#UKPHC18

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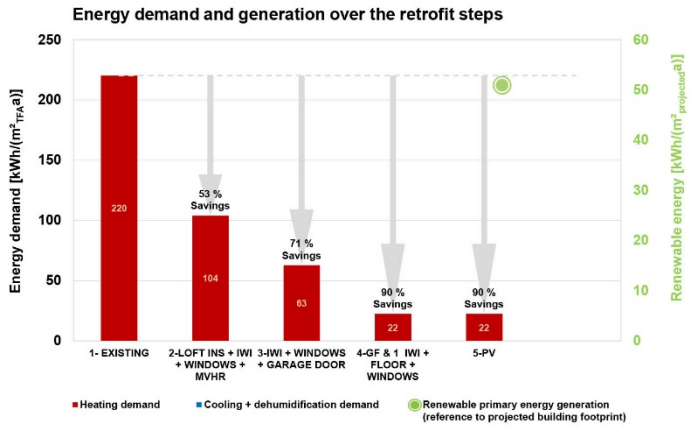
Whole House Step by Step Approaches:

EnerPHit Retrofit of 1970's townhouse in SE London

November 2018

Harry Paticas, Arboreal Architecture

@harrypaticas



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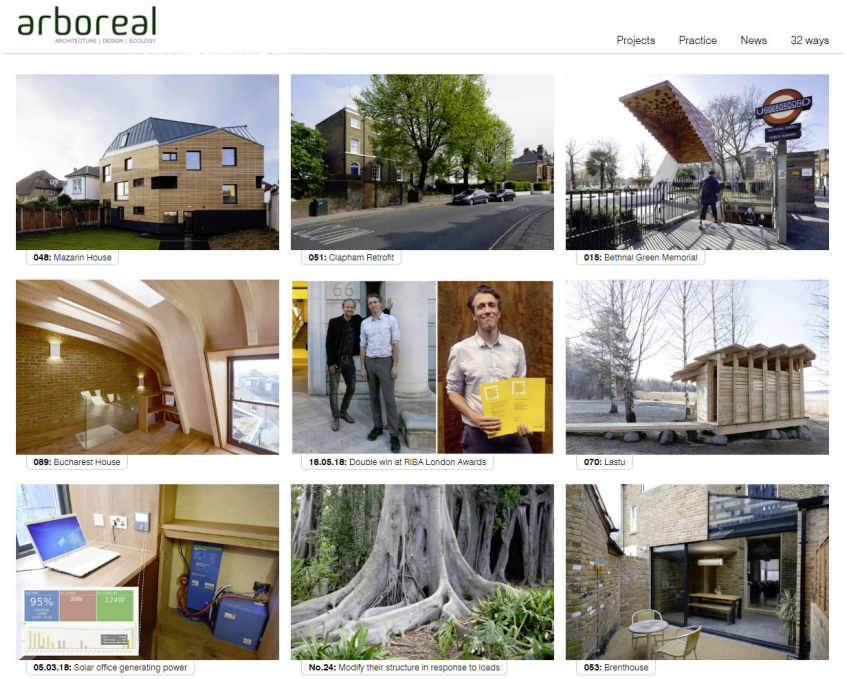
Step-by-step EnerPHit Retrofit: Introduction



- Co-director of Arboreal Architecture

Step-by-step EnerPHit Retrofit:
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15-40 ARCHITECTURE COLLECTIVE

- Co-director of Arboreal Architecture
- Co-director of 15-40

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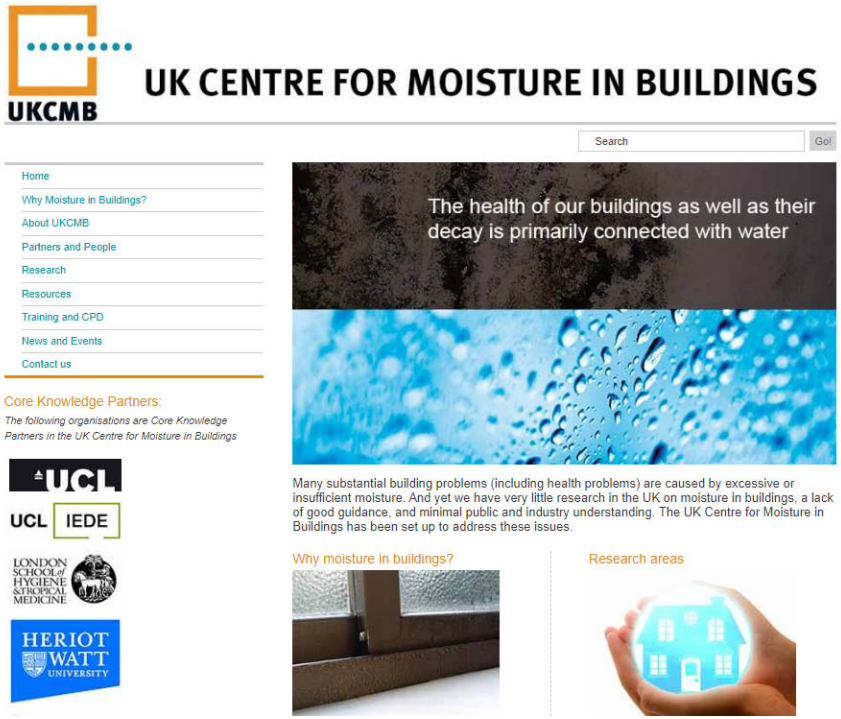

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STBA

SUSTAINABLE TRADITIONAL BUILDINGS ALLIANCE

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Step-by-step EnerPHit Retrofit:
Precedents

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AECB Silver Standard
(not certified yet)
- <40 kWh/m²/a
- <3.0ach @ 50pa

Step-by-step EnerPHit Retrofit:
Case Study – buying a freehold

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Step-by-step EnerPHit Retrofit:
Case Study – buying a freehold

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- Nearly bought house in Sydenham but purchase fell through

Step-by-step EnerPHit Retrofit:
Case Study – buying a freehold

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Case Study – buying a freehold

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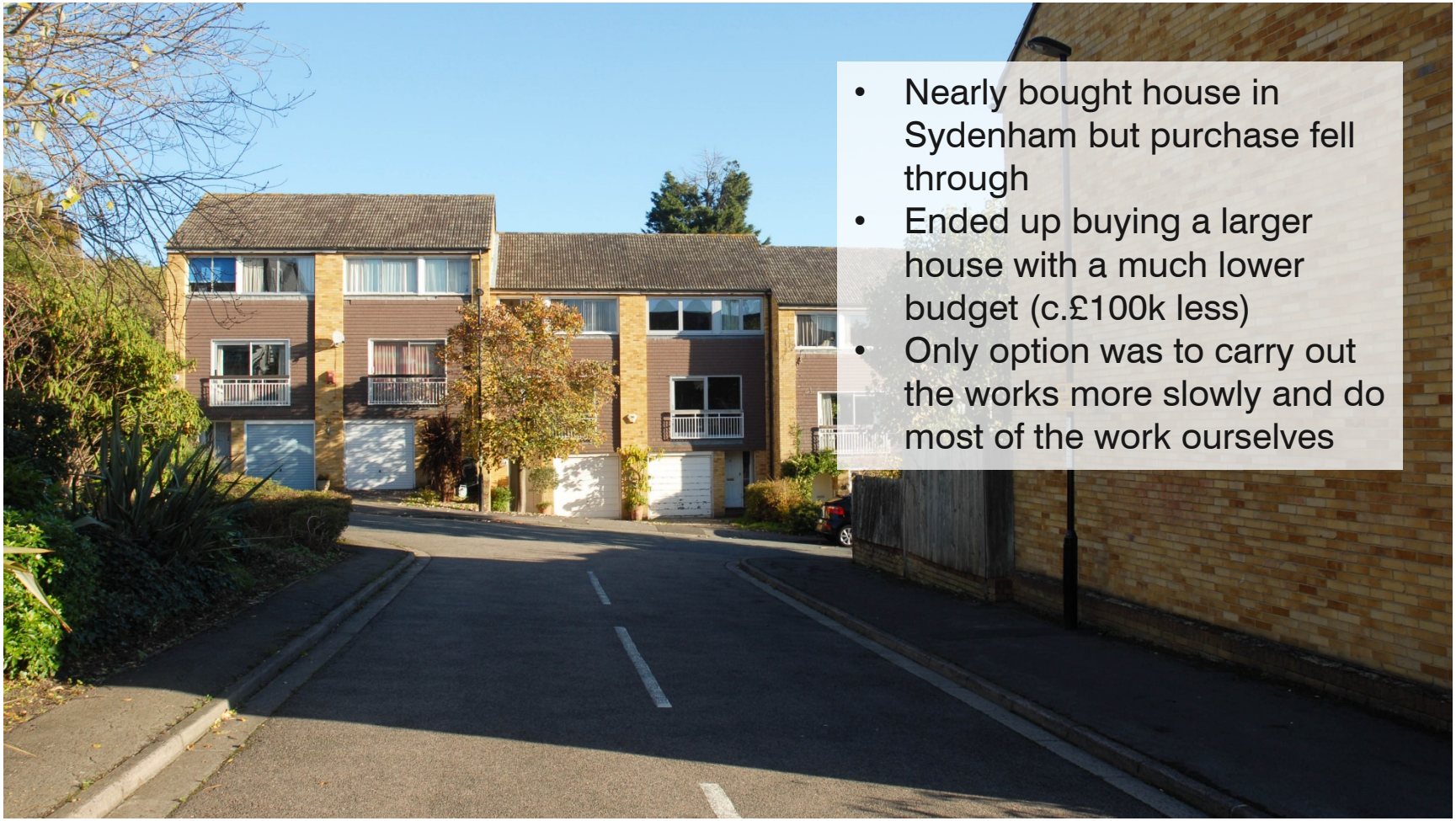

