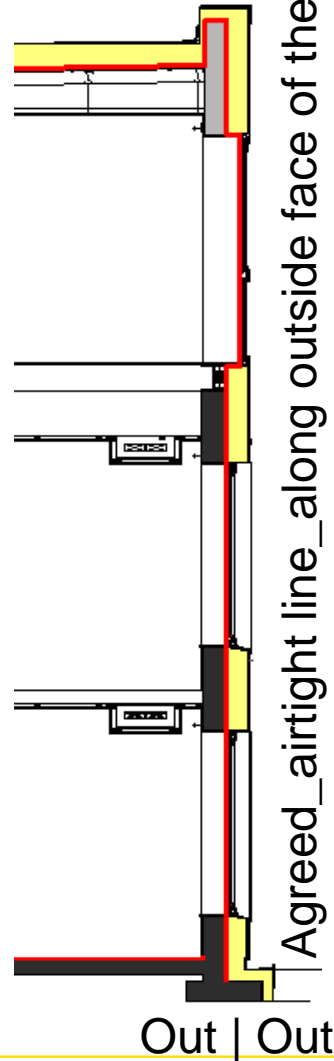
At design stage_airtight line_along inside face of the existing concrete structure.

Internal render on the aerated block to be the airtight line on the second floor



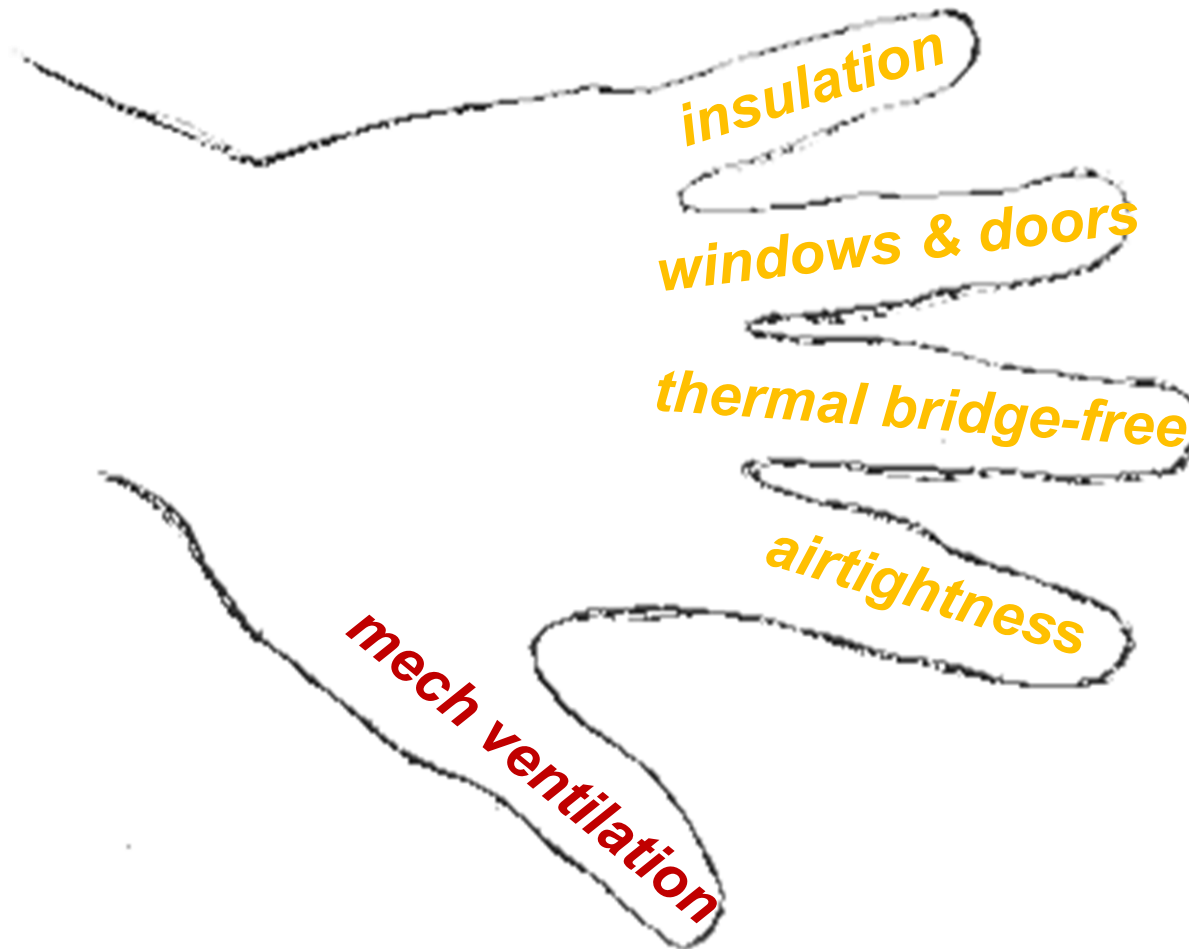
At construction stage_airtight line_along outside face of the existing concrete structure.

