BUNGALOW RETROFIT

A Certified Passive House EnerPHit Project

EnerPHit Certified Retrofit
Passive House Institute

BUNGALOW_RETROFIT

AT Awards – Submission
23.6.2024

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Existing Performance

Average over 2 years before move was **€4,242 per year.**

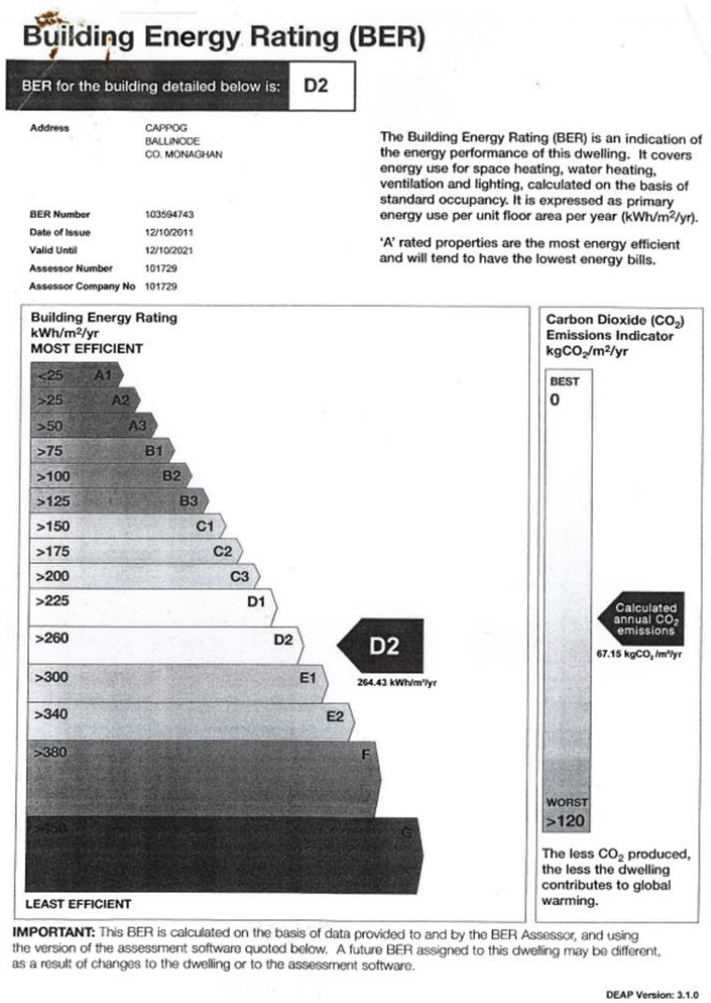
BER D2 Rating 289.86 kWh/m2/yr

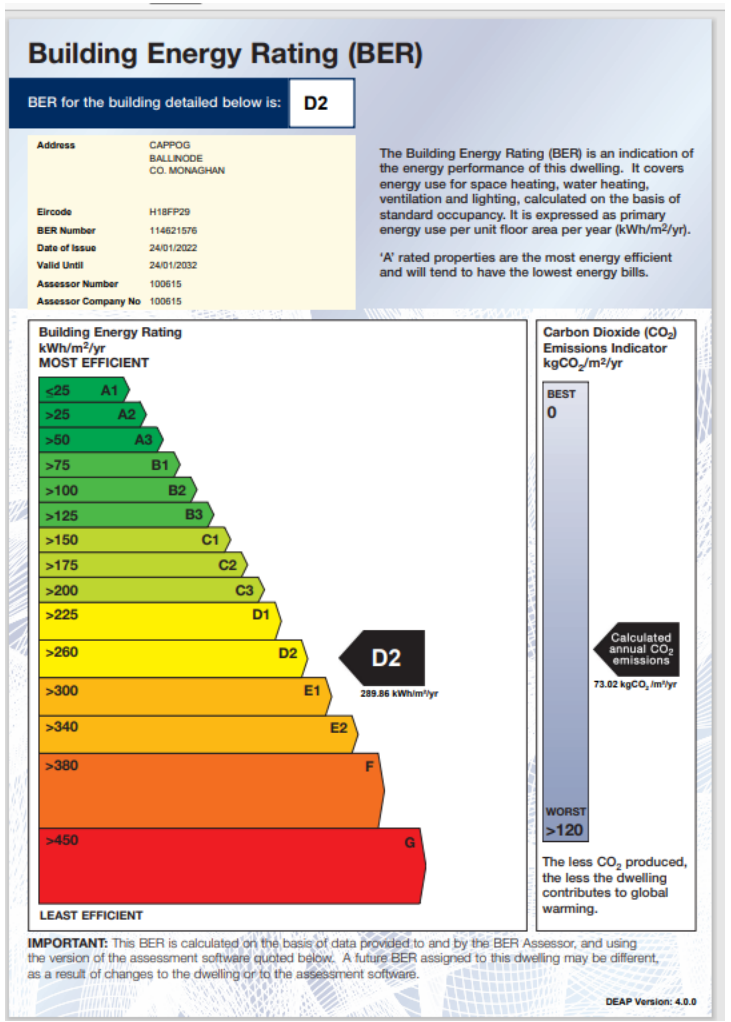
BER Emissions 73.02 kgCO2/m2/yr

Energy Costs Existing House		2020/21	Actual	
Fuel Type	Units	KwH	Price per Unit	Total
Electric	4088	4138	€ 0.24	€ 981.12
Oil	1500	15527	€ 0.86	€ 1,290.00
Firewood	4	5175	€ 300	€ 1,200.00
Smokless Coal	12	3900	€ 20	€ 240.00
				€ 3,711.12

Energy Costs Existing House		2021/22	*Predicted & Actual	
Fuel Type	Units	KwH	Price per Unit	Total
Electric	4088	4138	€ 0.32	€ 1,308.16
Oil	1500	15527	€ 1.35	€ 2,025.00
Firewood	4	5175	€ 300	€ 1,200.00
Smokless Coal	12	3900	€ 20	€ 240.00
				€ 4,773.16

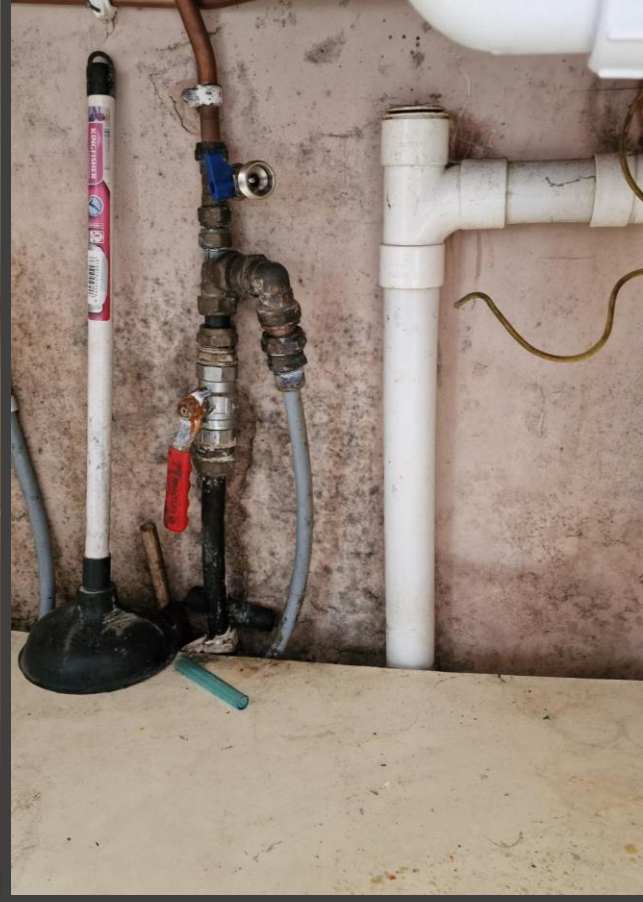
Old Annual Total Demand	€	€ 4,773.16
Old House Total Cost per Week	€	€ 91.79
Old House Total Cost per Day	€	€ 13.08