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- Ended up buying a larger house with a much lower budget (c.£100k less)
- Only option was to carry out the works more slowly and do most of the work ourselves

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Case Study – buying a freehold

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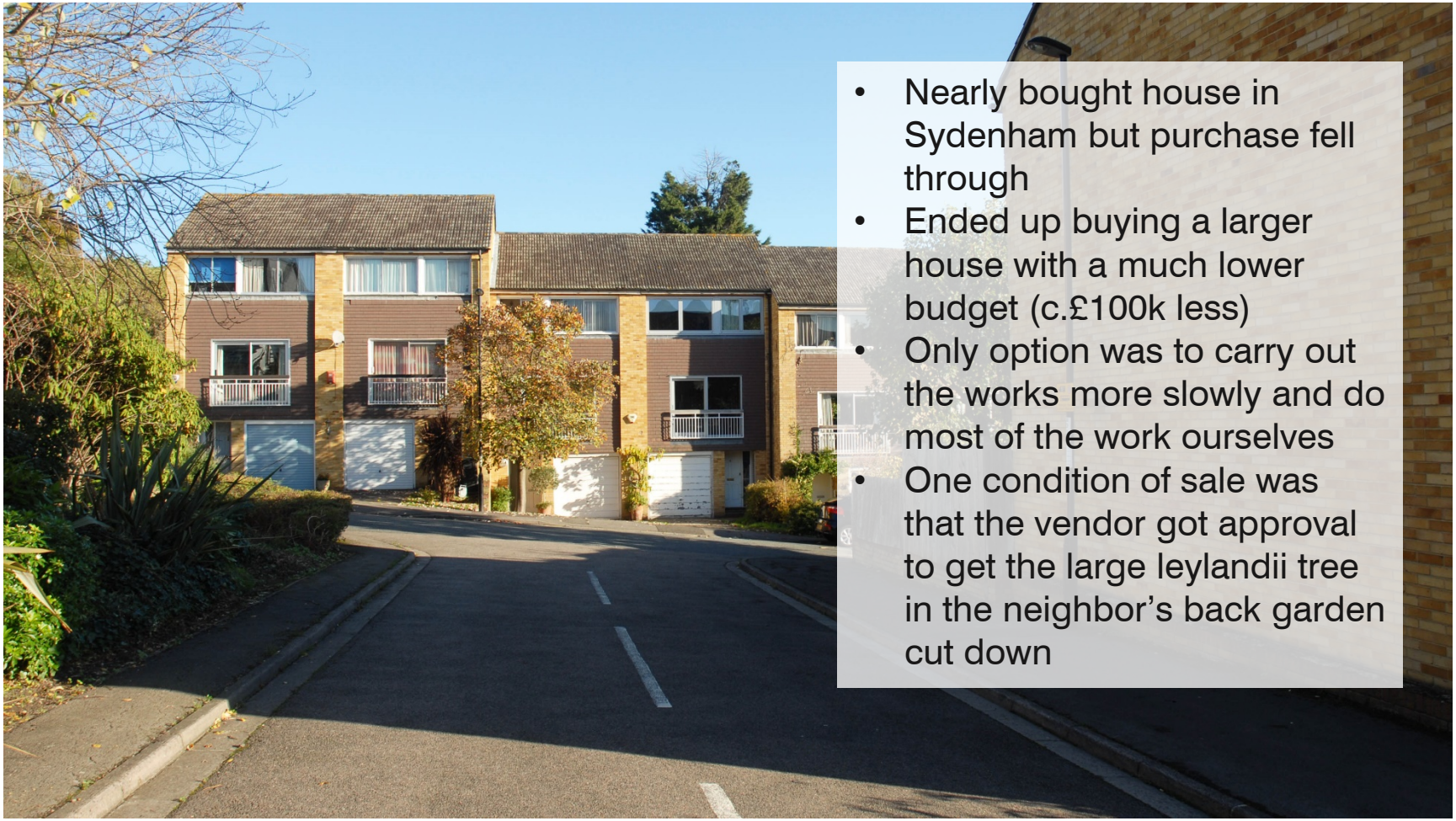

- Nearly bought house in Sydenham but purchase fell through
- Ended up buying a larger house with a much lower budget (c.£100k less)
- Only option was to carry out the works more slowly and do most of the work ourselves
- One condition of sale was that the vendor got approval to get the large leylandii tree in the neighbor's back garden cut down

Step-by-step EnerPHit Retrofit:
Case Study - context

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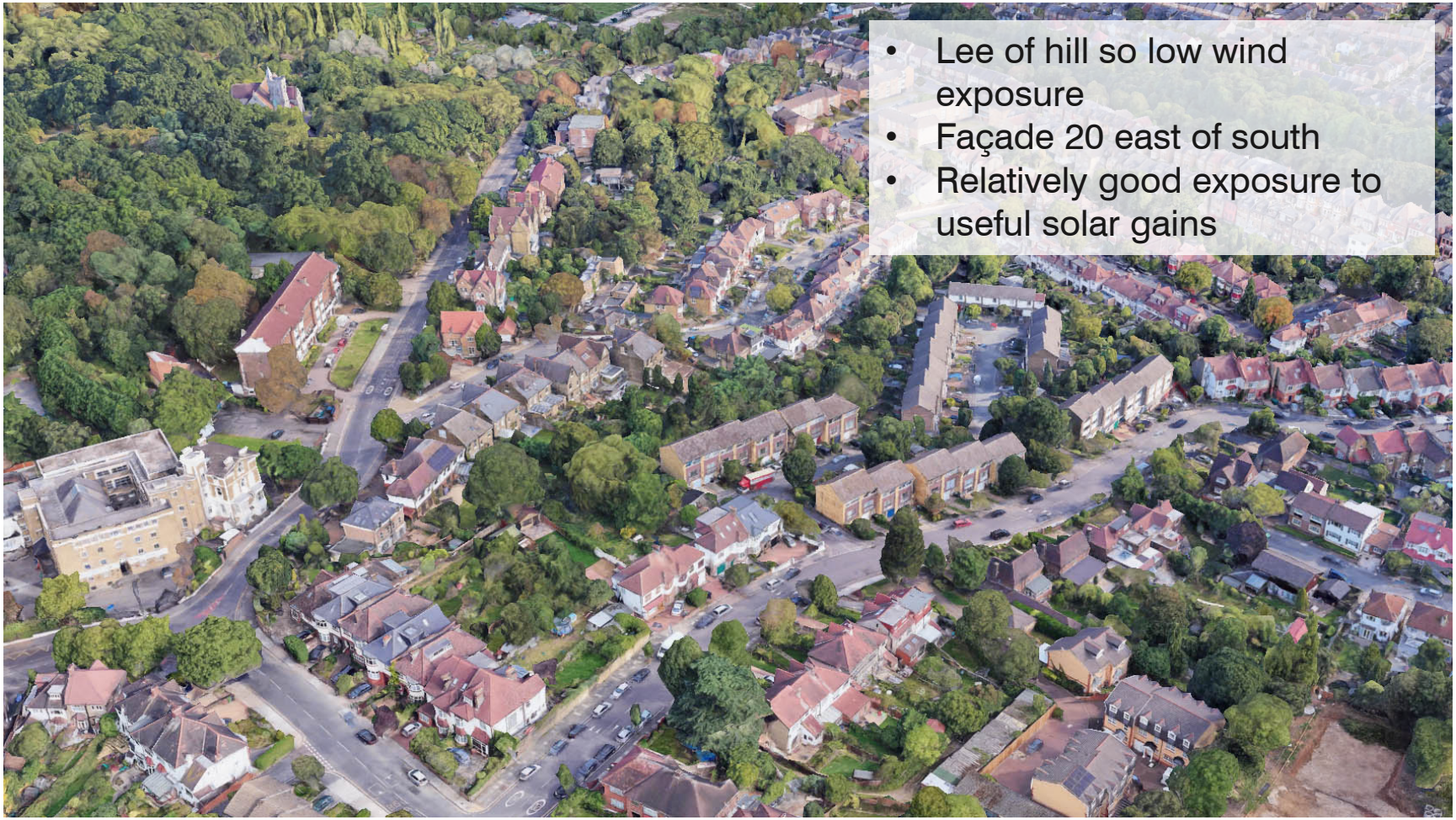