Internal render on the aerated block to be the airtight line on the second floor

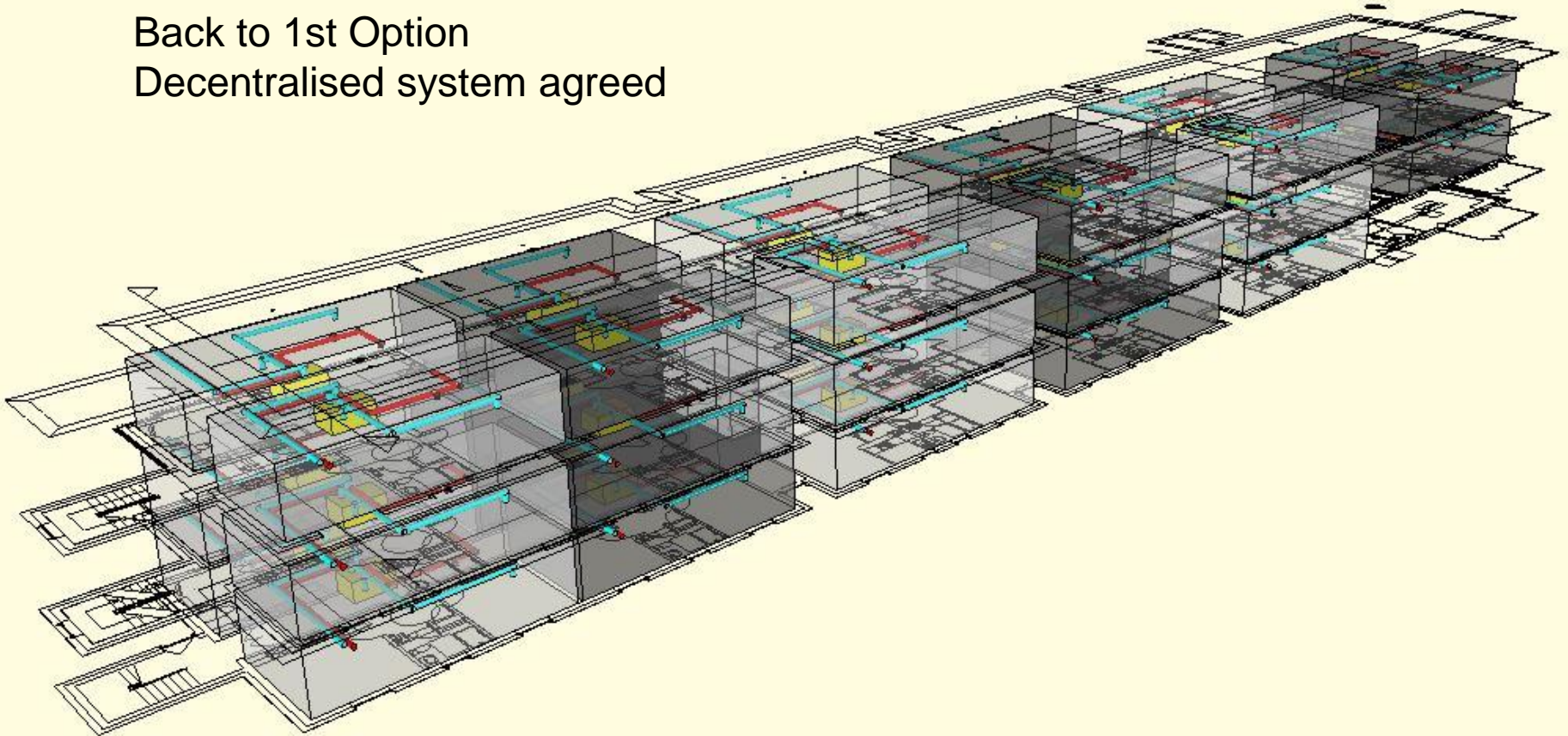


Agreed_airtight line_along outside face of the existing concrete structure. External render on the aerated block to be the airtight line on the second floor