Condensation



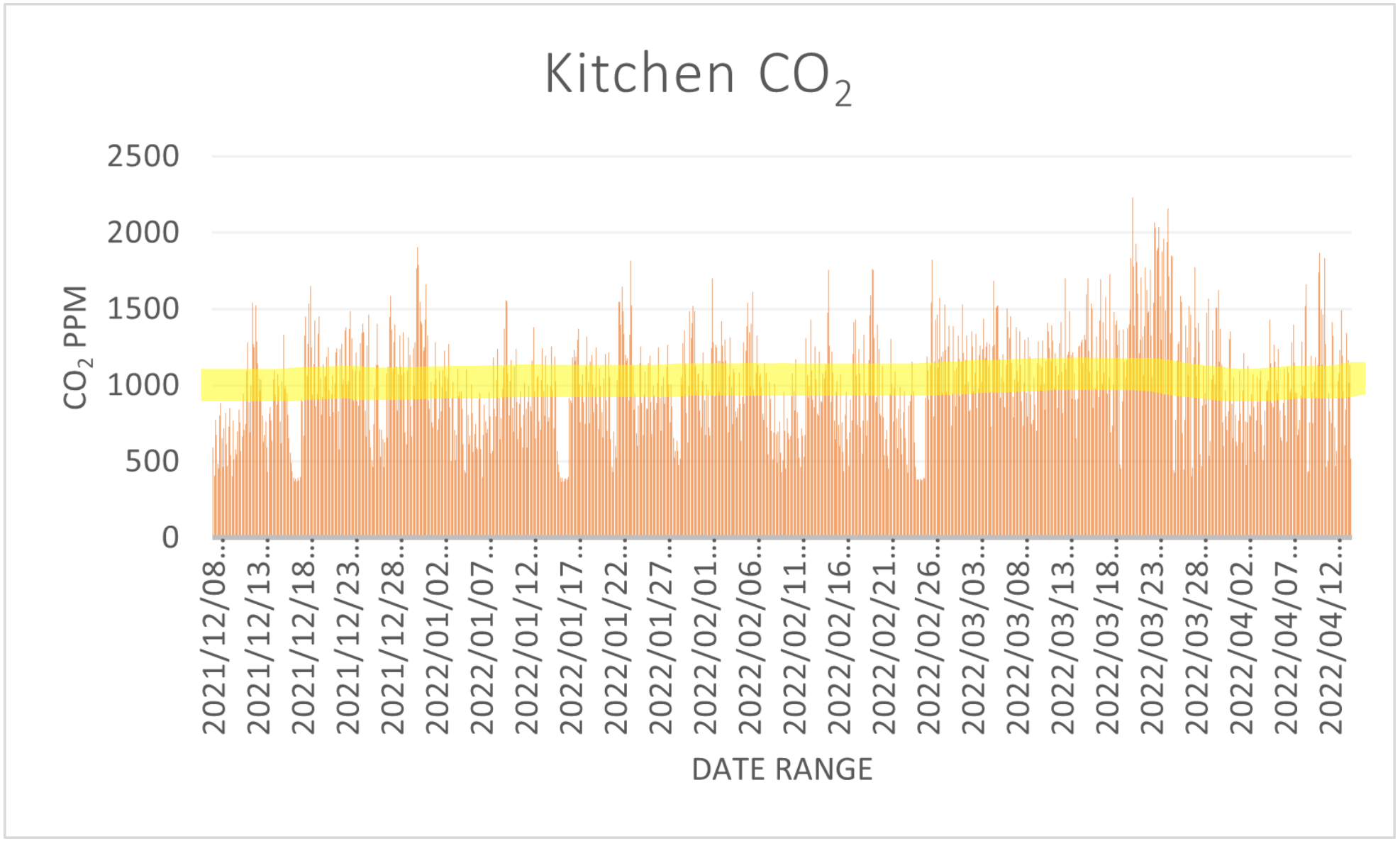



Mold

BUNGALOW_RETROFIT

Onsite

Kitchen IAQ Data: December – April

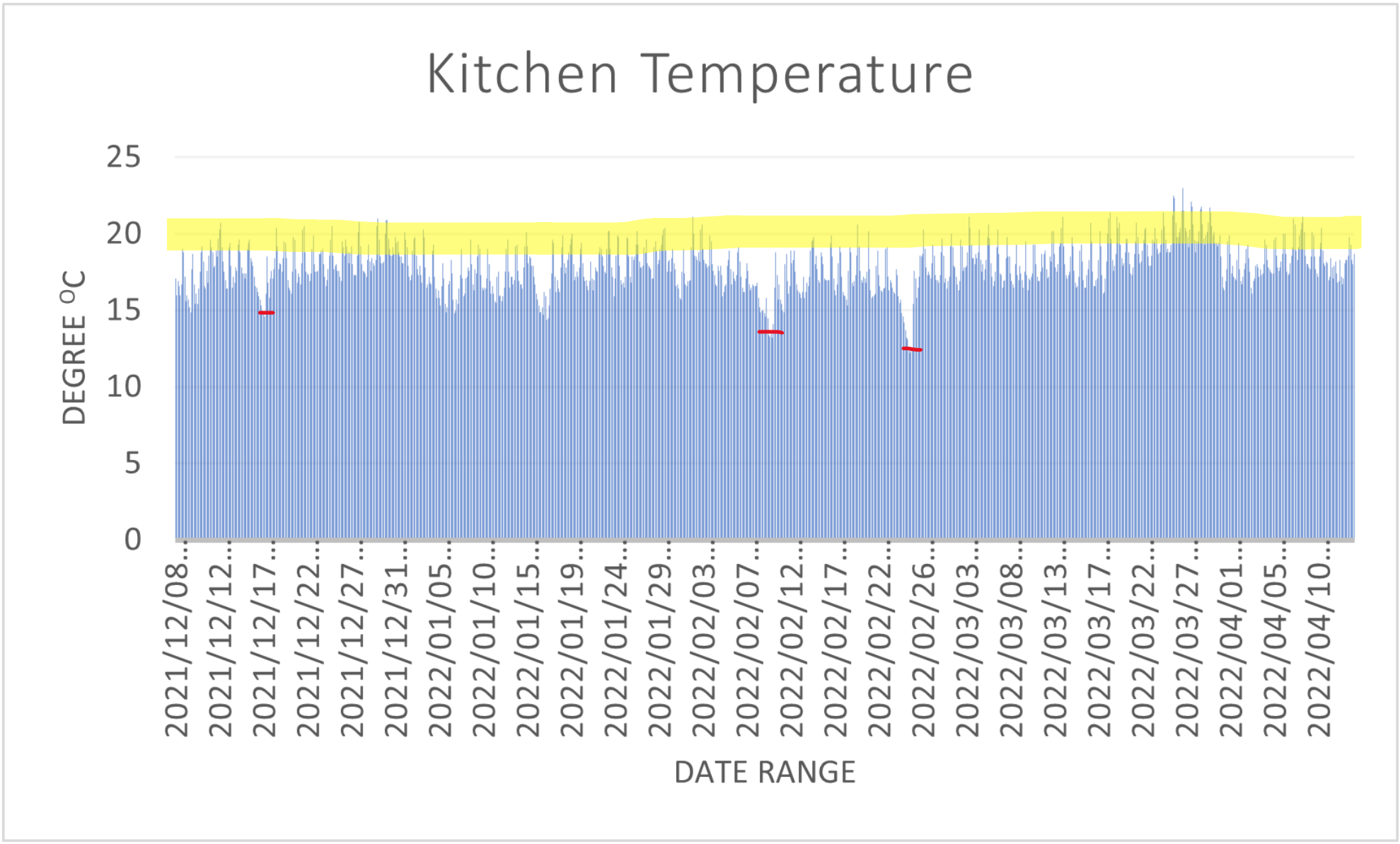


Average 1015 CO_2 ppm

Occupancy and Cooking Influenced

Maximum 200ppm +

Kitchen IAQ Data: December – April



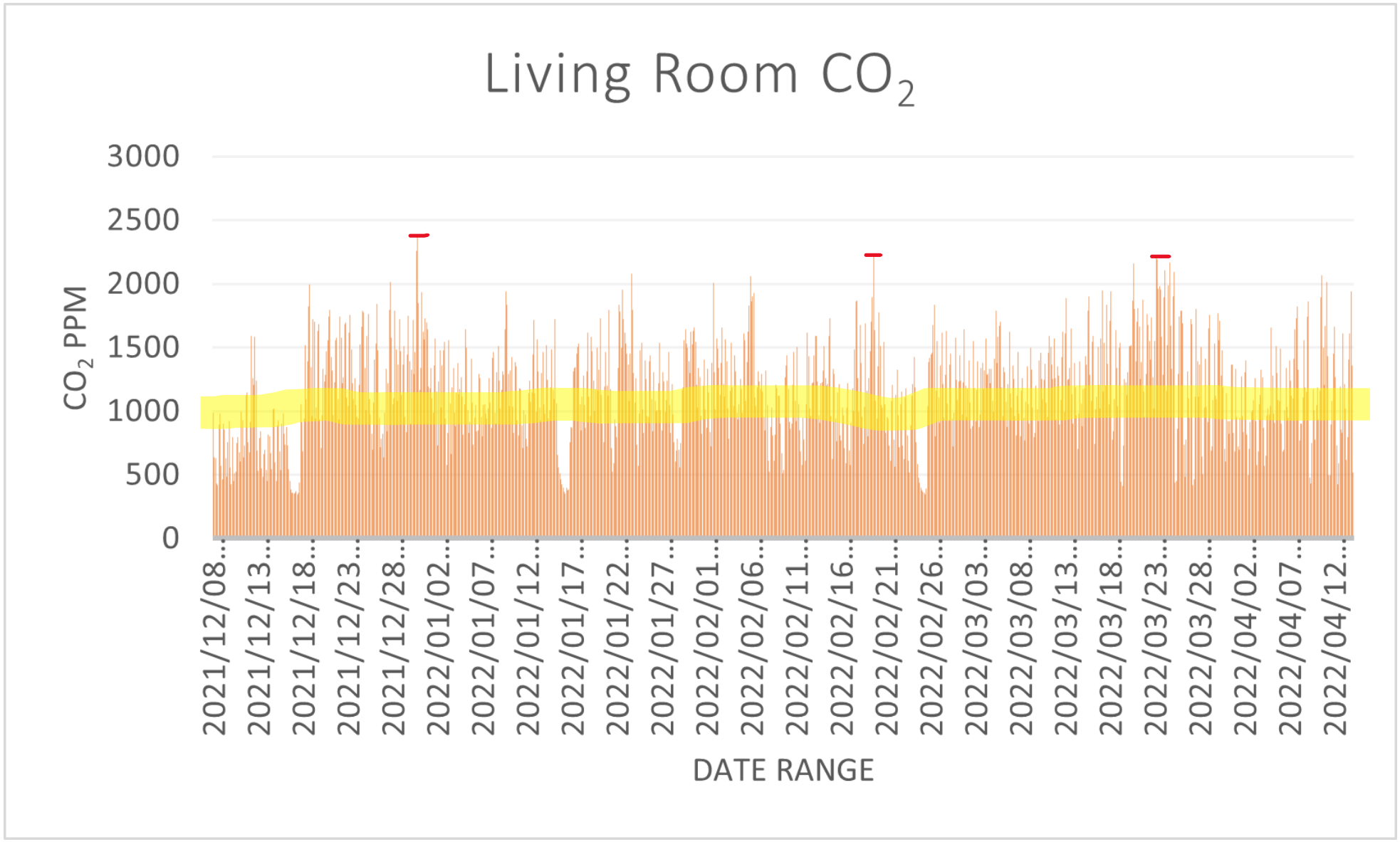
Average 17.8 °C

Kitchen is the Old Garage

Huge Air Gaps Identified behind kitchen units during decant

Minimum Temp below 15 °C

Living Room IAQ Data: December – April



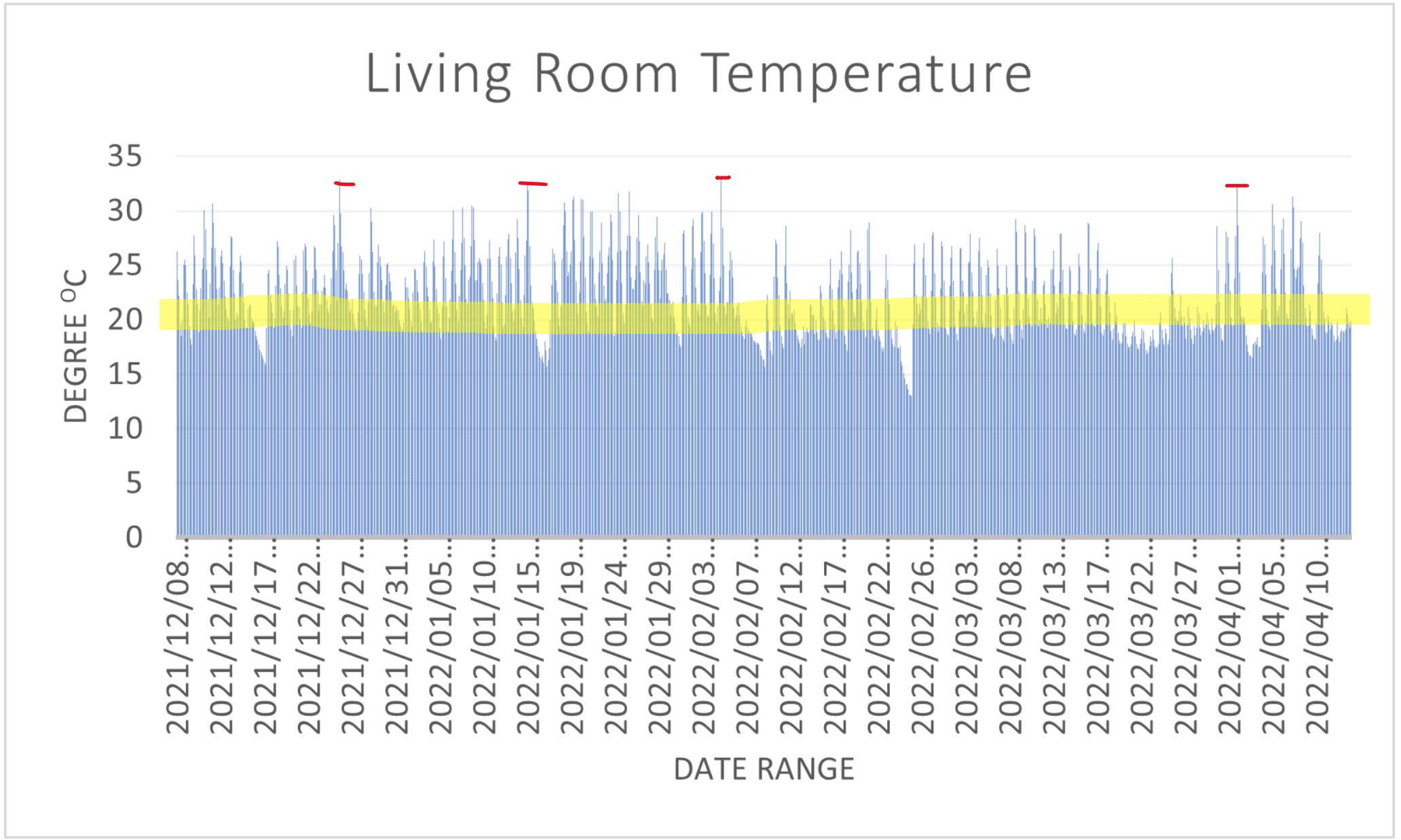
Average 1166 CO_2 ppm

Solid Fuel Stove Present in Room

High CO_2 due to the Stove and Occupancy

Maximum 2000 ppm

Living Room IAQ Data: December – April

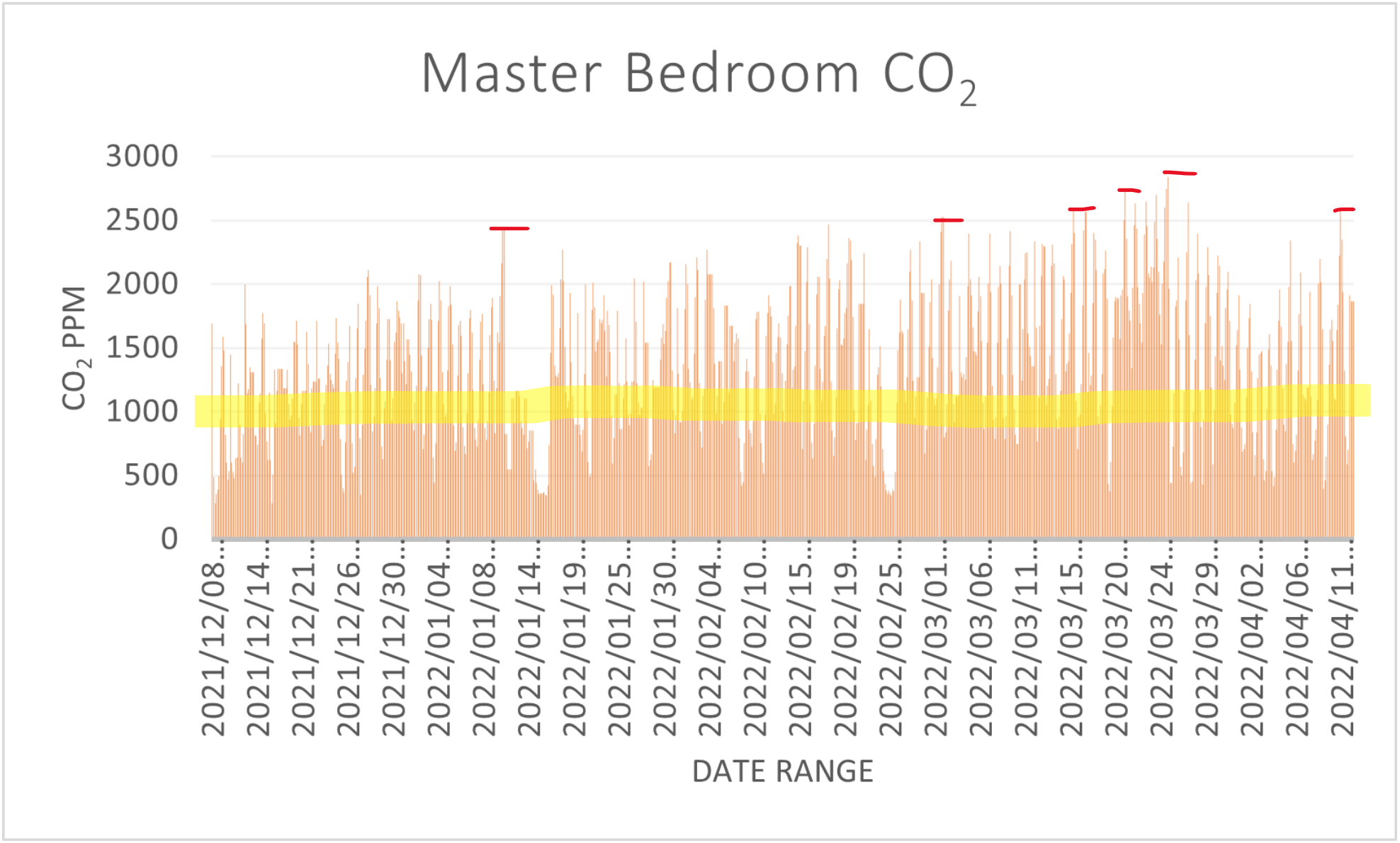


Average 22.1 °C

Highest Temperature In home.