- Lee of hill so low wind exposure
- Façade 20 east of south
- Relatively good exposure to useful solar gains

Step-by-step EnerPHit Retrofit:
Case Study – mid-terrace

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Case Study – mid-terrace

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Case Study – mid-terrace

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Step-by-step EnerPHit Retrofit:
Case Study – mid-terrace

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- 1978 Mid-terrace
- TFA of 90m^2 before works (97m^2 after)
- 3 storey with garage below and living/dining on 1st floor

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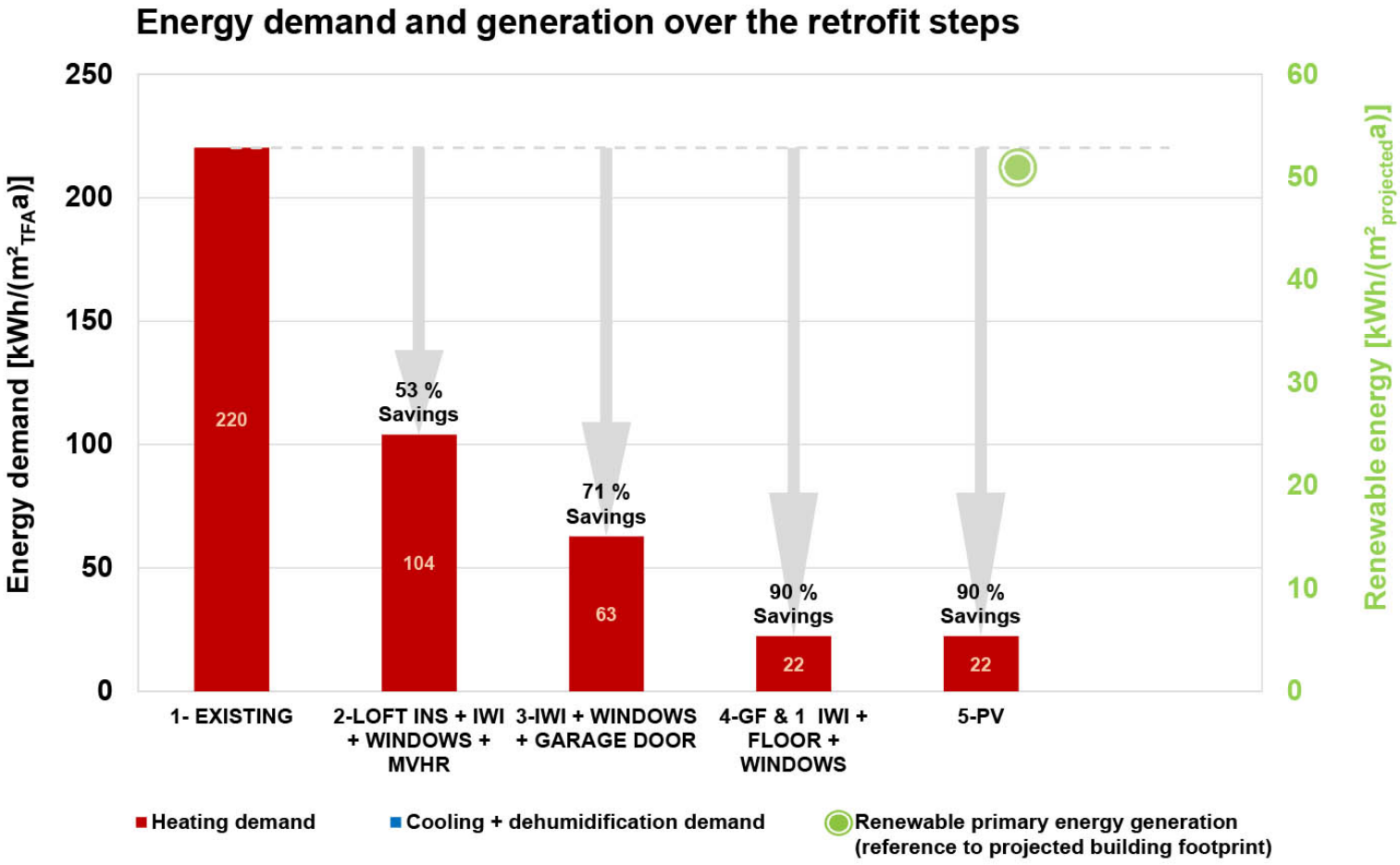
- Neighbouring house lower and staggered
- Only building regulation at the time was 0.6W/m^{2}K for loft insulation
- Retrofit ready works: minor repairs to roof, leadwork and hung tiles
- Striped out most layers before we moved in Nov 2016 (2 years to get here!)

Step-by-step EnerPHit Retrofit:
Case Study – retrofit steps



Step-by-step EnerPHit Retrofit:
Case Study – phased construction

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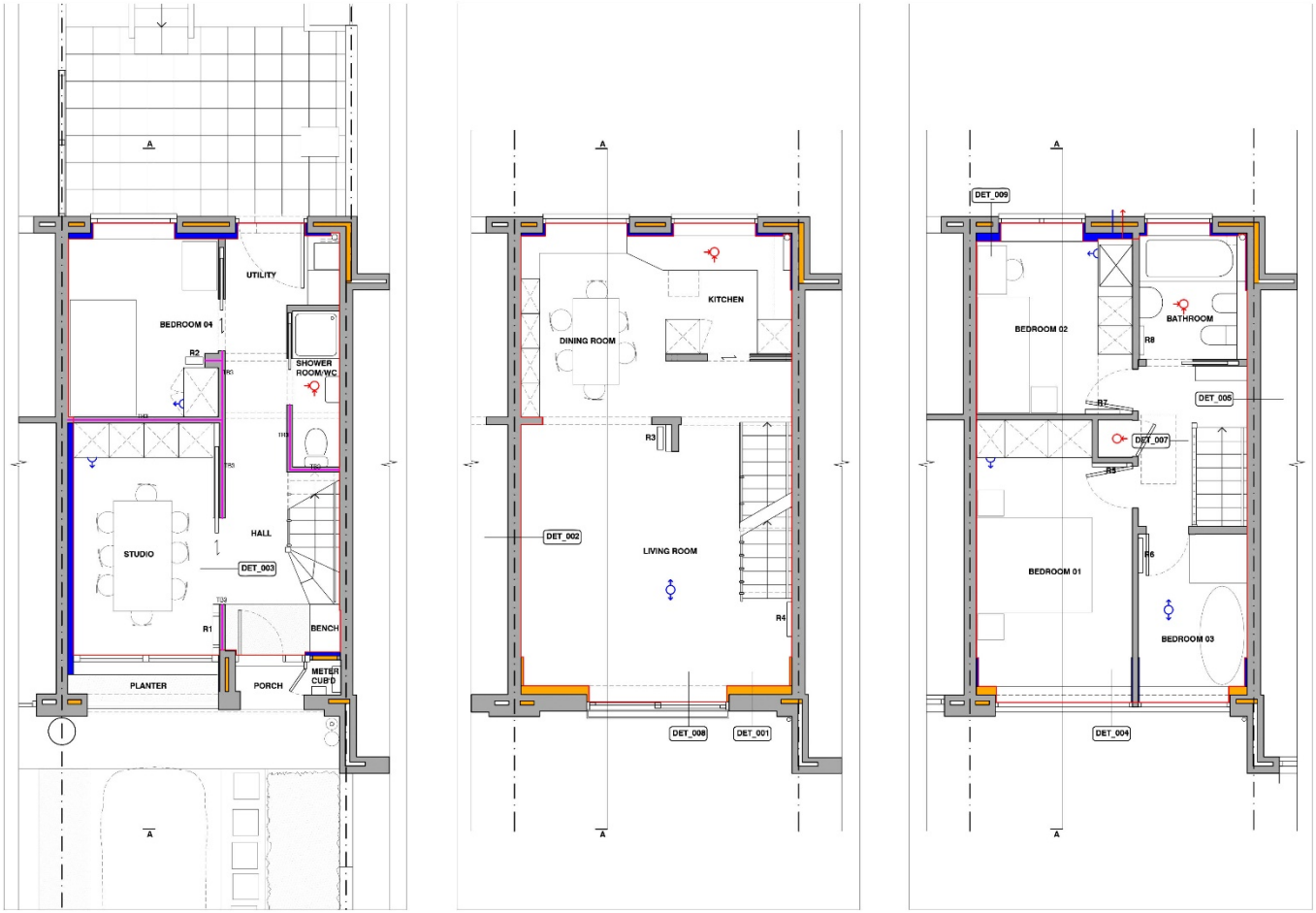