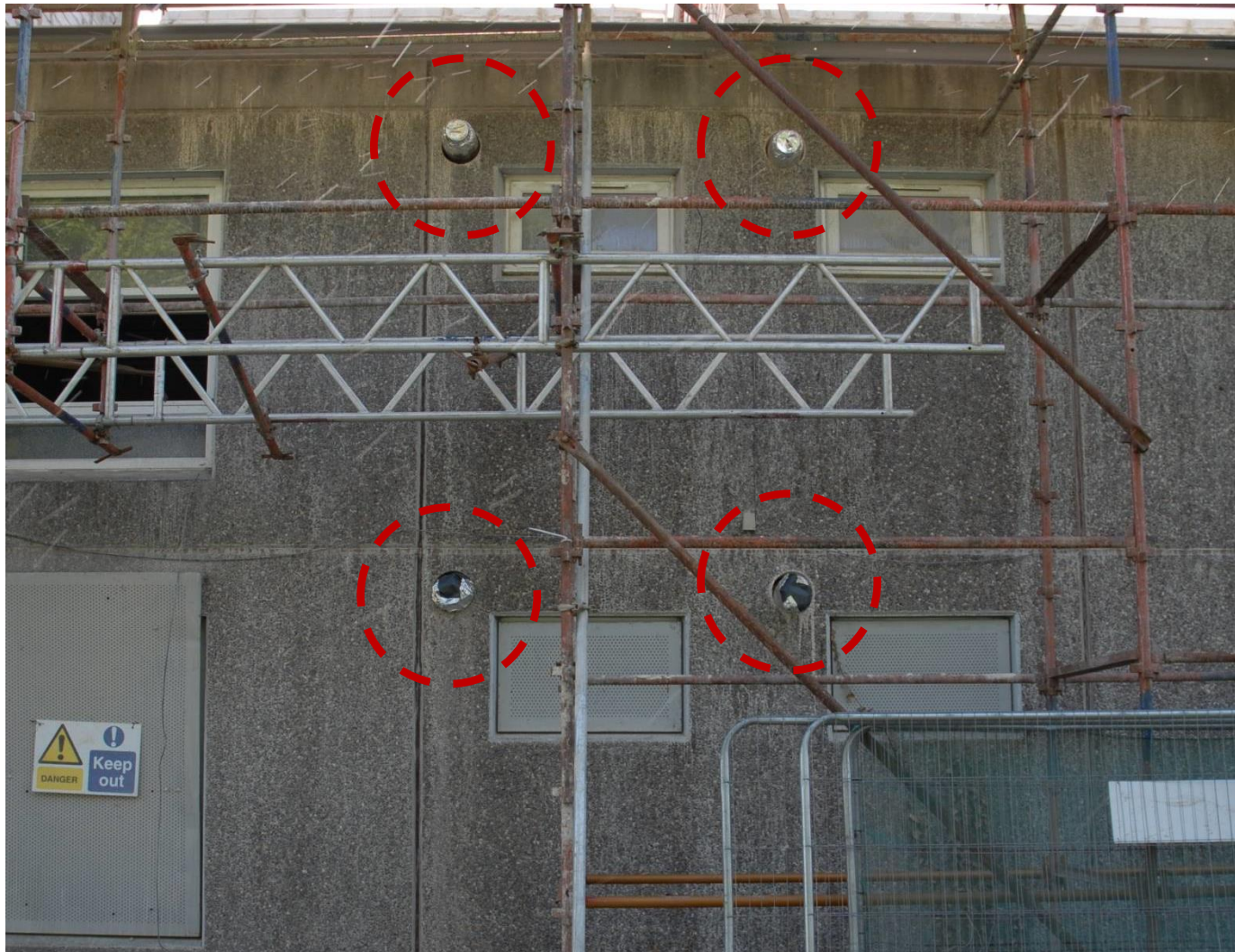


Back to 1st Option
Decentralised system agreed




Load bearing structure (cost)
Southeast view (DesignPH tool)