Maximum 30 °C +

Bedroom Room IAQ Data: December – April

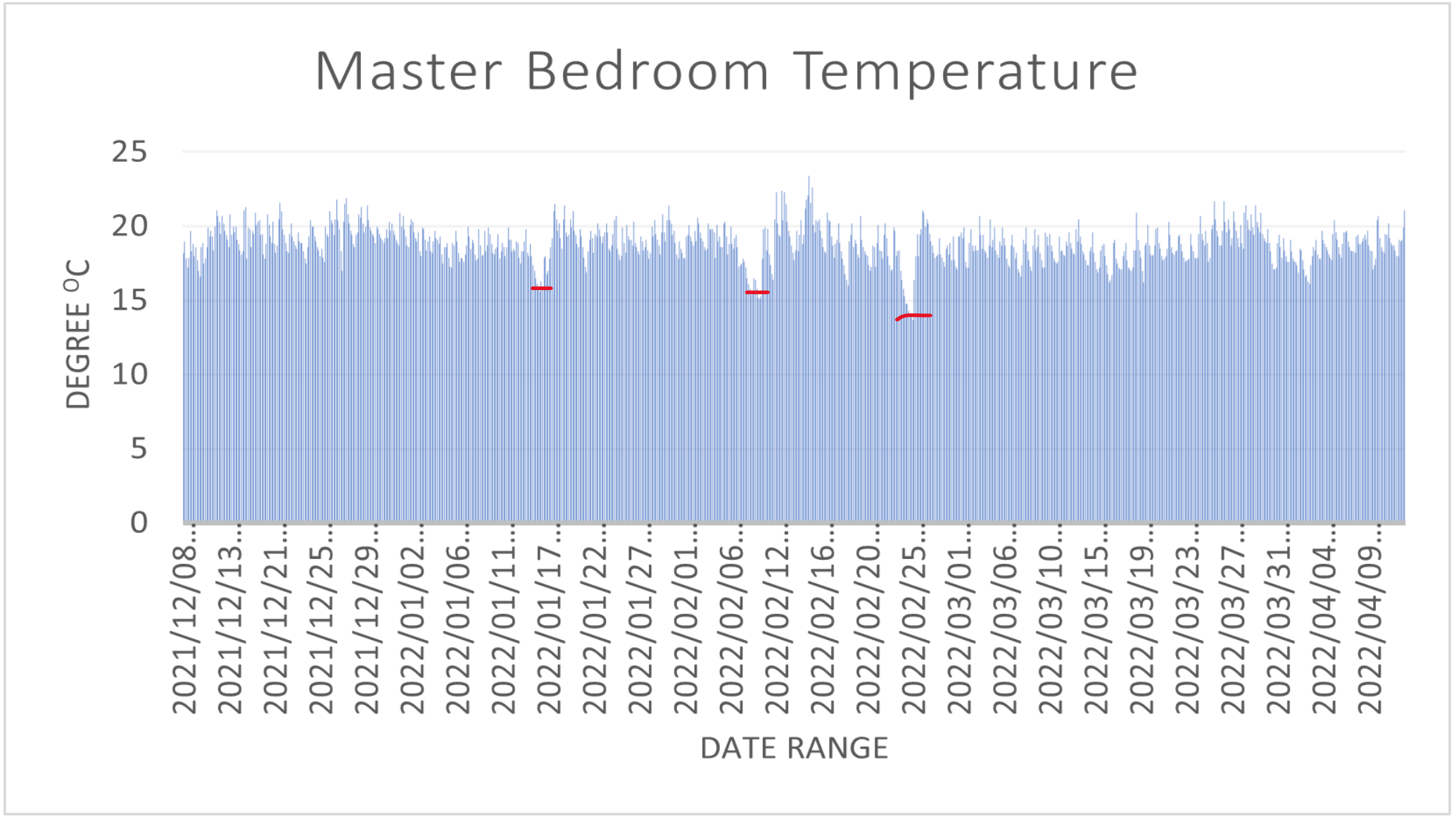


Average 1365 CO_2 ppm

Unacceptable but common Bedroom CO_2 Levels

Maximum 2500 ppm +

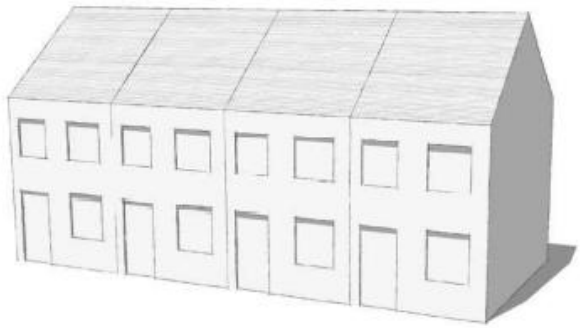
Bedroom Room IAQ Data: December – April



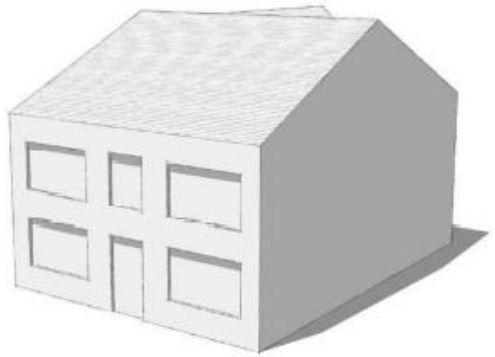
Average 18.7 °C

Acceptable Temperature for Bedroom (CIBSE)

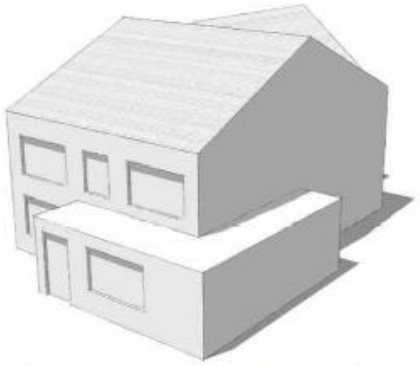
Form Factor Bungalow



terraced houses
approximate form factor of <2



compact detached house
approximate form factor of 2-3



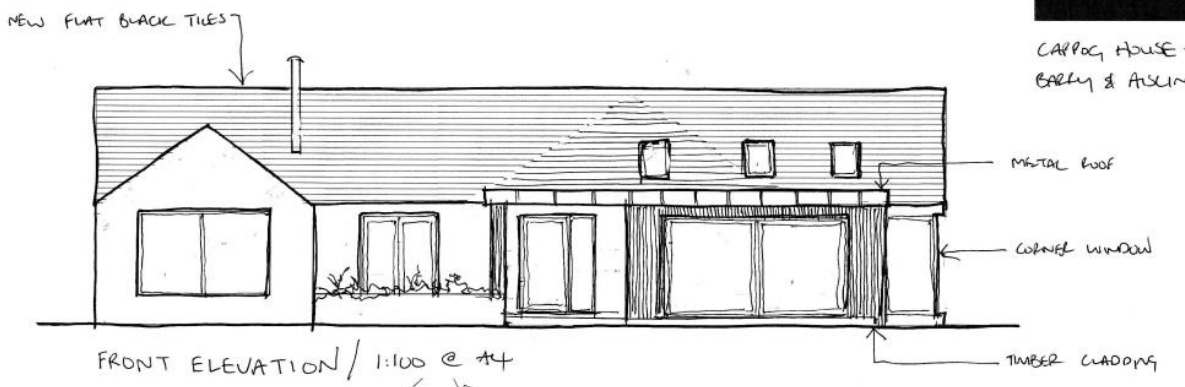
less compact detached house
approximate form factor of 3-4

Our Project Form Factor 3.85

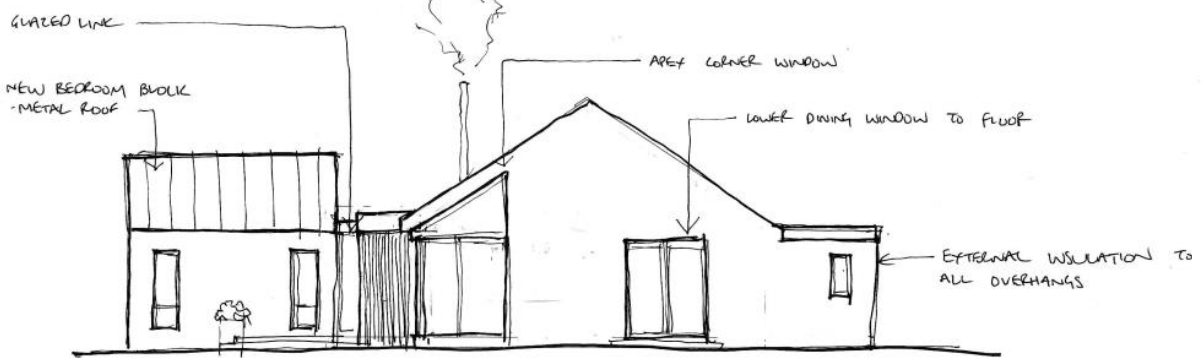
spread out bungalow
approximate form factor of >4

Form Factor	Typical Type of Building	Approximate U-value range in order to reach below 15kWh/m².a in the UK
< 2	Apartment block, terraced houses	0.15 W/m²K
2-3	Semi-detached dwelling or compact detached dwelling	0.10- 0.15 W/m²K
3-4	Less compact detached dwelling house or bungalow	0.10 W/m²K
> 4	Spread out bungalow or single story building	0.05-0.10 W/m²K

Design



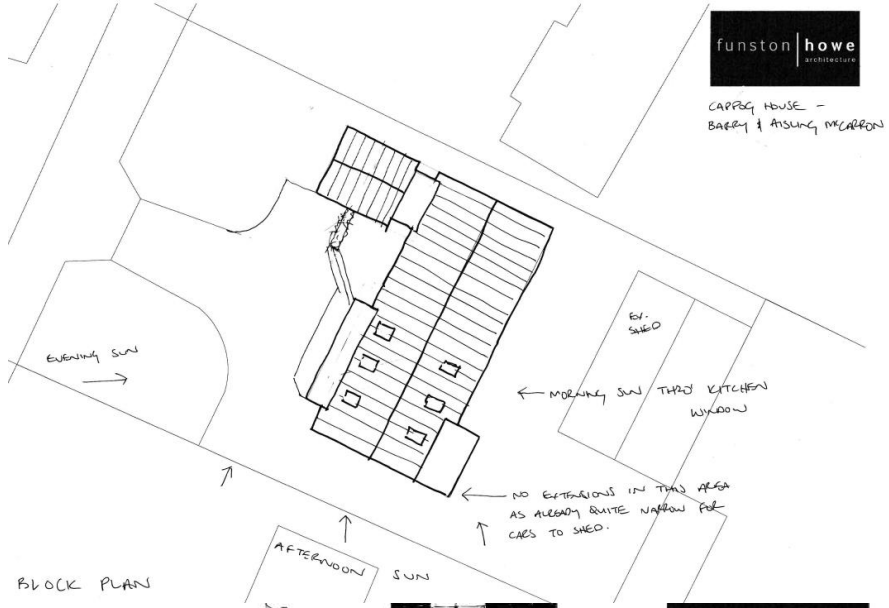
FRONT ELEVATION / 1:100 @ A4



SIDE ELEVATION / 1:100 @ A4

funston | howe architecture

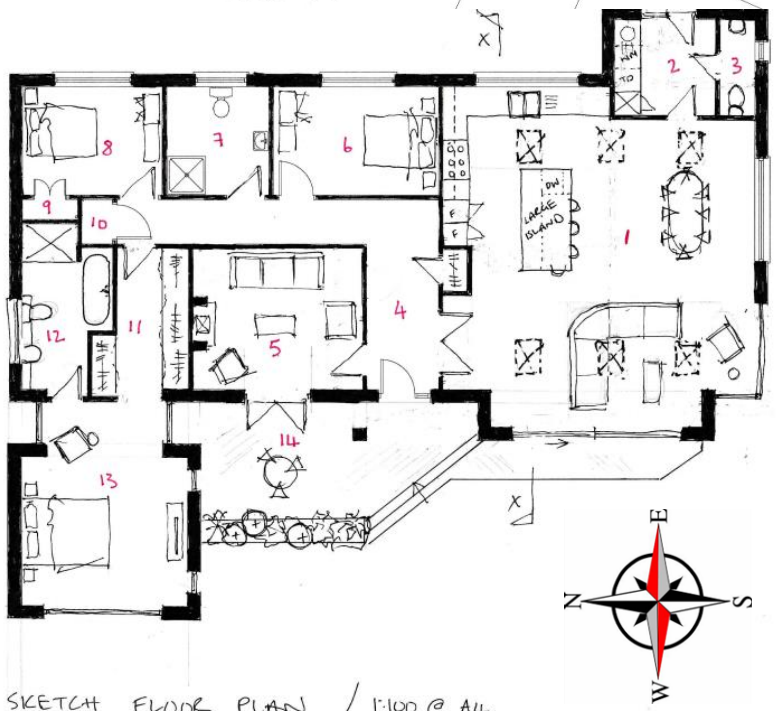
CAPPOG HOUSE –
BARRY & AISLING MCCARRON



BLOCK PLAN

funston | howe architecture

CAPPOG HOUSE –
BARRY & AISLING MCCARRON



SKETCH FLOOR PLAN / 1:100 @ A4.