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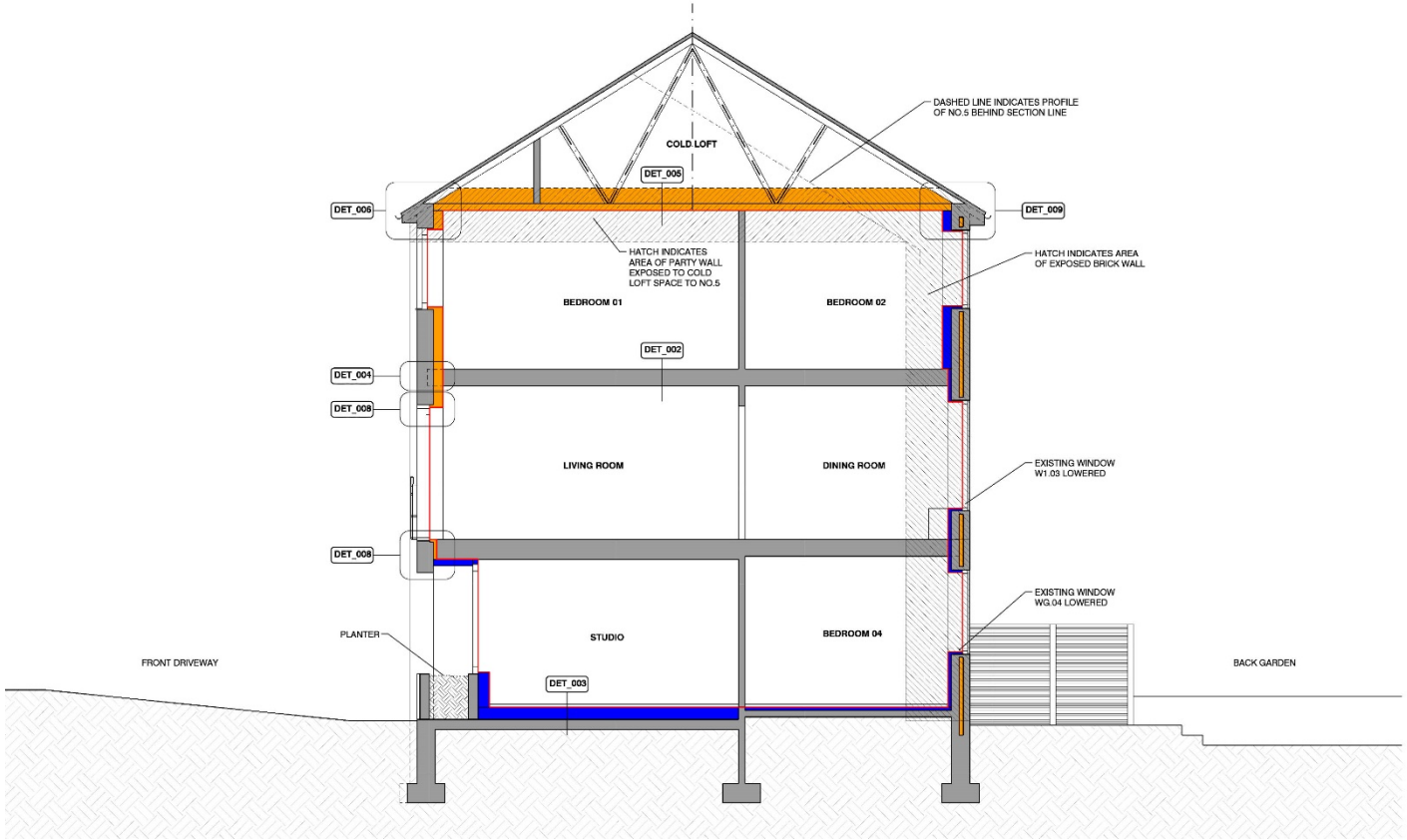

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Step-by-step EnerPHit Retrofit:
Case Study - Scheduler

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Scheduler

Source file: '4BL_V9.6a_EN_Variants_REVISED_180919.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: 4, London, GB-United Kingdom/ Britain

Retrofit steps:											1	2	2	3	4	5												
Assemblies	Last renewal	1978	1980	1985	1990	1995	2000	2005	2010	2015	2016	2017	2018	2018	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070
IWI to garage door (temp)	1978													X											
Front door	1978														X										
Pitched roof covering	1978															X									
Windows (front 1,2)	2002											X													
Windows (rear 2)	2002													X											
MVHR	2018												X												
IWI (front 1, 2)	2017											X													
CWI	2017											X													
Boiler	1978											X													
IWI (rear 2 bed)	2018													X											
Photovoltaics	2025															X									
IWI (GF, rear 1)	2020														X										
GF insulation	2020														X										
Windows (rear 1, GF)	1978														X										
Loft ins & airtightness	2017											X													
IWI (rear 2 bath)	2000														X										
Airtightn. test: X, Leakage search: (X)													(X)		(X)	X									

Initial condition

X Retrofit dates

Main-tenance

Smaller repairs

Extensive repairs

Immediate replacement

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Step-by-step EnerPHit Retrofit:
Case Study – Inter-relations

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Interrelations

Source file: '4BL_V9.6a_EN_Variants_REVISED.xlsm' (PHPP version: 9.6a)

EnerPHit Retrofit Plan: 4, London, GB-United Kingdom/ Britain

	current step	subsequent steps 1-Exterior wall insulation	2-Interior wall insulation	Pitched roof insulation	4-Flat roof insulation	5-Top floor ceiling insulation	6-Roof terrace insulation	7-floor slab insulation	8-Perimeter insulation	9-Window/entrance door replacement	10-Boiler	11-Radiators and distribution	12-Ventilation system	13-Photovoltaics	14-	15-	16-	17-	18-
1	Exterior wall insulation																		
2	Interior wall insulation									Ensure sufficient internal frame available for internal wall insulation. Note: it was decided to not install windows deeper into the reveals due to general appearance of adjacent terraced houses. Internal wall insulation has been installed to the 100mm brick reveals together with an insulating plaster.	If necessary, decrease the forward flow temperature.	Sizing of radiators on ground and 1st floors to change as shown on proposed plans.	Install external ducts for MVHR prior to IWI. Ensure IWI installed prior to MVHR unit.						
3	Pitched roof insulation																		
4	Flat roof insulation																		
5	Top floor ceiling insulation		Ensure continuity of internal wall insulation and airtightness with loft insulation.								If necessary, decrease the forward flow temperature		Ensure single MVHR duct in loft can be installed with minimal disruption.	All penetrations in the 2nd floor ceiling should be carried out prior to installation of airtightness and insulation.					
6	Roof terrace insulation																		
7	floor slab insulation		Ensure floor slab and associated damp proofing is installed prior to IWI.							Ensure doors are replaced at the same time as the floor slab.	All electrical and plumbing services for the ground floor to be laid in the ceiling.		Ventilation ducts have been preinstalled in the ceiling.						
8	Perimeter insulation																		
9	Window/entrance door replacement		Ensure sufficient internal frame available for internal wall insulation. Note: it was decided to not install windows deeper into the reveals due to general appearance of adjacent terraced houses. Internal wall insulation has been installed to the 100mm brick reveals together with an insulating plaster.							The threshold of the sliding doors in the living room has been set higher to anticipate future new floor finishes.	If necessary, decrease the forward flow temperature	Radiators have generally be installed behind doors in bedrooms rather than on external walls below windows.	A ventilation system has been installed prior to the completion of all window replacement. An air quality sensor has been installed to monitor relative humidity and carbon dioxide during the interim steps.						
10	Boiler		Boiler installed onto																
11	Radiators and distribution							Pipework routing is in ceilings and walls so does not affect the floor slab.				All radiators and associated pipework have been installed away from external walls and wall returns.							
12	Ventilation system					The vertical riser and location of penetration of airtightness layer in loft for electrical cable has already been determined (services cupboard) - ensure cable is installed prior to installation of PV panels on roof													
13	Photovoltaics					The vertical riser and location of penetration of airtightness layer in loft for electrical cable has already been determined (services cupboard) - ensure cable is installed prior to installation of PV panels on roof.													