PHPP – Energy Balance *Before*

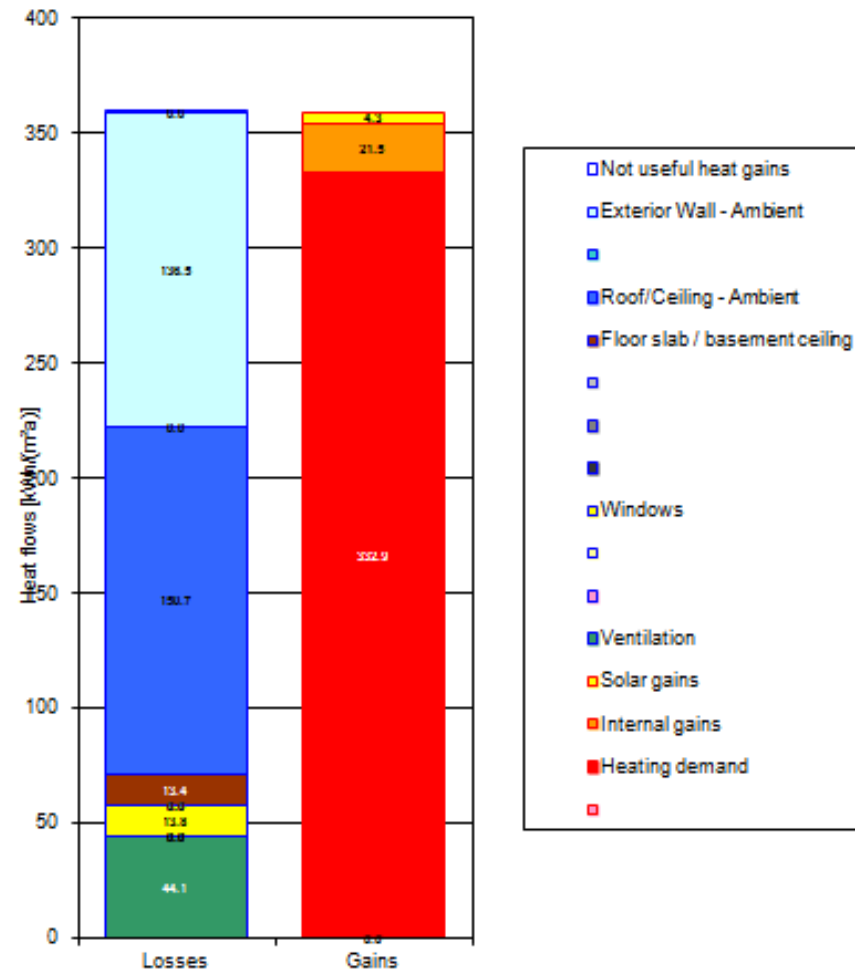
EnerPHit verification



Building	Block One Rochestown House
Street	Sallynogin Road Upper
Postcode/City	Dún Laoghaire
Country	Ireland
Building type	Home for Elderly
Climate	[IE] - Dublin
Altitude of building site (in [m] above sea level)	
-	
Home owner/client	DLR CC
Street	Dún Laoghaire
Postcode/City	Dún Laoghaire
Mechanical System:	
Street:	
Postcode/City:	
Certification:	
Street:	
Postcode/City:	

Architecture:	DLR CC	Mechanical System:			
Street:	Dún Laoghaire	Street:			
Postcode/City:	Dún Laoghaire	Postcode/City:			
Energy consulting:		Certification:			
Street:		Street:			
Postcode/City:		Postcode/City:			
Year of Construction:	1960	Interior temperature winter [C°]	20.0	Interior temp. summer [C°]	25.0
Number of dwelling units:	34	Internal heat gains winter [W/m²]	4.1	IHG summer [W/m²]	4.1
Number of Occupants:	46.1	Spec. capacity [Wh/K per m² TFA]		204	
Exterior vol. V _e :	6339.6 m³	Mechanical cooling:			

Heating energy balance (annual method)