KEY

1/ KITCHEN / LIVING / DINING (OPEN CEILING)
2/ UTILITY
3/ WC
4/ ENTRANCE HALL
5/ SNUG / GUEST BEDROOM (SOFA BED)
6/ EX. BEDROOM
7/ EX. BATHROOM
8/ EX. BEDROOM
9/ EX. WRD.
10/ EX. HOTPRESS
11/ WALK THRU' WARDROBES
12/ WASHROOM
13/ MASTER BEDROOM - OPEN CEILING
14/ EVENING SUN TERRACE

Floor Details

Old U-Value 0.57 W/m2K

New U-Value 0.11 W/m2K

Wall Details

Old U-Value 0.57 W/m2K

New U-Value 0.10 W/m2K

Roof Details

Old U-Value 0.147 W/m2K

New U-Value 0.125 W/m2K

Decrement delay

Very lightweight insulations may perform well on thermal conductivity, but they tend to perform poorly on decrement delay.

My choice of insulation for the roof was based on Decrement delay.

252 x 12.5kg Bags or 3.15 Tonnes of Cellulose

Over 1.3 Tonnes in Comparison to PIR Insulation

DÄMMSTATT

ecological BUILDING SYSTEMS

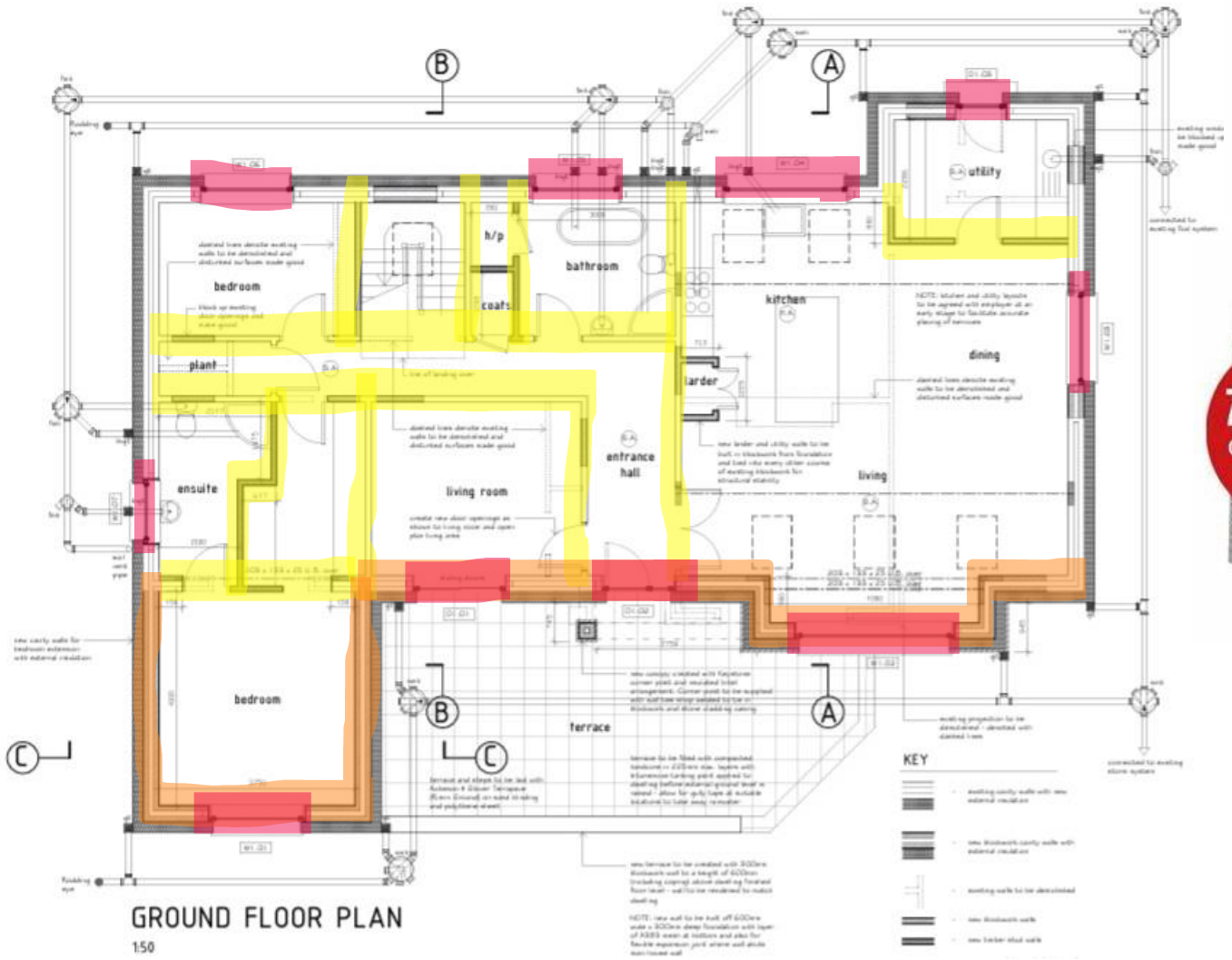
FSC

PEFC

THIRD-PARTY VERIFIED EPD Institut Bauen und Umwelt e.V.

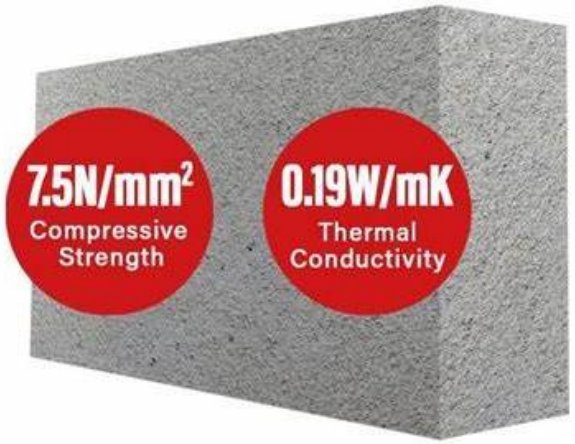
natureplus natural sustainable building

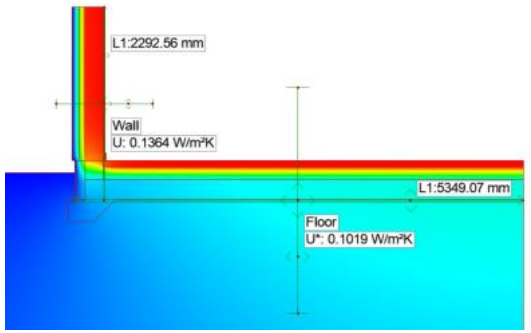
Thermal Bridging

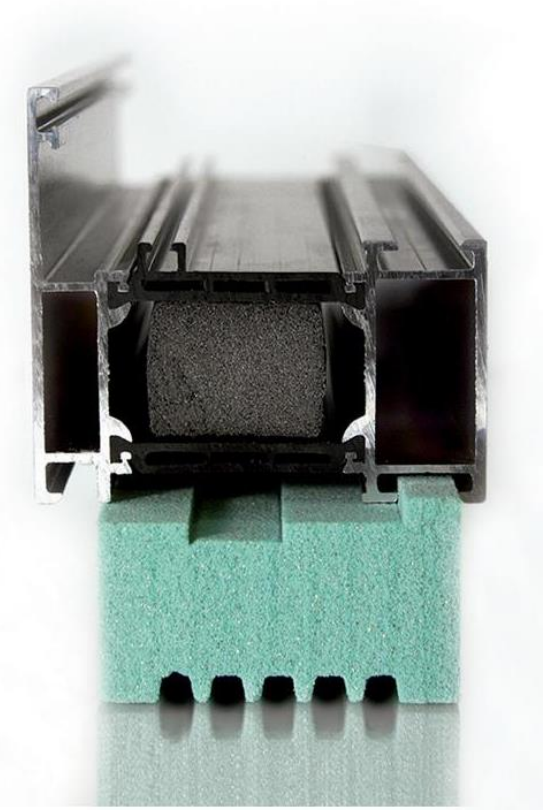


MANNOK

Partel
Passive Building Supplies





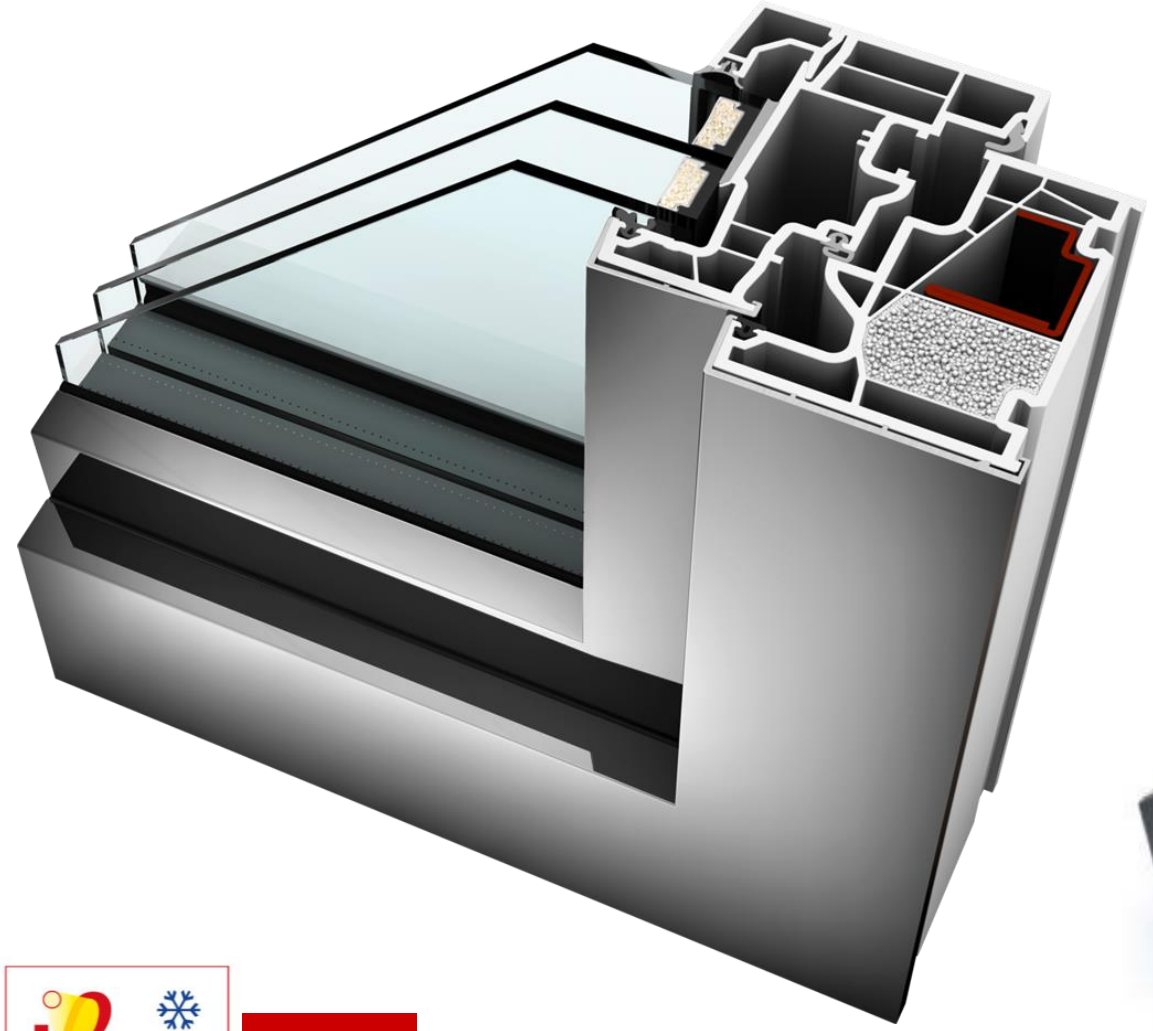


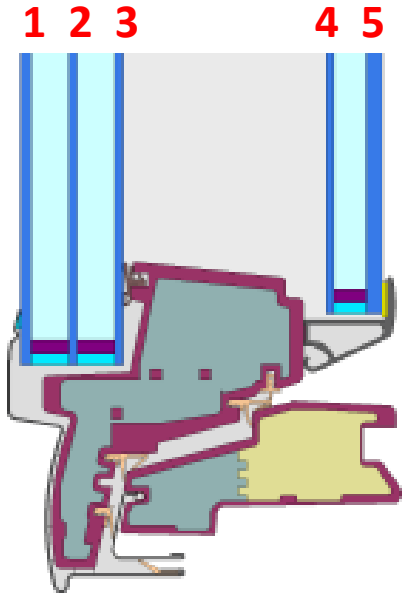
Total of 290 Linear Meters of Thermal Bridging Assessed and heat loss mitigated