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Step-by-step EnerPHit Retrofit:
Case Study – Inter-relations

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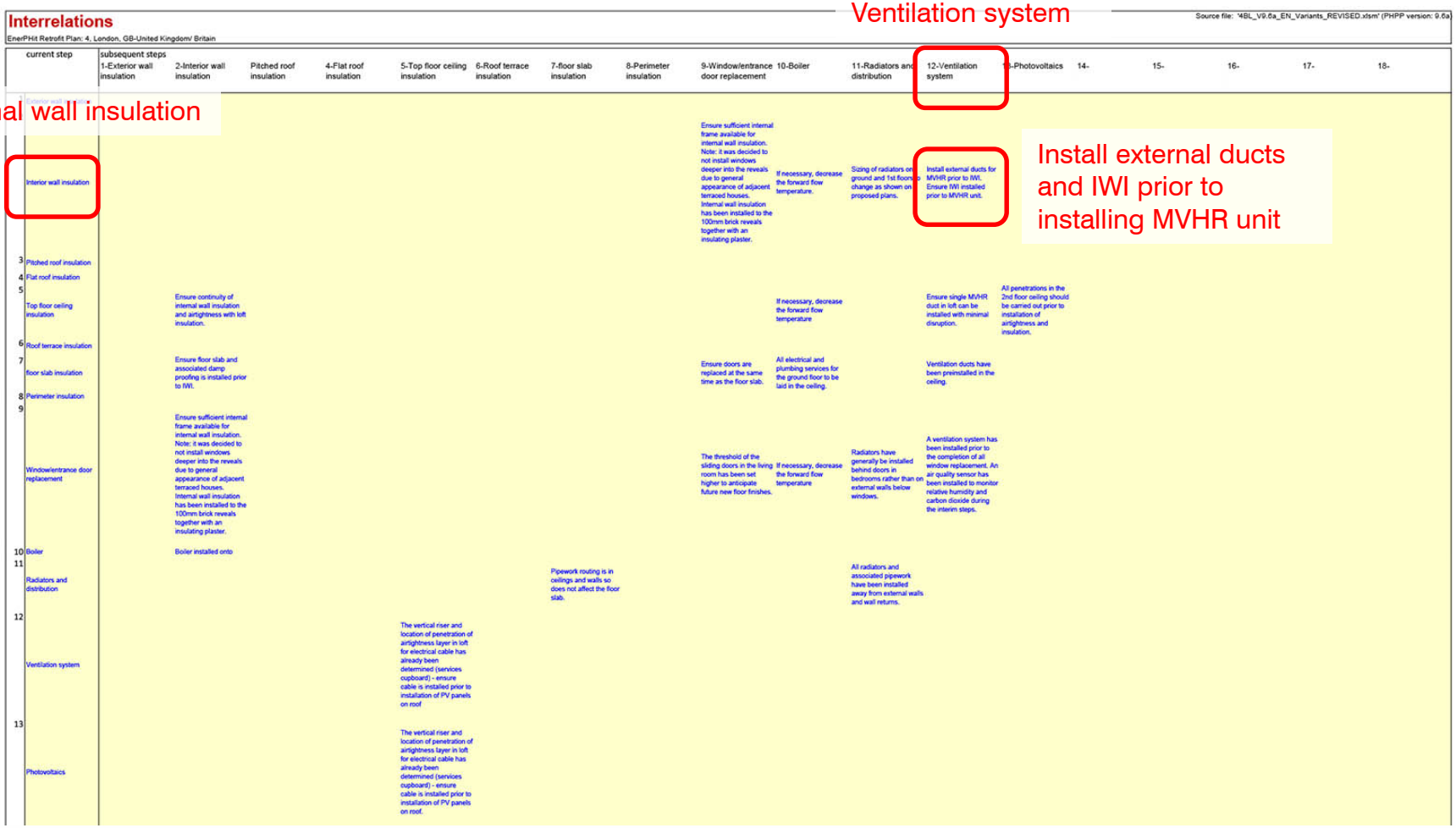
Ventilation system

Internal wall insulation

Install external ducts and IWI prior to installing MVHR unit



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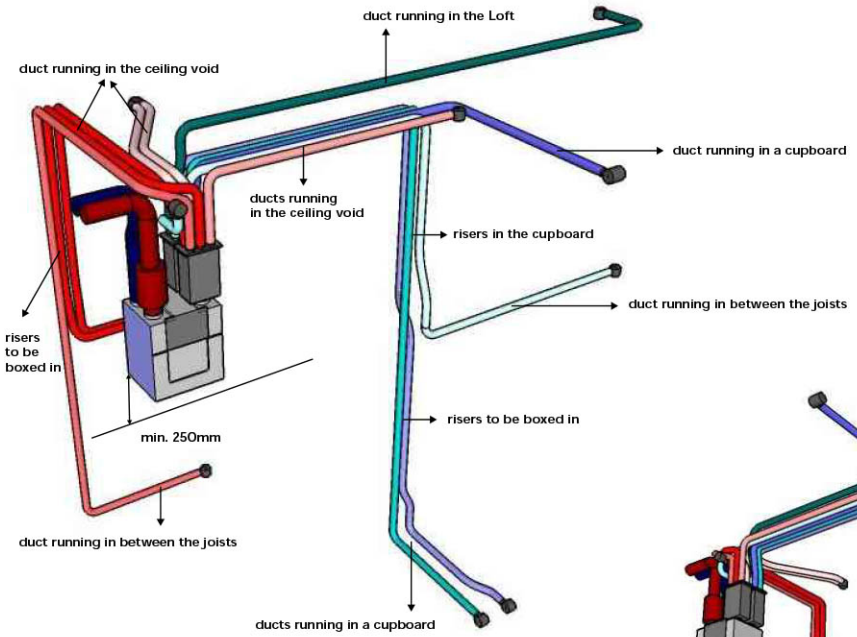
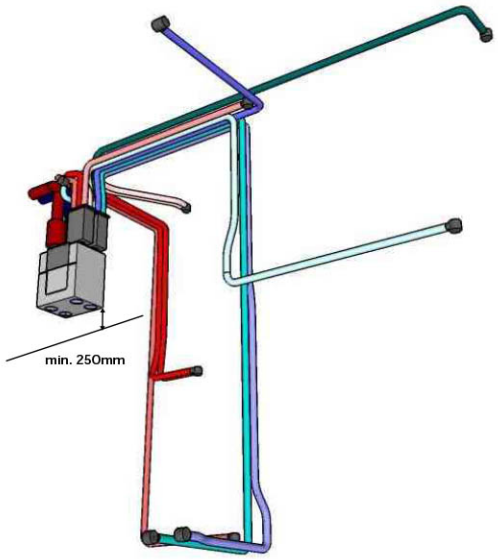
Step-by-step EnerPHit Retrofit:
Case Study – MVHR





Thanks to Enhabit for detailed design and supply

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Case Study – MVHR

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Case Study – ceiling airtightness

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Case Study – loft insulation

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Step-by-step EnerPHit Retrofit:
Case Study – new triple glazing

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Case Study – new triple glazing

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Case Study – cork insulation

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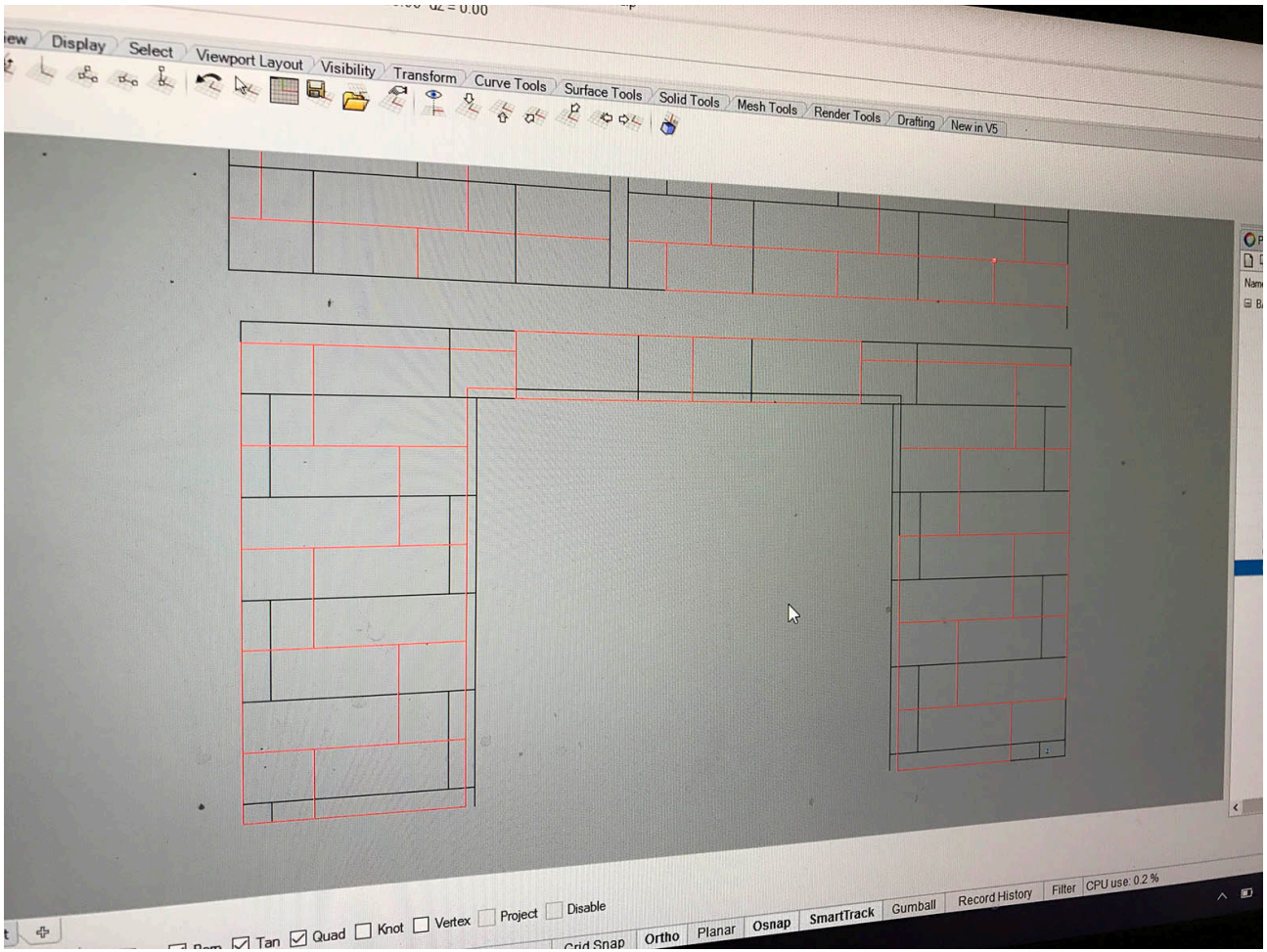

