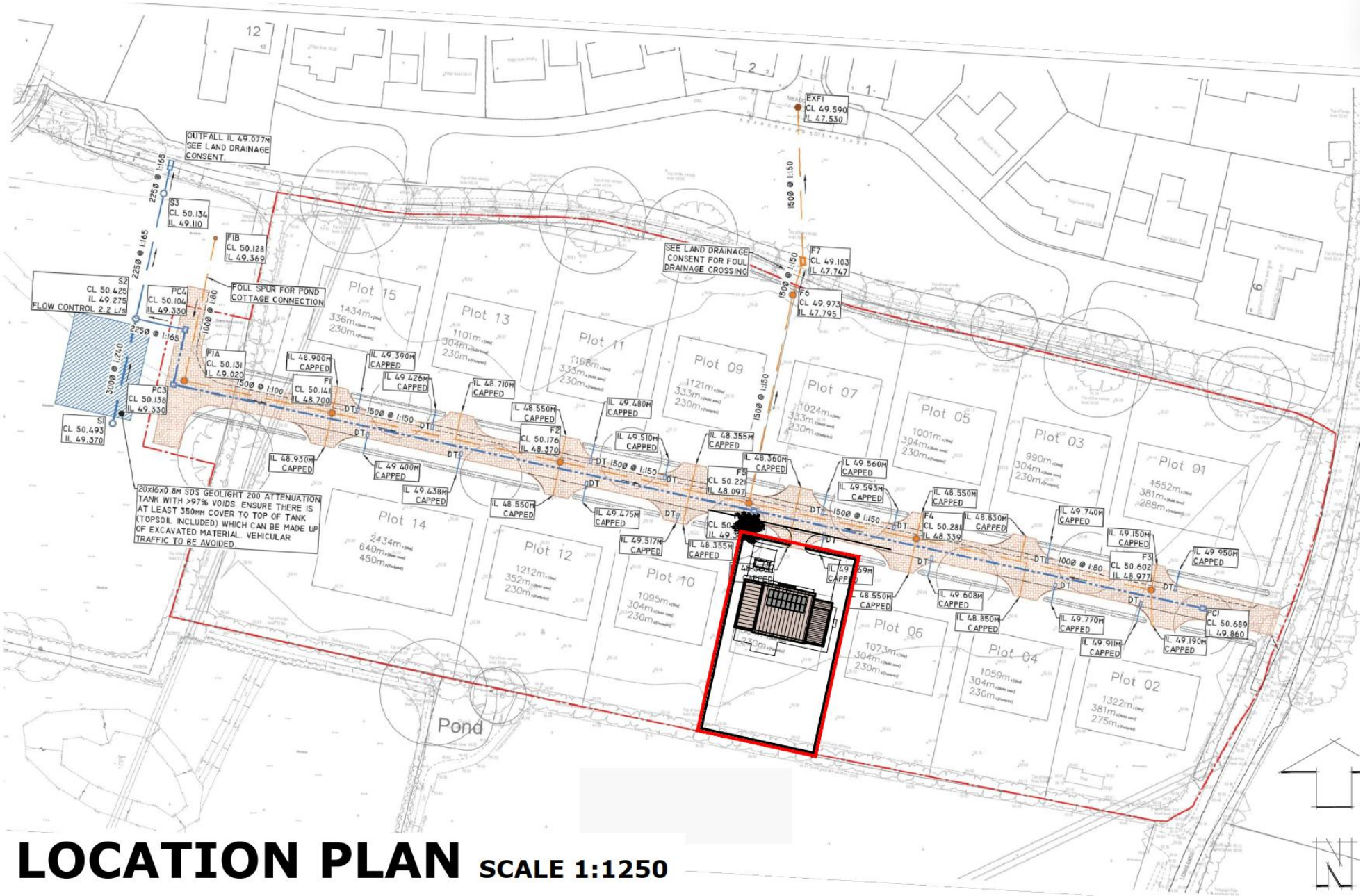
# Small New Build Project: Long Four Acres

Martin Ingham




# LOCATION PLAN SCALE 1:1250

## SITE PLAN

# Design:

- Meet our needs
- Comply with Design Code
- Energy Efficient
- Employ natural materials
- Quick to build
- Proven approach