Thermal Bridging

DIASEN
GREEN BUILDING FUTURE

Window Specification





VELUX®
Bringing light to life

Solar

CERTIFIED COMPONENT
Passive House Institute

3 YEARS GUARANTEE
ON ALL BLINDS, ELECTRICAL PRODUCTS AND ACCESSORIES

10 YEARS GUARANTEE
ON WINDOWS AND FLASHINGS

15°-90°

BBA BRITISH BOARD OF AGRÉMENT

CERTIFIED COMPONENT
Passive House Institute

Internorm

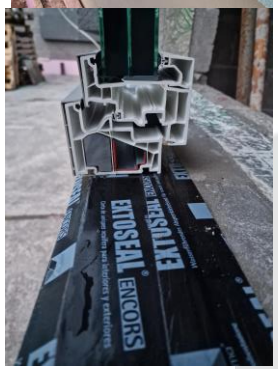
SYSTEMS InterLux

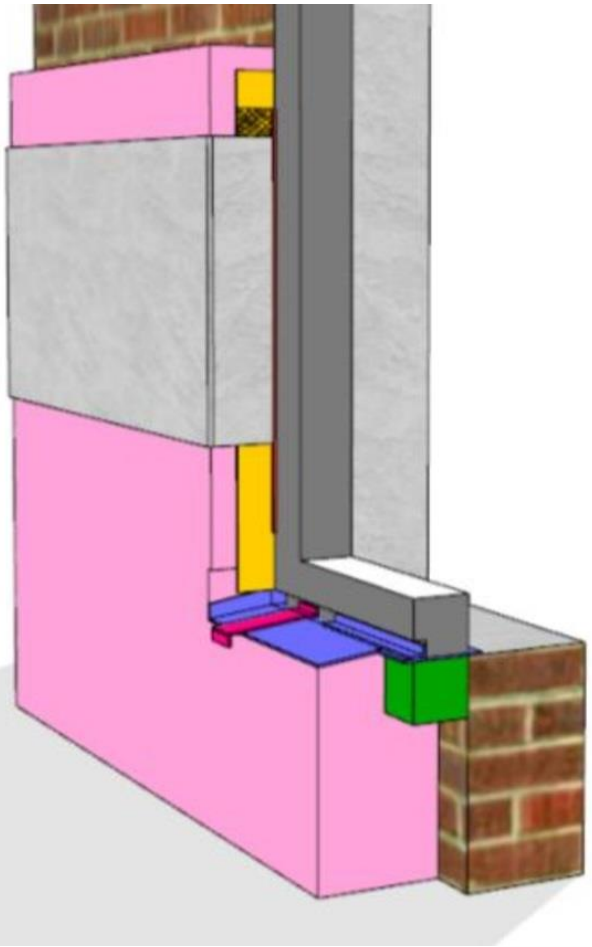
Door U-Value: 0.60 W/m²K

Window U-Value: 0.71 W/m²K

Roof Light U-Value: 0.57 W/m²K

Window Installation





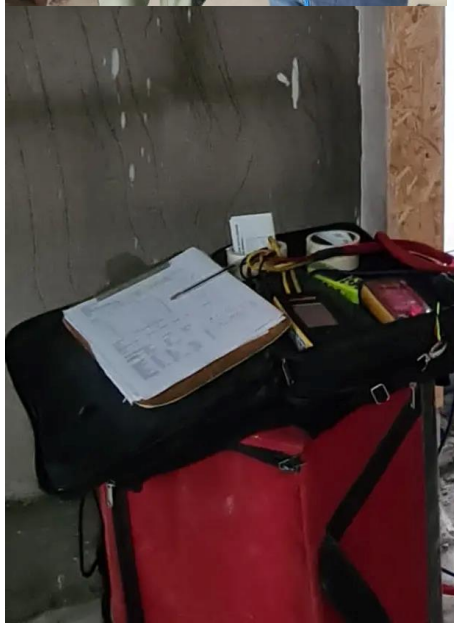
Airtightness

pro clima®

ecological BUILDING SYSTEMS

clíoma house

Airtightness Test



Pressure Test Result Summary

Preliminary Test

Cappog
Ballinode
Co Monaghan

2022-12-02

Result @50Pa	Flow m^3/h	Air changes (n50)	Permeability $m^3/(hr.m^2)$ (qe50)
Averaged Result	**398.51**	0.69	**0.697**

Air permeability rate less than ($m^3/hr.m^2$):

0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	15	>15
	X																				

How this result can be understood depends on the type of building and the regulations being checked against. A table can be found in Appendix B with an overview of common building type/regulations.

Notes:

The flow result is area independent.

The air changes rate (air leakage) and $m^3/(hr.m^2)$ (air permeability) results are both dependent on accurate measurements of the volume and envelope area of the property under test. The measurements used here were calculated from measurements taken on site.

For visualisation purposes, the equivalent leakage area is calculated at approximately 199.1 cm^2 (@50Pa)
This is approximately the size a single hole would be through the wall, if all of the leaks now present in the property were concentrated into one hole going directly outside, measured at 50Pa.

Ventilation

Passive House Institute

Component Database

English Deutsch
polski 简体中文

Ventilation system (capacity < 600 m^3/h)
Endura Delta 450 PH

Info

Component id:	1335vs03
Manufacturer:	Renson Ventilation nv
Air flow range from:	56 m^3/h
To:	352 m^3/h
Heat recovery rate:	84 %
Specific electric power:	0.25 Wh/m^3
Efficiency ratio:	0.67
Humidity recovery:	0 %
Sound level of unit:	55.8 dB(A)
Climate zones:	Cool, temperate

Leakage

Internal leakage: 0.93 %
External leakage: 0.41 %

Acoustic duct

Outdoor air: 59.2 dB(A)
Supply air: 71.1 dB(A)
Extract air: 59.8 dB(A)
Exhaust air: 71.3 dB(A)

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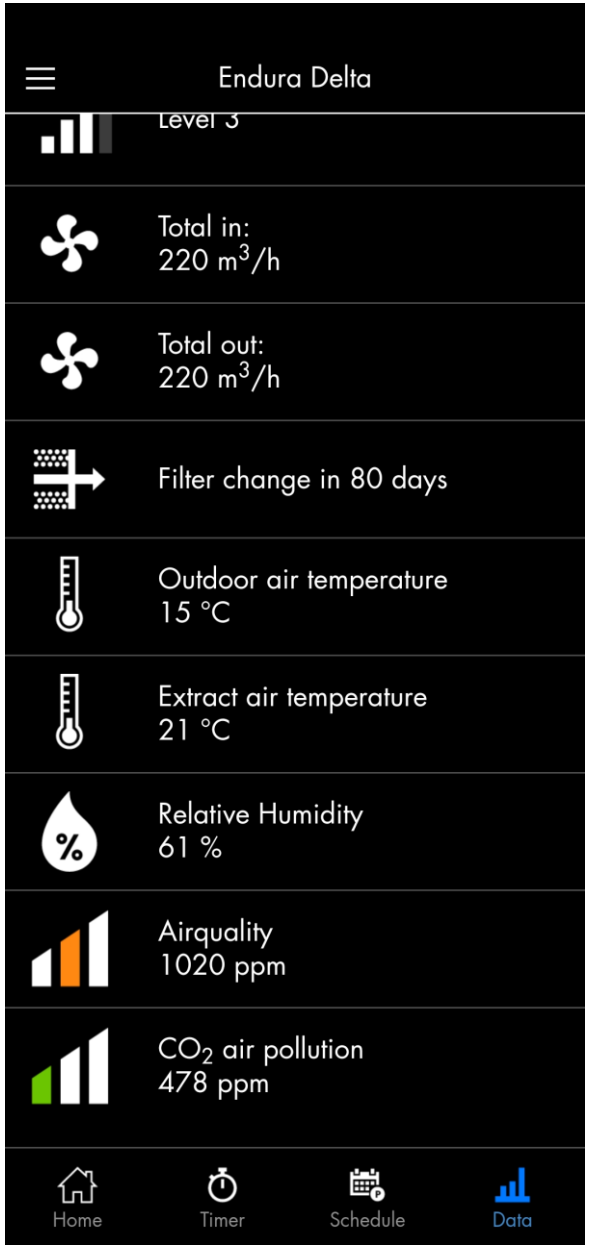
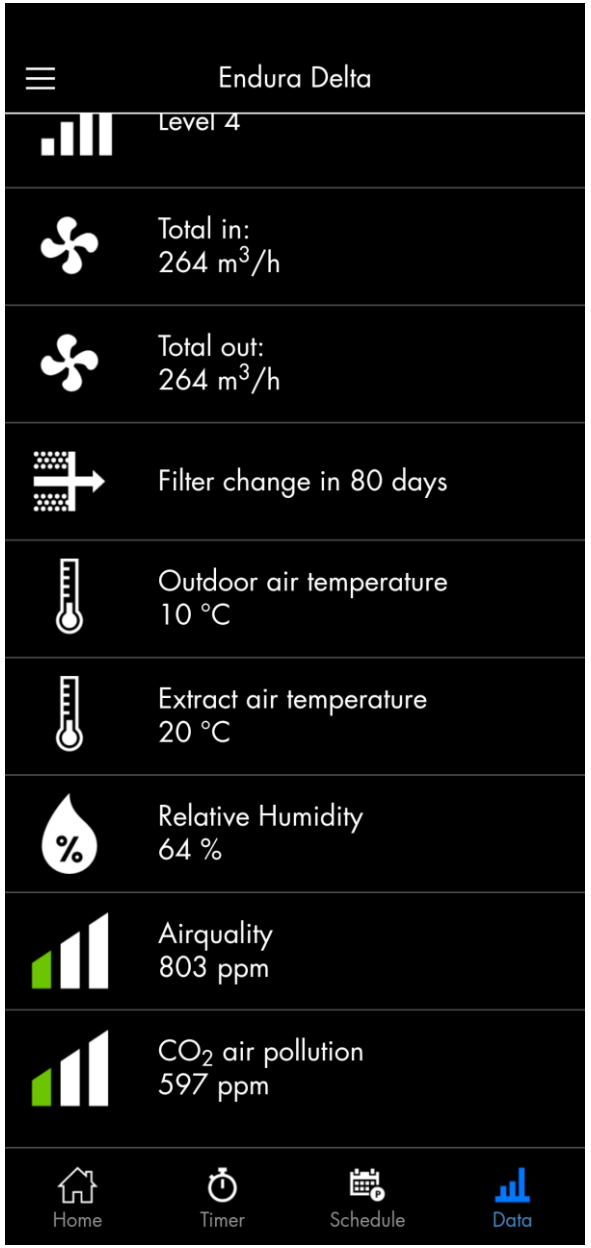
Ventilation





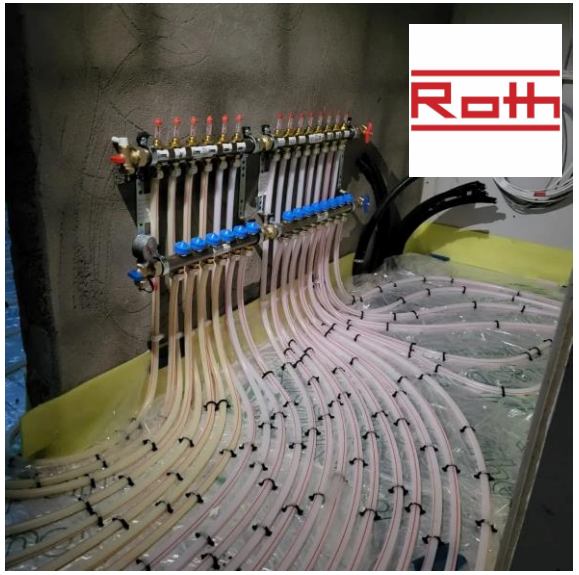
CERTIFIED COMPONENT
Passive House Institute