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Case Study – cork insulation

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Step-by-step EnerPHit Retrofit:
Case Study – cork insulation

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Reasons for using cork

- Easy to cut and install
- Smells good
- Natureplus certified
- Low embodied energy
- Renewable source
- Offered the opportunity to experiment with the concept of being able to see the insulation – this is part of telling the story about the retrofit and looks unusual

Step-by-step EnerPHit Retrofit:
Case Study – pencil and watercolour details

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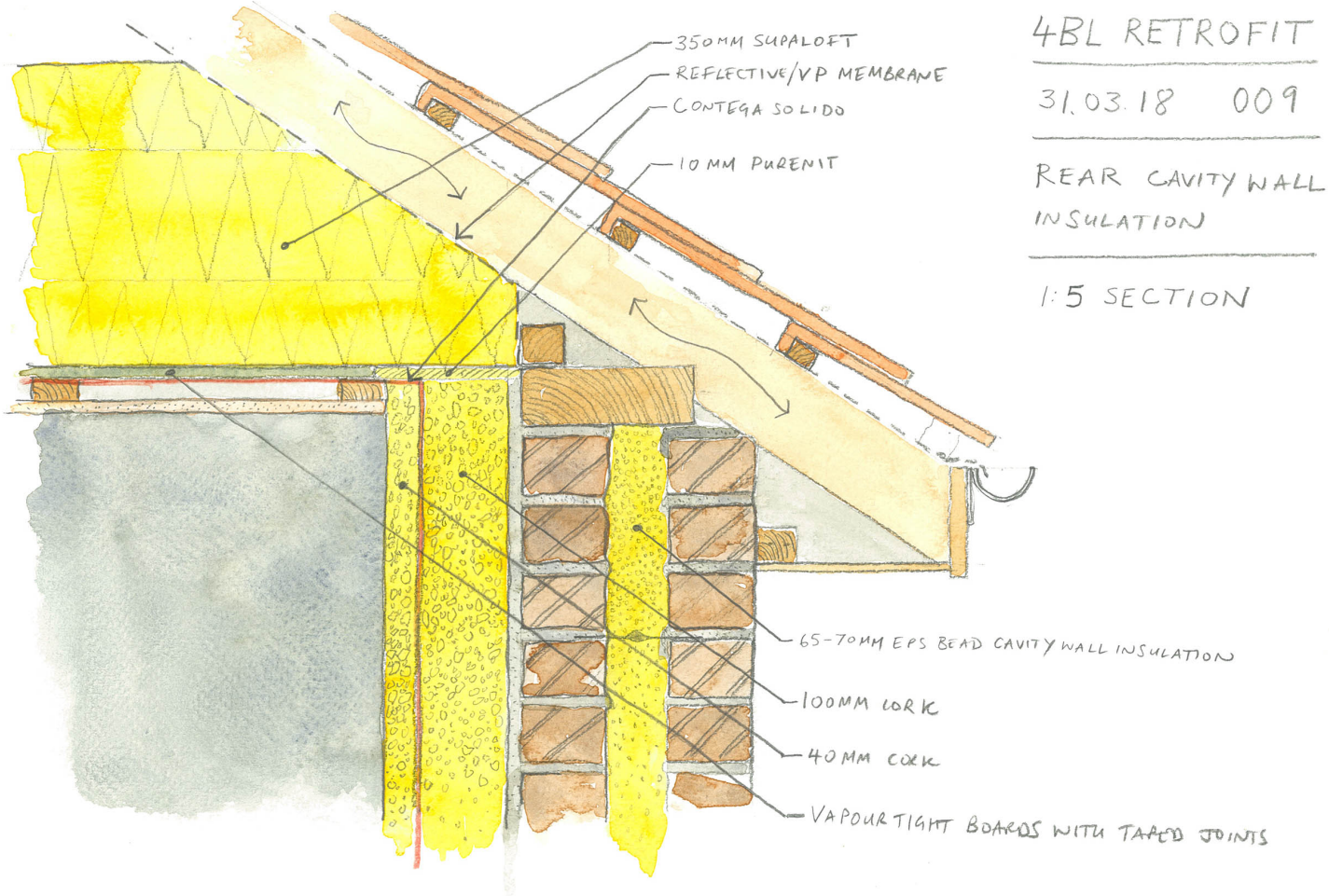

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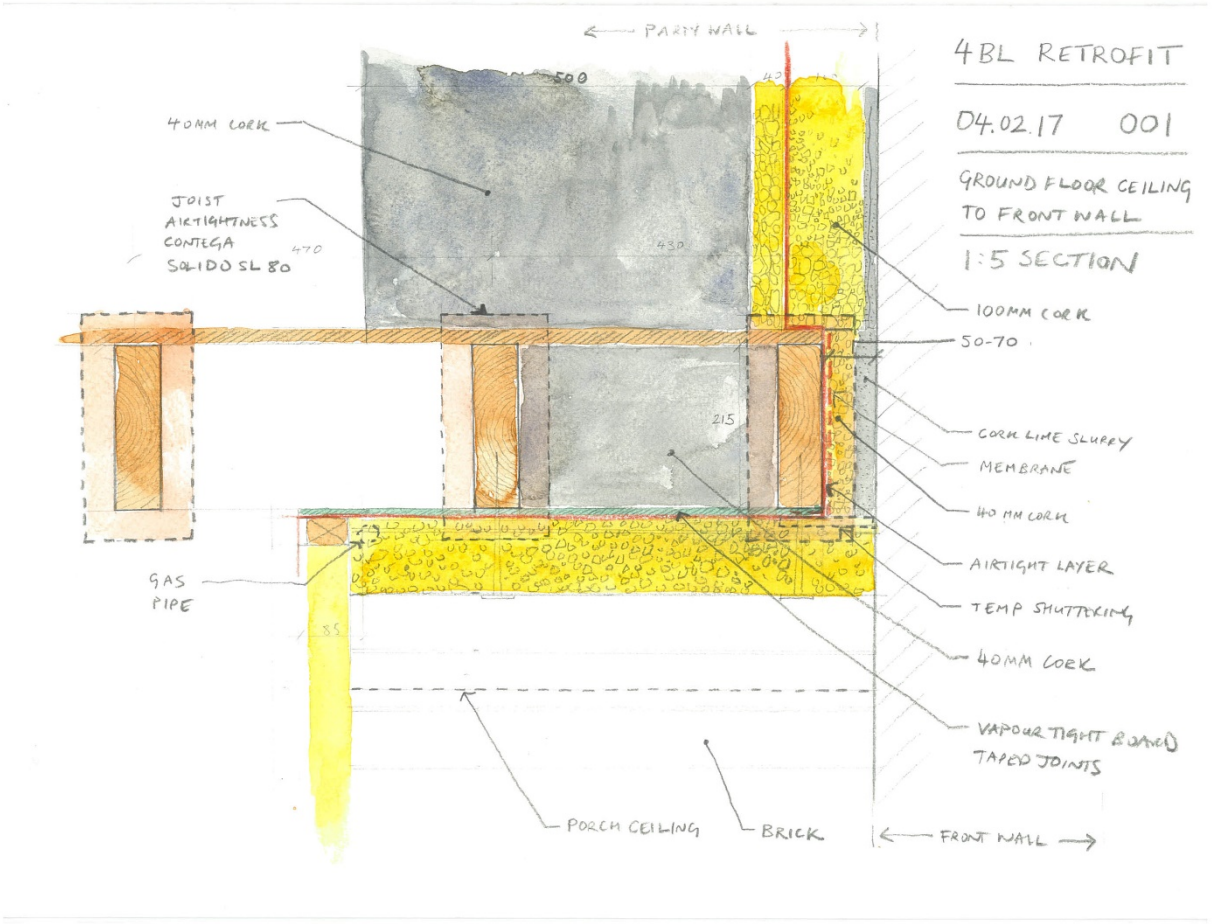