Passivhaus Plus targeted

Parsons+Whittley architects for planning,

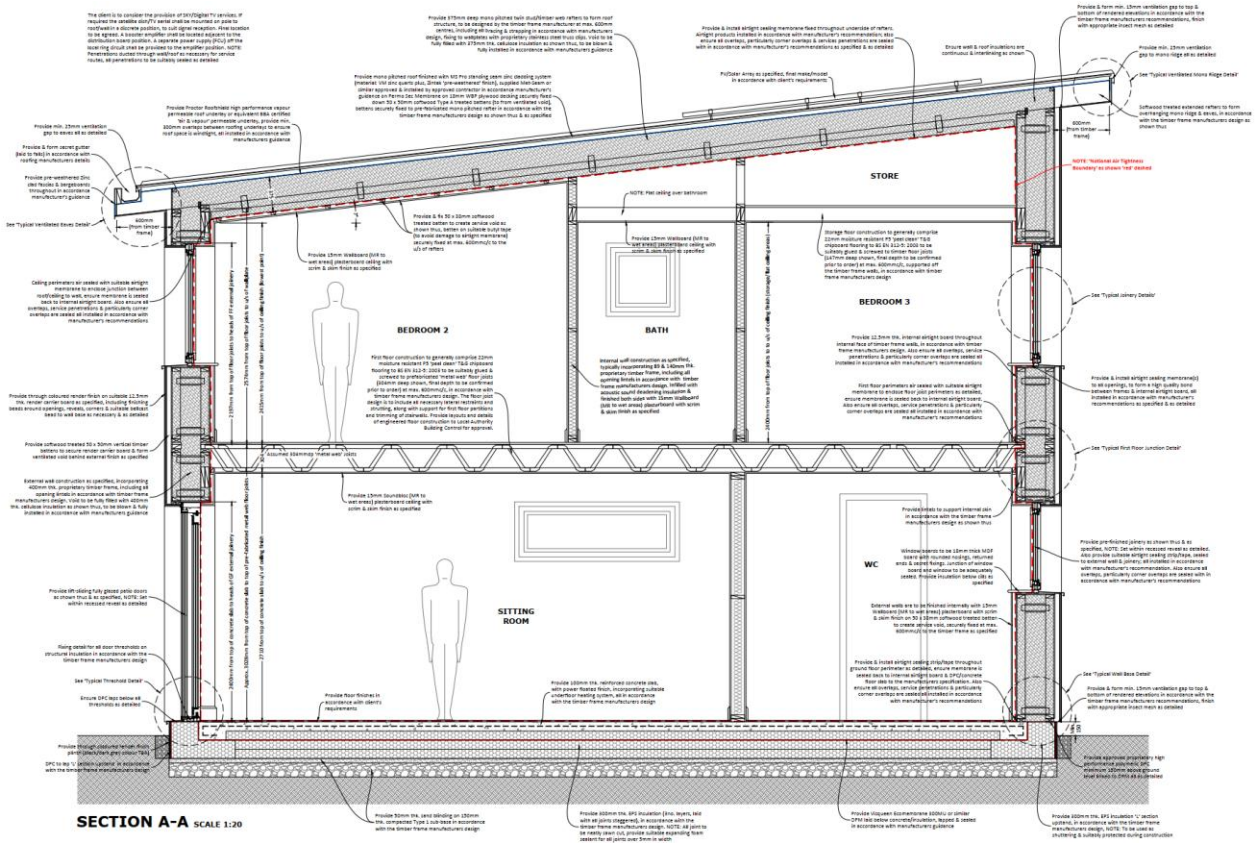
Void Architecture for building control

MBC Timber Frame

WARM certifiers



Simple box form
+ASHP
+MVHR
+PV panels & battery
Cost conscious
no EV yet




# ARCHITECTURAL DESIGN & AESTHETICS: Section & images

# The Build

Started on site Nov. 2019

Foundations, Frame, Windows, Zinc, Air-tightness works, Penetrations and insulation blown

Then… COVID

Singular trades
Self project managed
Supervision difficult
Supply & labour issues