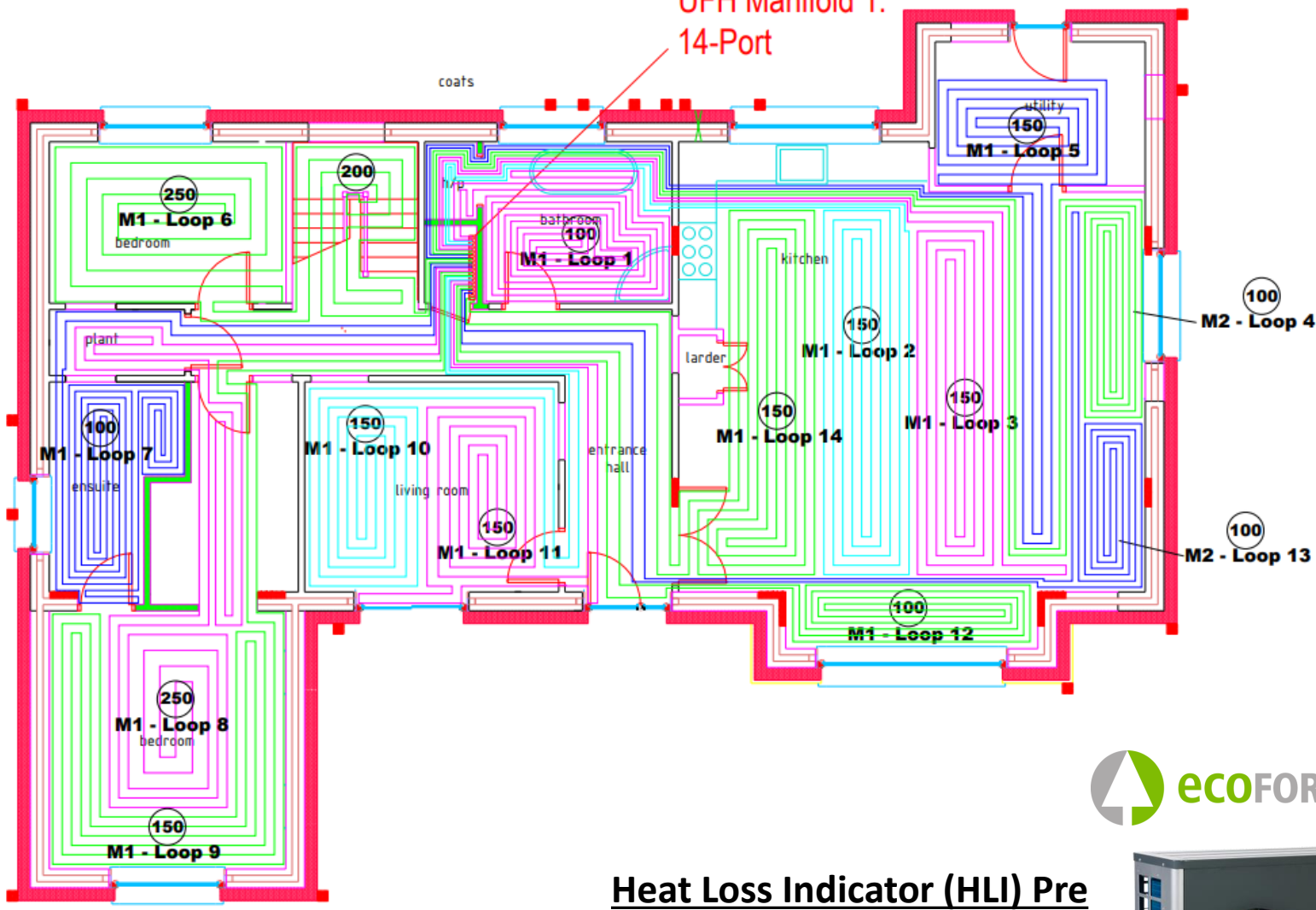
RENSON
Creating healthy spaces

220 m3/h or
60 Liters per second

Daly
Renewable Energy Systems

Renewables





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BT28 2BP
TEL: (028) 92667745
FAX: (028) 95072745
EMAIL: INFO@DALYRENEWABLES.COM
WEB: WWW.DALYRENEWABLES.COM

project: New Dwelling		client: Barry McCarron	
drg title: UFH Layout			status: Proposed
drg no: M01			job no: –
drawn by: A.Carnduff	checked by: R DALY		approved by:
date: 05/12/22	scale: N.T.S		rev: -

ecoFOREST

Heat Loss Indicator (HLI) Pre Works 2.69

Heat Loss Indicator (HLI) Post Works 0.71

Heat Pump Optimization

Daly
Renewable Energy Systems

Solar Edge 3.6kW Inverter. 280mm H x 370mm W x 142mm D. Mounted in Coats Room above UFH Manifold

EcoForest EcoAir 1-7kWv ASHP. 823mm H x 1040mm W x 435mm D. Positioned 300mm from wall.

3-Port Diverting Valve

UFH Manifolds

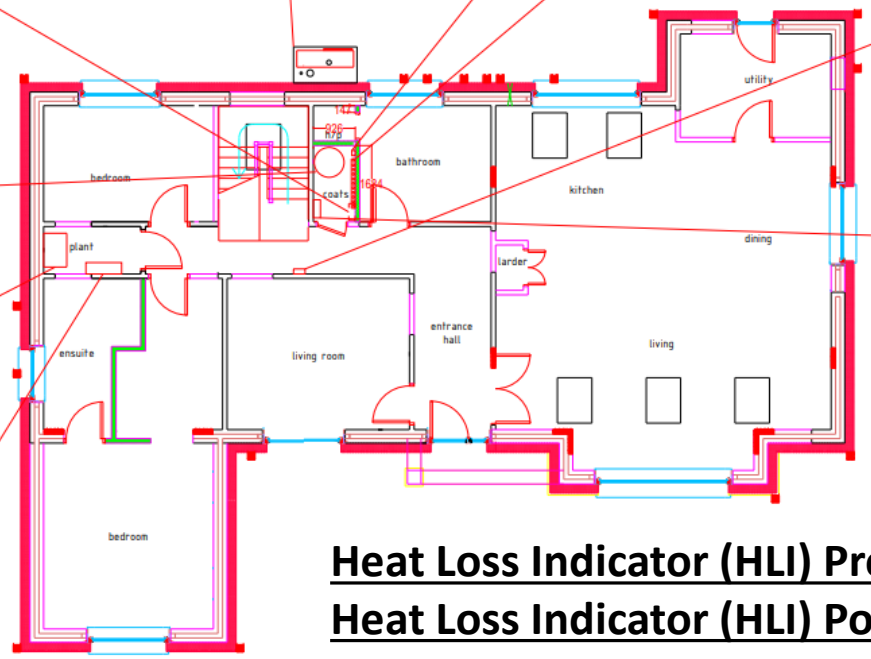
EcoForest TH-T Master Stat.

500L Hot Water Cylinder 660mm D x 1880mm H

EcoForest Indoor CM-Module. 600mm H x 400mm W x 158mm D. Mounted on wall 1.6m from F.F.L

Renson Endura Delta 450 MHRV Unit. 735mm W x 862mm H x 510mm D. Mounted in Plant Room.

Solar Edge Energy Bank 10kWh Battery. 790mm W x 1179mm H x 250mm D. Located in Plant Room



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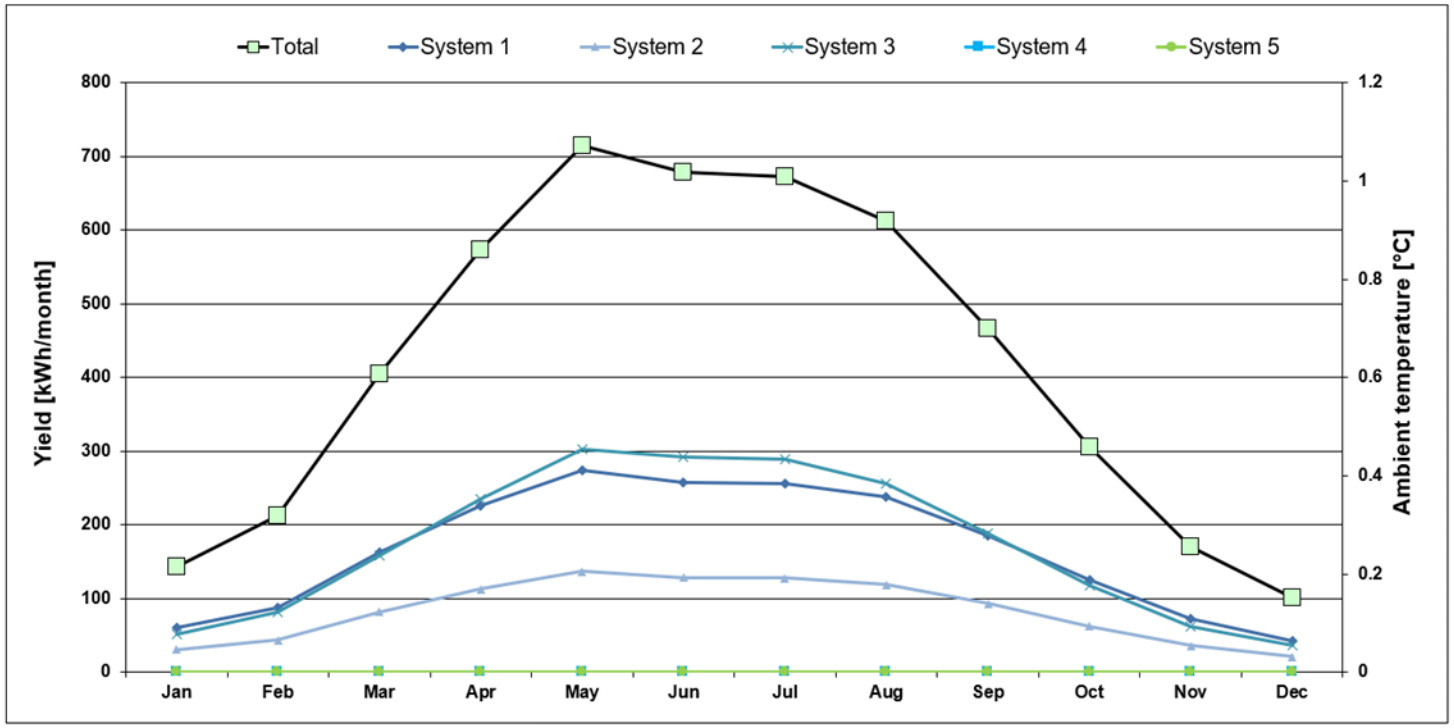
project: New Dwelling		client: Barry McCarron	
drg title: Plant Layout			status: Proposed
drg no: M01			job no: -
drawn by: A.Carnduff	checked by: R DALY		approved by:
date: 14/09/22	scale: N.T.S		rev: -