Specific building demands with reference to the treated floor area			
	Treated floor area	Requirements	Fulfilled?*
Space heating	Annual heating demand	354.08 kWh/(m²a)	25 kWh/(m²a) <input type="checkbox"/> no
	Heating load	110 W/m²	- <input type="checkbox"/> -
Space cooling	Overall specific space cooling demand	kWh/(m²a)	- <input type="checkbox"/> -
	Cooling load	W/m²	- <input type="checkbox"/> -
	Frequency of overheating (> 25 °C)	0.0 %	- <input type="checkbox"/> -
Primary Energy	Heating, cooling, dehumidifying, DHW	688 kWh/(m²a)	527 kWh/(m²a) <input type="checkbox"/> no
	DHW, space heating and auxiliary electricity	604 kWh/(m²a)	- <input type="checkbox"/> -
	Specific primary energy reduction through solar electricity	kWh/(m²a)	- <input type="checkbox"/> -
Airtightness	Pressurization test result n ₅₀	5.0 1/h	1.1/h <input type="checkbox"/> no



EnerPHit (Modernisierung): Bauteilkennwerte			
Gebäudehülle	Außendämmung zu Außenluft	4.05 W/(m²K)	-
mittlere U-Werte	Außendämmung zu Erdreich	3.85 W/(m²K)	-
	Innendämmung zu Außenluft	W/(m²K)	-
	Innendämmung zu Erdreich	W/(m²K)	-
	Wärmebrücken ΔU	0.00 W/(m²K)	-
Fenster	Außen Türen	1.71 W/(m²K)	-
	Außen Türen	W/(m²K)	-
Luftungsanlage	eff. Wärmebereitstellungsgrad	%	-