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Step-by-step EnerPHit Retrofit:
Case Study – the challenges

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- How to balance airtightness and ventilation through the retrofit steps

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Case Study – the challenges

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Case Study – the challenges

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- How to balance airtightness and ventilation through the retrofit steps

Step-by-step EnerPHit Retrofit:
Case Study – the challenges

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- How to balance airtightness and ventilation through the retrofit steps
- Maintaining basic creature comforts (such as curtains which have to be re-hung at the end of a working day)

Step-by-step EnerPHit Retrofit:
Case Study – the upsides

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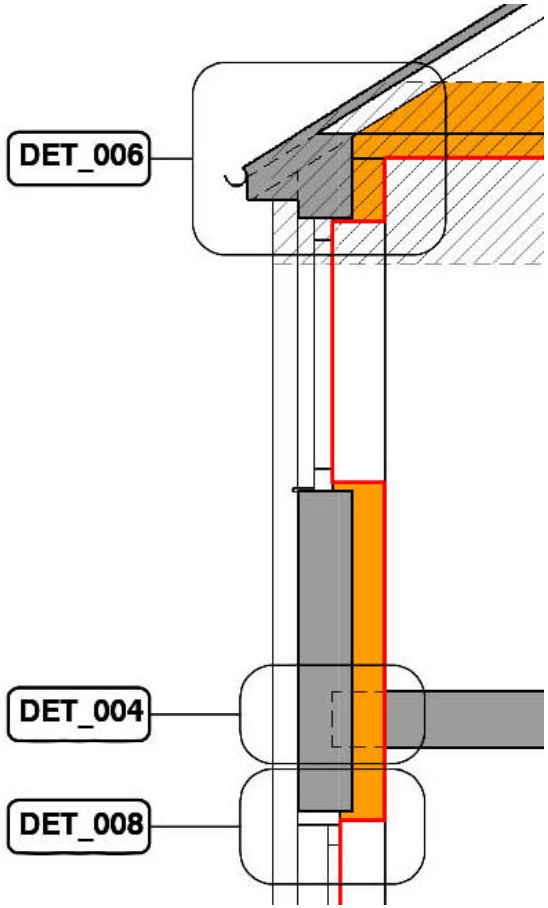

- How to balance airtightness and ventilation through the retrofit steps
- Maintaining basic creature comforts (such as curtains which have to be re-hung at the end of a working day)
- Careful sequencing - in particular of airtightness and thermal continuity

Step-by-step EnerPHit Retrofit:
Case Study – the upsides

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Case Study – the challenges

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Case Study – the challenges

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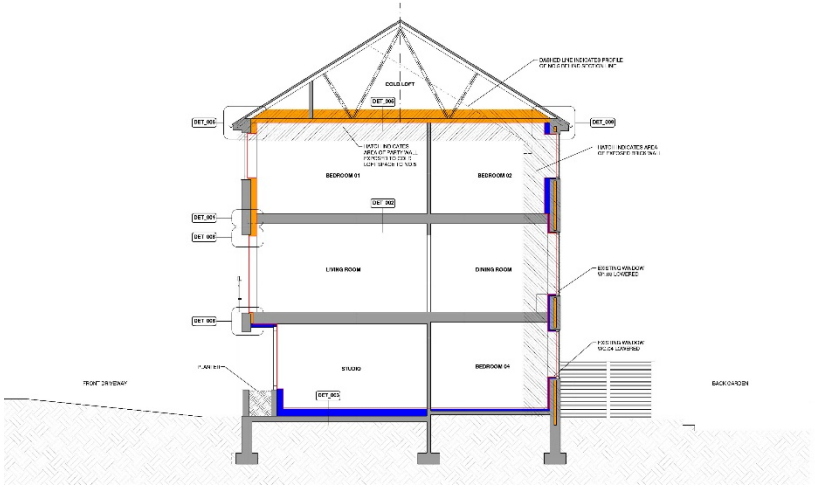

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Case Study – the upsides

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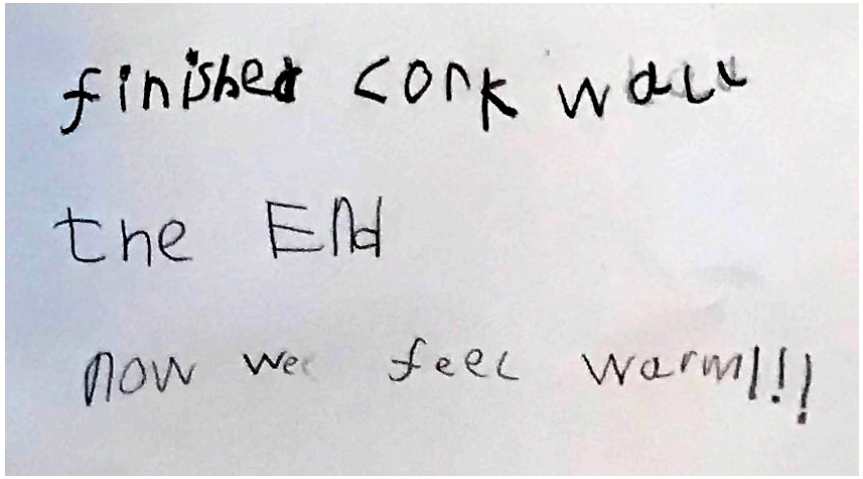

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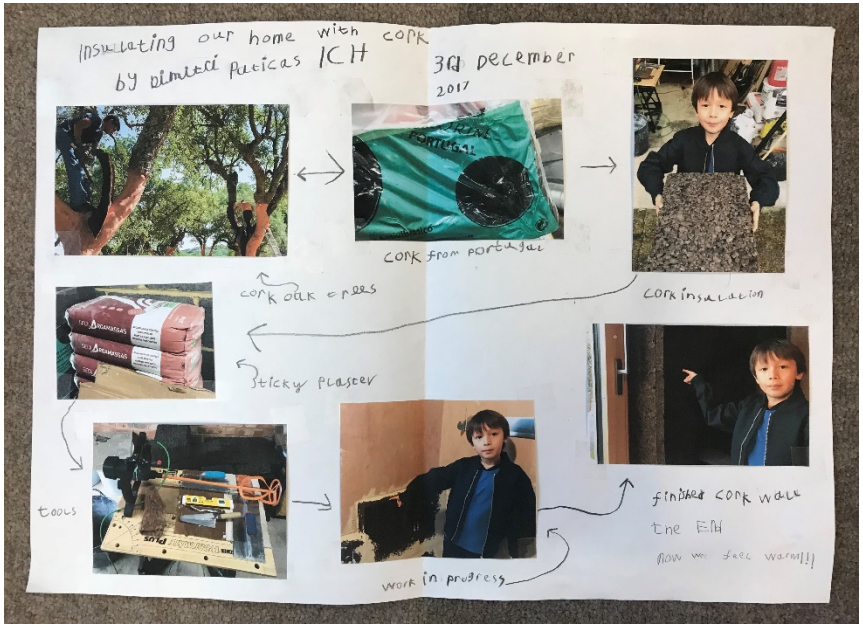

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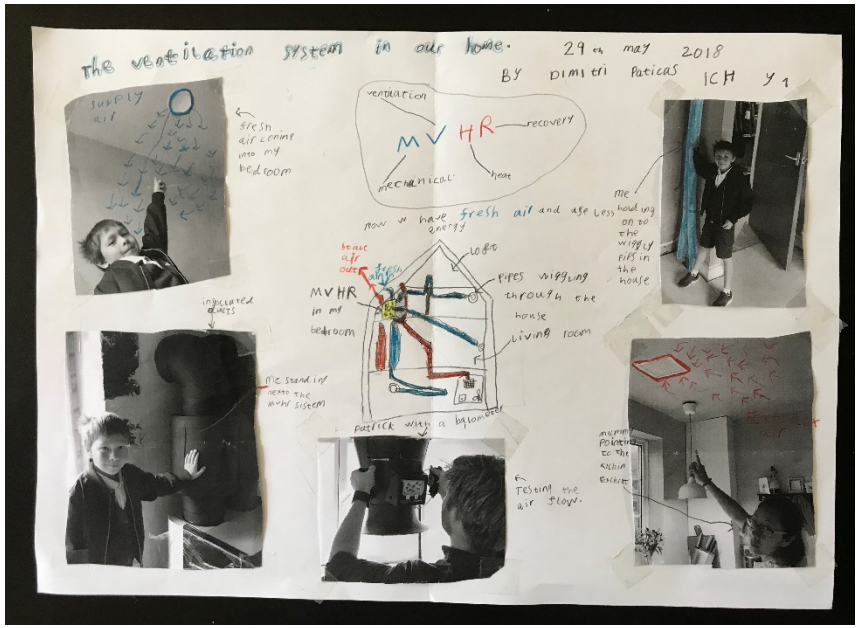

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- Opportunity for retrofit action!