MicroGrid = HP + PV Microgeneration (5.92kW) + EV

Daly
Renewable Energy Systems

ecoFOREST



PHPP

EnerPHit Verification

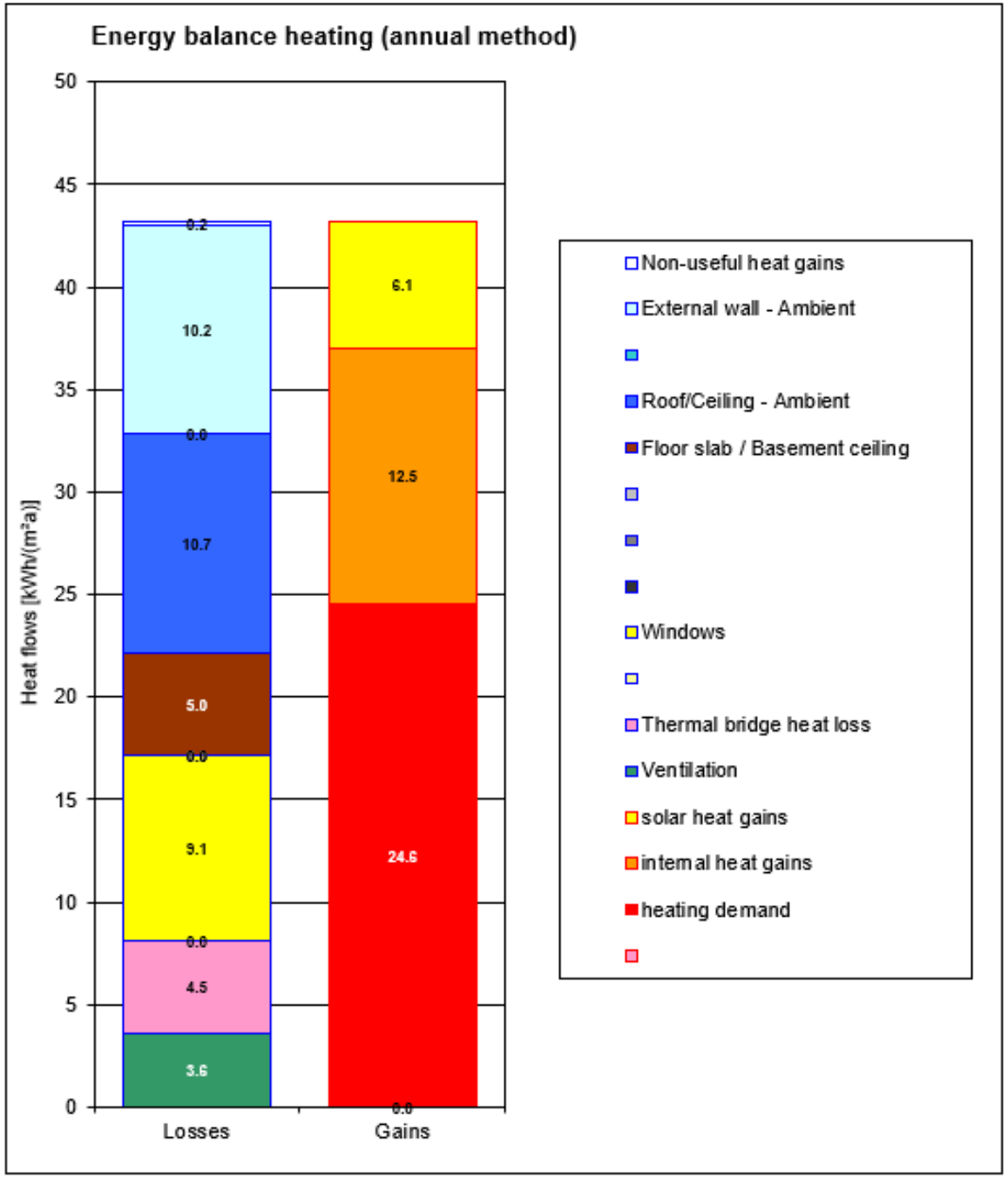
Photo or Drawing

Building:	Bungalow EnerPhit		
Street:	Cappog Ballinode		
Postcode/City:	H18 HF83	Monaghan	
Province/Country:	Ulster	IE-Ireland	
Building type:	Bungalow EnerPhit		
Climate data set:	IE0001a-Dublin		
Climate zone:	3: Cool-temperate	Altitude of location:	44 m
Home owner / Client:	Barry & Aisling Mc Carron		
Street:	Cappog Ballinode		
Postcode/City:	H18 HF83	Monaghan	
Province/Country:	Ulster	IE-Ireland	
Architecture:	Funston Howe Architecture		
Street:	30 Cullion Road, Edenmore		
Postcode/City:	BT94 3AR	Tempo Fermangh	
Province/Country:	Ulster	GB-United Kingdom/ Britain	
Mechanical engineer:	Daly Renewable Energy Systems		
Street:	Suite 701, Lisburn Enterprise Organisation		
Postcode/City:	BT28 2BP	Lisburn	
Province/Country:	Ulster	1-Residential building	
Energy consultancy:	MosArt		
Street:	Clermont House Rathnew		
Postcode/City:	A67 X566	Wicklow	
Province/Country:	Leinster	IE-Ireland	
Certification:	MosArt		
Street:	Clermont House Rathnew		
Postcode/City:	A67 X566	Wicklow	
Province/Country:	Leinster	2-User determined	

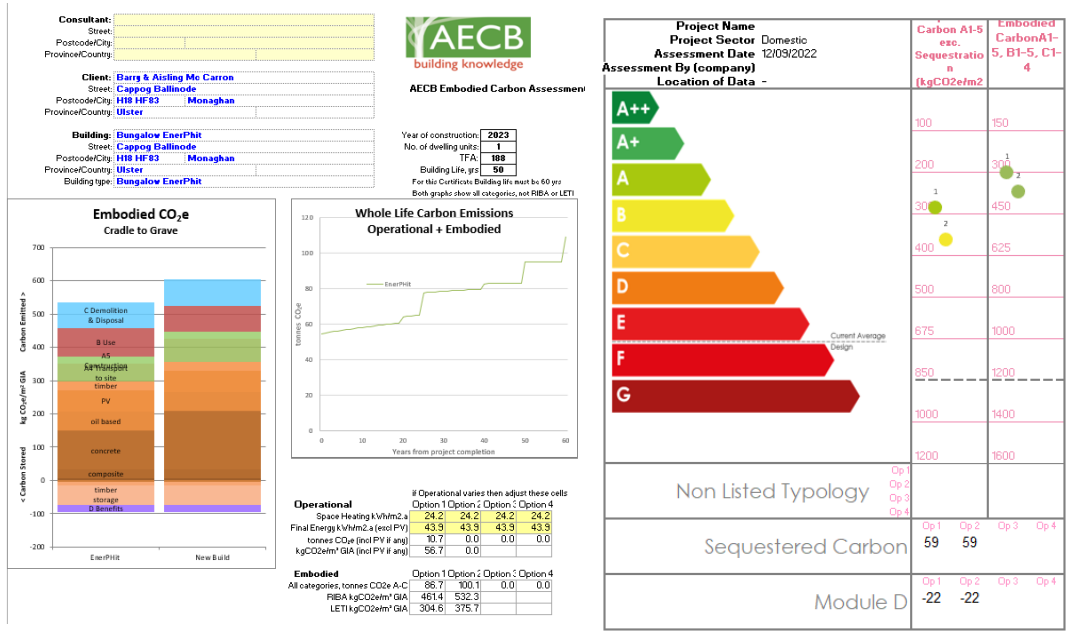
Year of construction:	2023	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.4	IHG cooling case [W/m²]:	2.4
No. of occupants:	5.0	Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	188.2				
Space heating	Heating demand kWh/(m²a)	24	≤	-	-	-
	Heating load W/m²	10	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	0	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	3	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0.7	≤	1.0		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	83	≤	116		yes
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	47	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	27	≥	-	-	



PHPP RIBBON

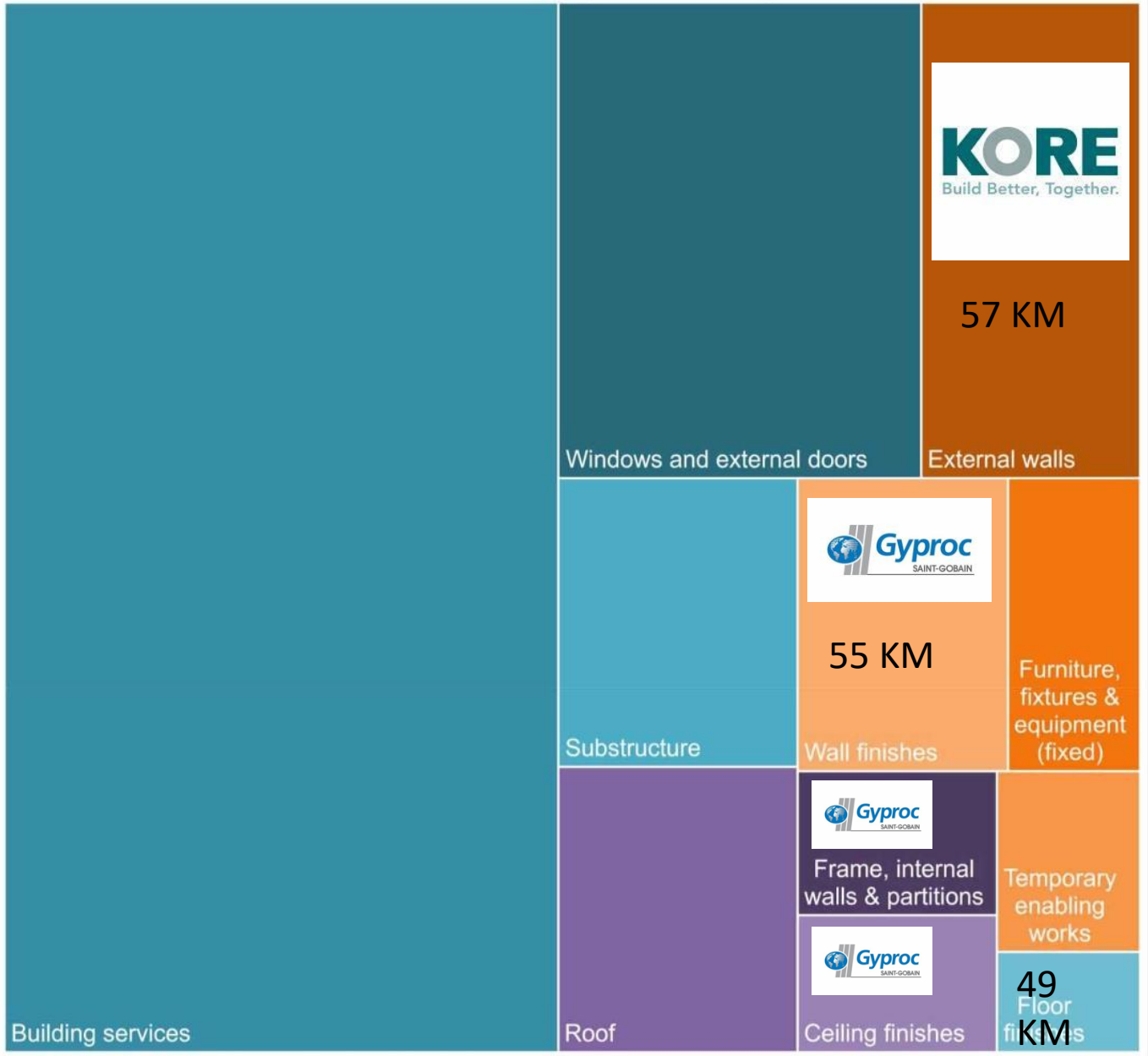


Result
RIBA 461.4 kgCO2e/m3 GIA

LETI 304.6 kgCO2e/m3 GIA

25% of Existing Retained
66% of all Walls Retained 100m2

- Reduced operational carbon
- Reduced whole life carbon
- Reduced operational and maintenance costs
- Increased summer and winter comfort
- Increased indoor air quality



Build Costs for Project

Price is €1,914 per m^2

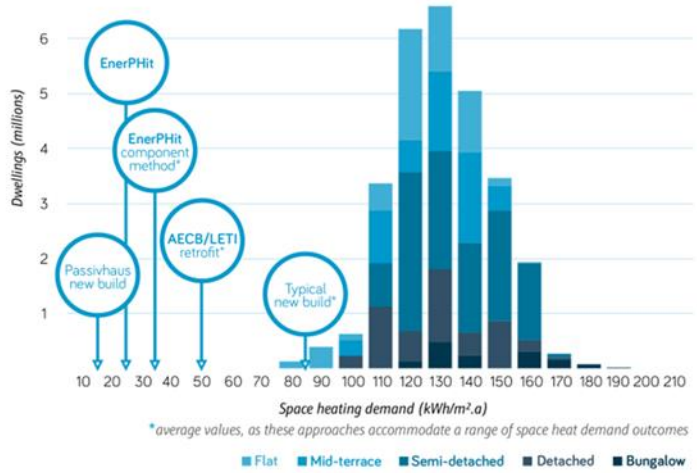
Total Build Cost €360,000.00

PH Extras Estimated €14,800 **Maximum**

5% Extra or €80 extra per m^2 of floor area.