* empty field: data missing; - no requirement



PHPP – Energy Balance *At the moment*

EnerPHit verification

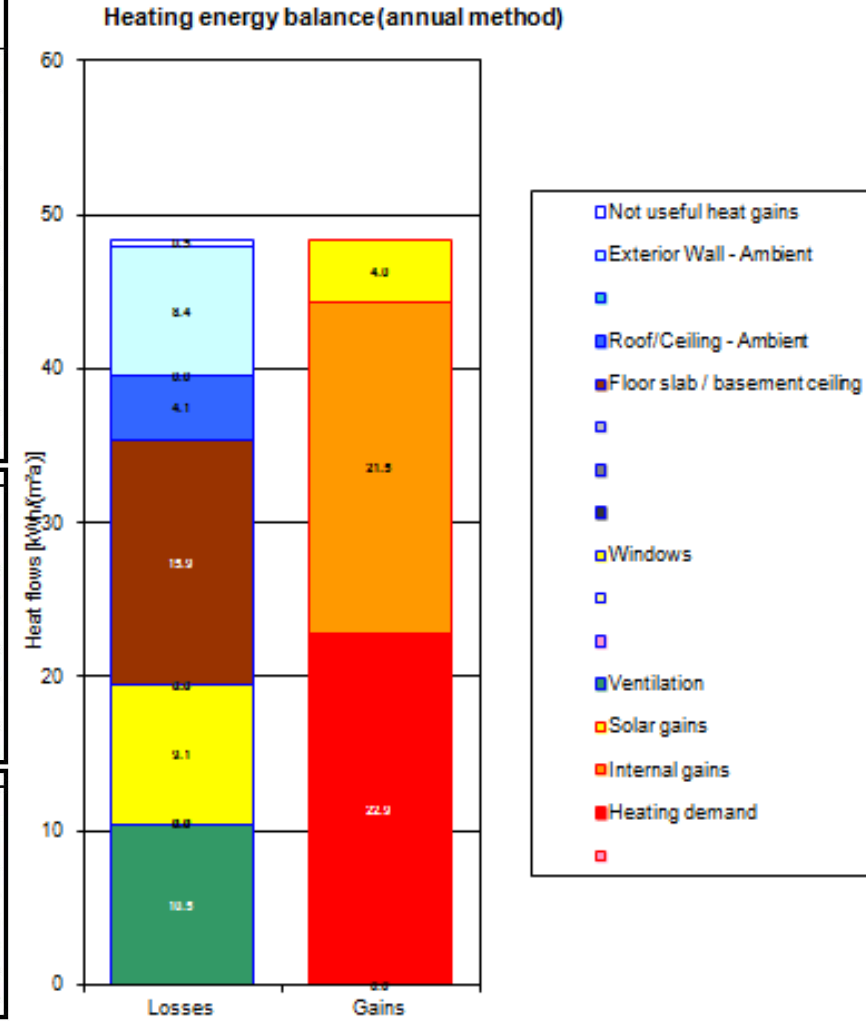



Building:	Block One Rochestown House		
Street:	Sallynoggin Road Upper		
Postcode/City:	Dún Laoghaire		
Country:	Ireland		
Building type:	Home for Elderly		
Climate:	[IE] - Dublin		
Altitude of building site (in m) above sea level:			
-			
Owner/client:	DLR CC		
Street:	Dún Laoghaire		
Postcode/City:	Dún Laoghaire		
Architecture:	DLR CC	Mechanical System:	
Street:	Dún Laoghaire	Street:	
Postcode/City:	Dún Laoghaire	Postcode/City:	
Energy consulting:		Certification:	
Street:		Street:	
Postcode/City:		Postcode/City:	
Year of Construction:	2015	Interior temperature winter [C°]	20.0
Number of dwelling units:	34	Internal heat gains winter [W/m²]	4.1
Number of Occupants:	53.0	Interior temp. summer [C°]	25.0
Exterior vol. V _e :	6339.6 m³	IHG summer [W/m²]	4.1
		Spec. capacity [Wh/K per m² TFA]	204
		Mechanical cooling:	

Specific building demands with reference to the treated floor area			
		Treated floor area	1856.1 m²
Space heating	Annual heating demand	23.72 kWh/(m²a)	25 kWh/(m²a)
	Heating load	13 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,	109 kWh/(m²a)	130 kWh/(m²a)
	DHW, space heating and auxiliary electricity	38 kWh/(m²a)	-
	Specific primary energy reduction through solar electricity	kWh/(m²a)	-
Airtightness	Pressurization test result n ₅₀	1.0 1/h	1.1/h

EnerPHit (Modernisierung): Bauteilkennwerte			
Gebäudehülle	Außendämmung zu Außenluft	0.14 W/(m²K)	-
	mittlere U-Werte	3.74 W/(m²K)	-
	Innendämmung zu Außenluft	W/(m²K)	-
	Innendämmung zu Erdreich	W/(m²K)	-
	Wärmebrücken ΔU	0.00 W/(m²K)	-
Luftungsanlage	Fenster	1.00 W/(m²K)	-
	Außentüren	W/(m²K)	-
	eff. Wärmebereitstellungsgrad	78 %	-

* empty field: data missing; - no requirement



Cost to heat this building to 20 °C 24/7/365

€53 000 per year



Cost to heat this building to 20 °C 24/7/365

€ 4 000 per year

At least **80% reduction** of heat demand







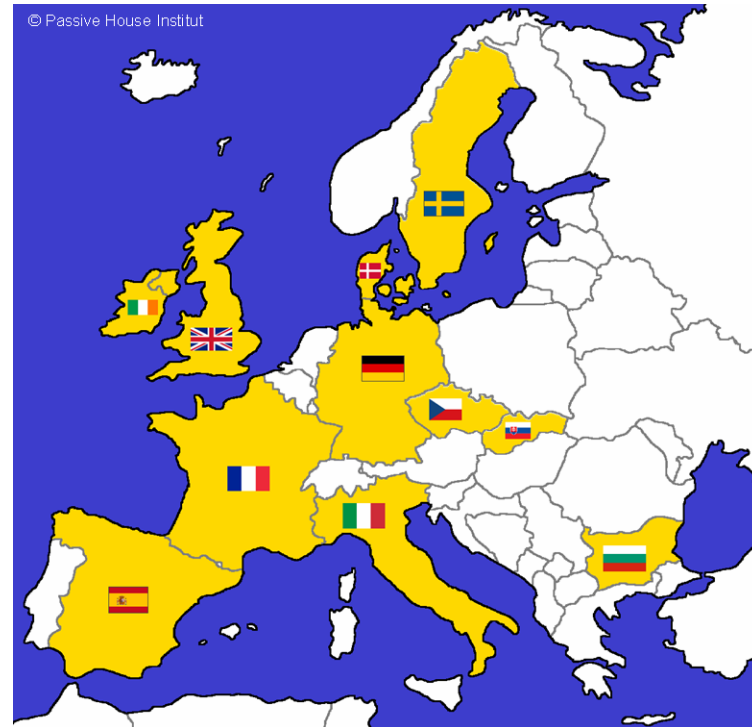






Thank you
for your attention
www.euophit.eu
Mariana Moreira

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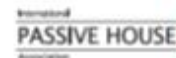
Coordinator:



Project Partners:



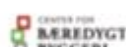
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