Step-by-step EnerPHit Retrofit:
Case Study – scaling up

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Kingspan
MUNSTER JOINERY
econeKT
THE INTELLIGENT BUILDING SYSTEM
ukpassivhaus conference 2018

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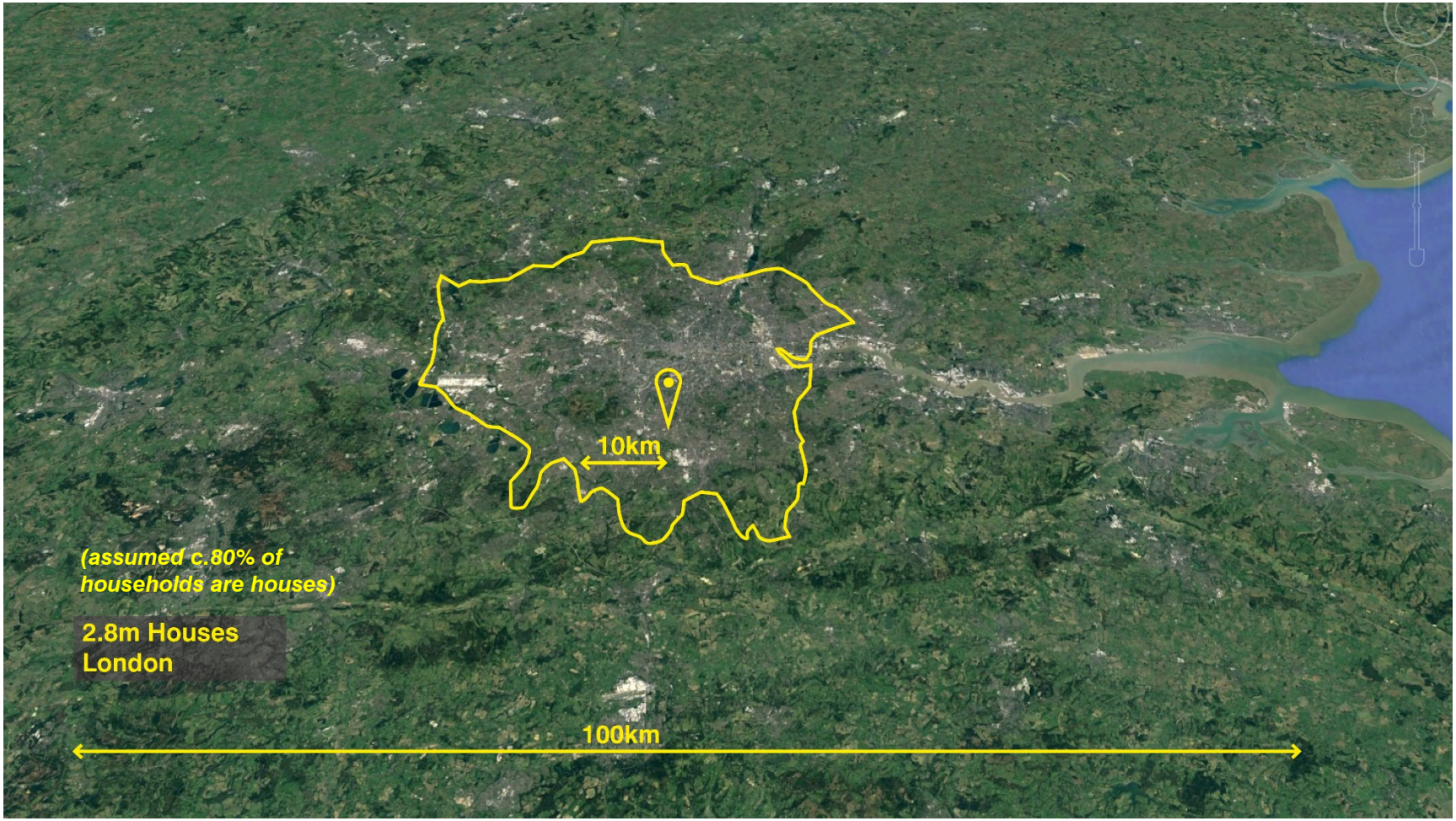

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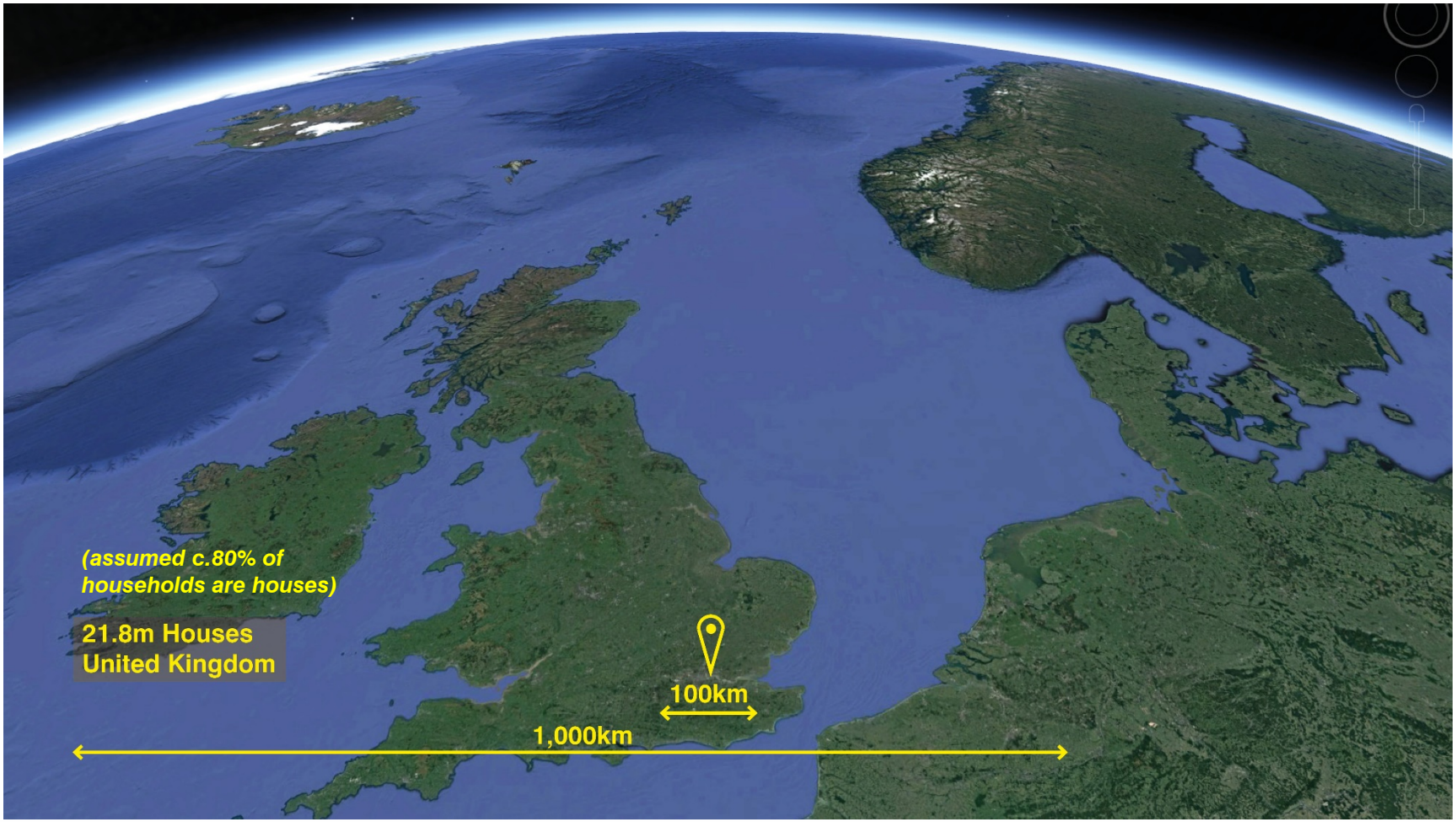

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- Making required savings really is achievable – we have cut 53% of energy for heating in 2 years with relatively low funds and carrying out DIY on Sundays. It has also been great fun!