Q1 2022 Costs €2,250 m^2 of floor area

PH EnerPhit Build Extra Over Costs		
Floor Insulation	No Extra	€0
Wall Insulation	Extra	€2,000
Roof Insulation	Extra	€2,000
Thermal Bridging	No Extra	€0
Windows	Extra	€0
Airtightness	Extra	€4,000
MVHR	Extra	€6,800
		€14,800



SINGLE OR TWO-STOREY HOUSE TO "ONE-OFF" DESIGN

- Traditional materials and construction methods
- Reasonable level of finishes and fittings

Cost Range per m²
€2,500 to €2,800

RENOVATIONS TO EXISTING HOUSE ONLY

This would include the following non-exhaustive list:

- New kitchen/ bathrooms
- New finished flooring/ tiling etc.
- Replacement windows
- Insulation upgrade
- Renovation/ replacement of existing services
- Assumes standard site and access conditions

Cost Range per m²
€1,800 to €2,000

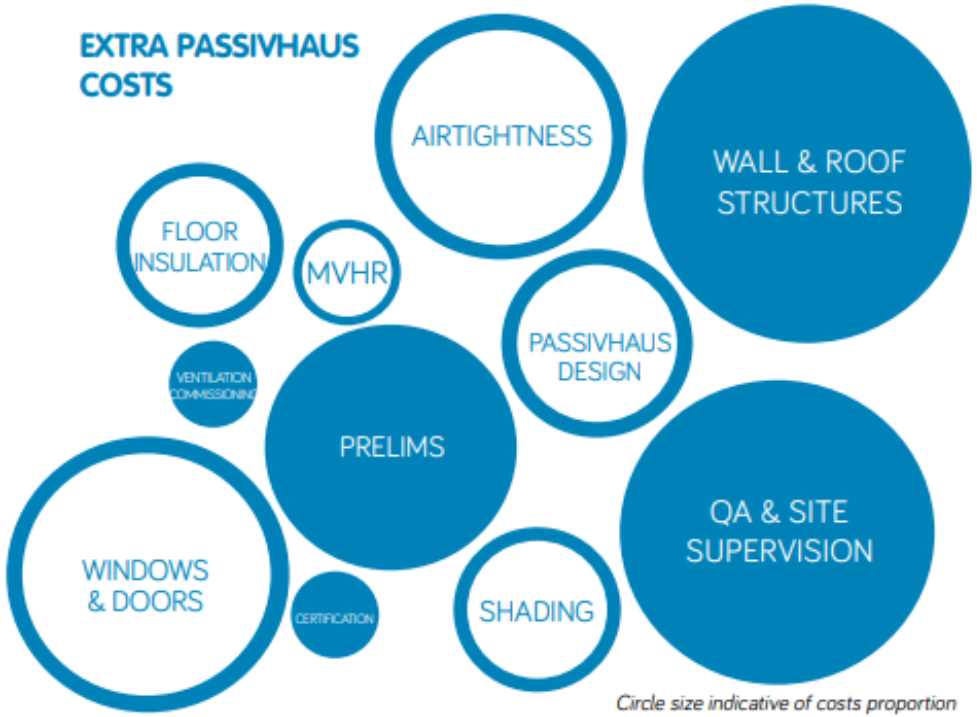
Note:

- In providing cost estimates the architect should make the client aware of the cost implications of high quality kitchens, bathroom fittings and tiling which can increase these guideline figures significantly.
- Does not includes for upgrading to NZEB/ Part L Requirements

RIAI CONSUMER GUIDE

BUILDING/CONSTRUCTION COST GUIDELINES

A CONSUMER GUIDE PUBLISHED BY THE RIAI FOR 2019
DOMESTIC AND COMMERCIAL WORK



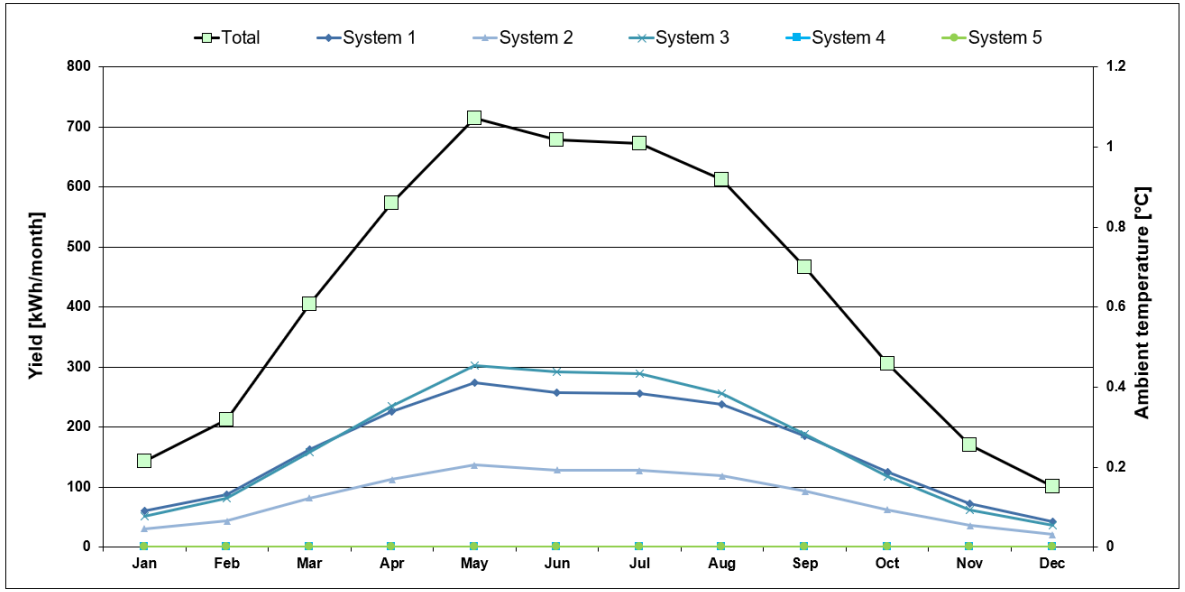
Predicted Annual Running Costs

Average over 2 years before move was **€4,242 per year.**

Predicted annual running cost **€546 per year.**

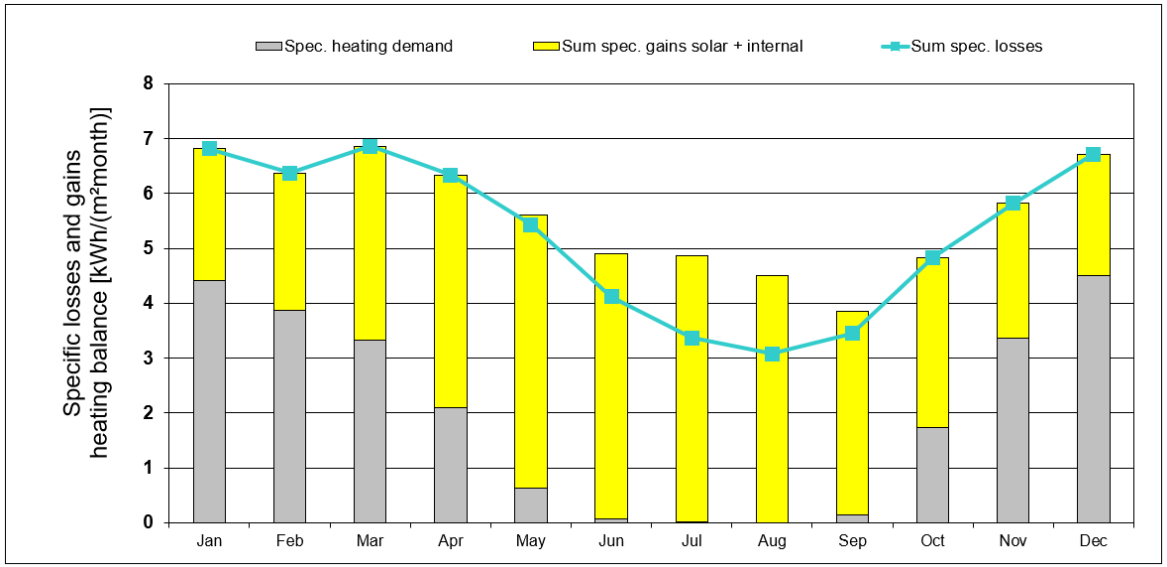
Over Mortgage total savings estimated

€125,568.00



Energy Costs Existing House		2020/21	Actual	
Fuel Type	Units	KwH	Price per Unit	Total
Electric	4088	4138	€ 0.24	€ 981.12
Oil	1500	15527	€ 0.86	€ 1,290.00
Firewood	4	5175	€ 300	€ 1,200.00
Smokless Coal	12	3900	€ 20	€ 240.00
				€ 3,711.12

Energy Costs Existing House		2021/22	*Predicted & Actual	
Fuel Type	Units	KwH	Price per Unit	Total
Electric	4088	4138	€ 0.32	€ 1,308.16
Oil	1500	15527	€ 1.35	€ 2,025.00
Firewood	4	5175	€ 300	€ 1,200.00
Smokless Coal	12	3900	€ 20	€ 240.00
				€ 4,773.16



Annual Running Costs

Average over 2 years before move was **€4,242 per year.**

New Predicted annual running cost is **€1,085 per year.**

New Predicted annual running cost is €546 per year if PV Included.

Over Mortgage total savings estimated €106,947.00

Over Mortgage total savings estimated €122,568.00

Saving Per Year €3,687 - €4,226

4 years payback for Full PH Standard

Provisional Building Energy Cert A1 Rating

23.06 kWh/m2/yr

4.65 kgCO2/m2/yr

EnerPHit Verification

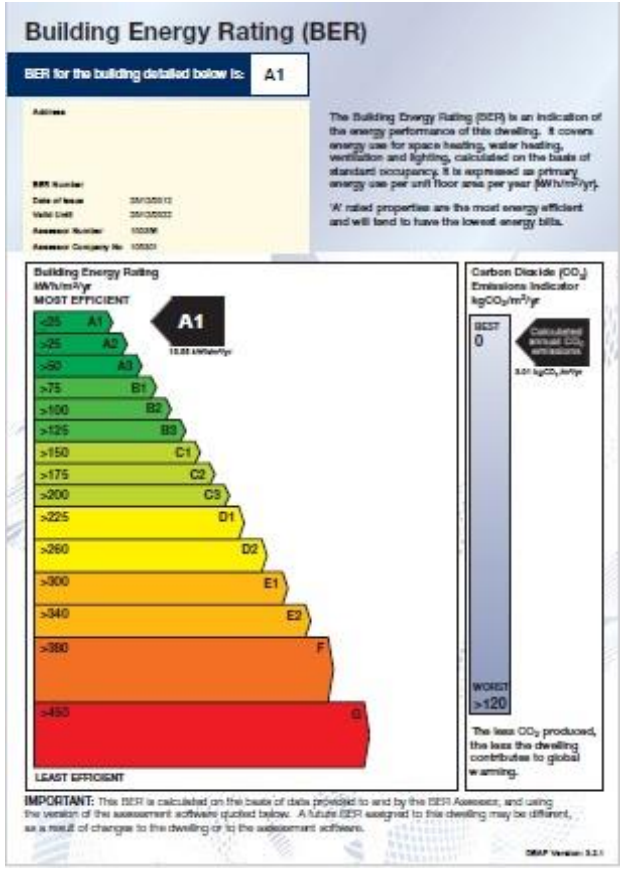
Photo or Drawing

Building:	Bungalow EnerPhit		
Street:	Cappog Ballinode		
Postcode/City:	H18 HF83	Monaghan	
Province/Country:	Ulster	IE-Ireland	
Building type:	Bungalow EnerPhit		
Climate data set:	IE0001a-Dublin		
Climate zone:	3: Cool-temperate	Altitude of location:	44 m
Home owner / Client:	Barry & Aisling Mc Carron		
Street:	Cappog Ballinode		
Postcode/City:	H18 HF83	Monaghan	
Province/Country:	Ulster	IE-Ireland	
Architecture:	Funston Howe Architecture		
Street:	30 Cullion Road, Edenmore		
Postcode/City:	BT94 3AR	Tempo Fermangh	
Province/Country:	Ulster	GB-United Kingdom/ Bri	
Energy consultancy:	MosArt		
Street:	Clermont House Rathnew		
Postcode/City:	A67 X566	Wicklow	
Province/Country:	Leinster	IE-Ireland	
Mechanical engineer:	Daly Renewable Energy Systems		
Street:	Suite 701, Lisburn Enterprise Organisation		
Postcode/City:	BT28 2BP Lisburn		
Province/Country:	Ulster	1-Residential building	
Certification:	MosArt		
Street:	Clermont House Rathnew		
Postcode/City:	A67 X566	Wicklow	
Province/Country:	Leinster	2-User determined	

Year of construction:	2023	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.4	IHG cooling case [W/m²]:	2.7
No. of occupants:	5.0	Specific capacity [Wh/K per m² TFA]:	132	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[1]
	Treated floor area m²	188.2				
Space heating	Heating demand kWh/(m²a)	24	≤	-	-	-
	Heating load W/m²	11	≤	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	1	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	3	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	1.0	≤	1.0		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	96	≤	116		yes
	PER demand kWh/(m²a)	55	≤	-	-	-
Primary Energy Renewable (PER)	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	27	≥	-	-	



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Lessons Learnt

- Embodied Carbon Materials – Advocate post project
- Supply Chain Strength – Window Options, MVHR Options, Material Choice
- Electrical Supply Upgrade – 12 KVA to 16 KVA (Future Car Charging and Induction Cooking)
- Optimized Heat Pump Installation – Floor Screed Thickness and Large Hot Water Cylinder
- External Wall Insulation – Aluminum Rail Thermal Damage (€200 per M2)
- Cellulose and Wood Fibre – Attributes (Decrement delay)
- Diasen Cork Plaster – Used as an Insulation (0.037 W/mK)
- Considered Design – Multiple iterations
- On Site Quality – Attention to Detail very important particularly to Airtightness at Passive House Levels (Airtightness Paint)
- Window Area Consideration - €400 - €800 per m2, Overheating assessment, 20 kWh/m^2 solar gain limit
- Domestic Hot Water Heat loss contribution to Internal Gains
- Grants don’t work – removal of VAT much better Policy recommendation VAT €45,000.00
- Use €1800-€2000 per m2 as a rule of thumb cost estimate
- Passive House EnerPhit Standard by Component very achievable – Can be above 25 kWh per m2 and still obtain Certification