Occupied Dec 2020

# Airtightness

MBC works

March 2020 0.47 ach

Penetrations & cellulose blown

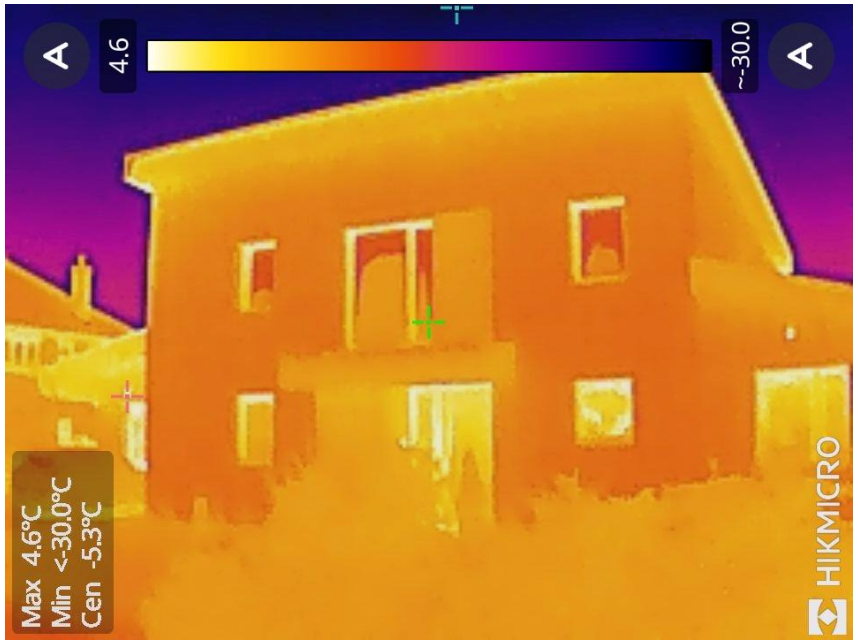
June 2020 0.77 ach

Actions:

- additional taping
- sub-contractors guided on maintaining air-tightness
- Covid restrictions compromised regular oversight

March 2021 0.81 ach

Certification on hold






# Monitoring

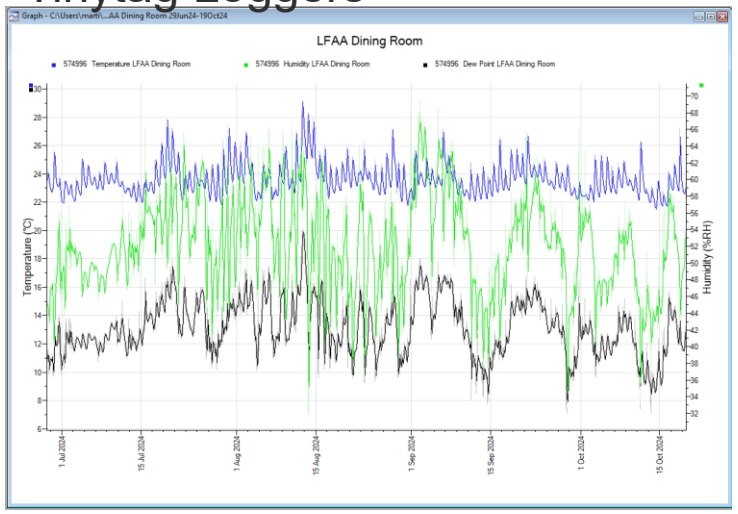
10+ years Wimbish experience

Budget limits

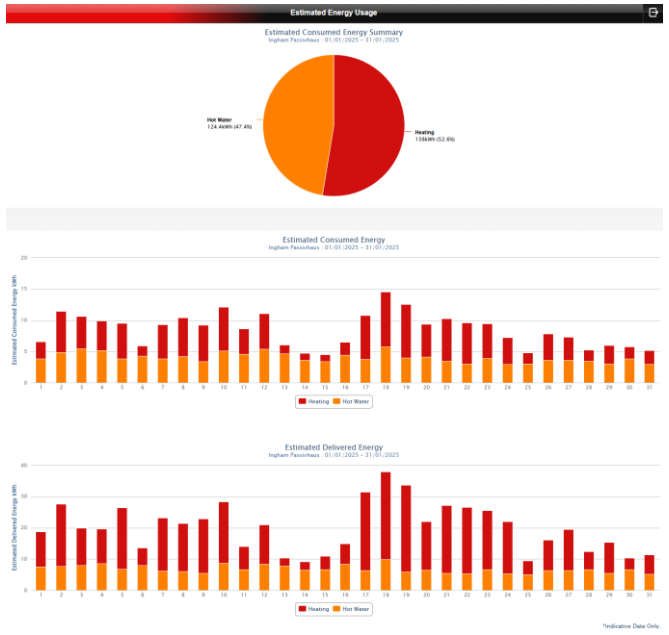
App. Sources

Fine granularity

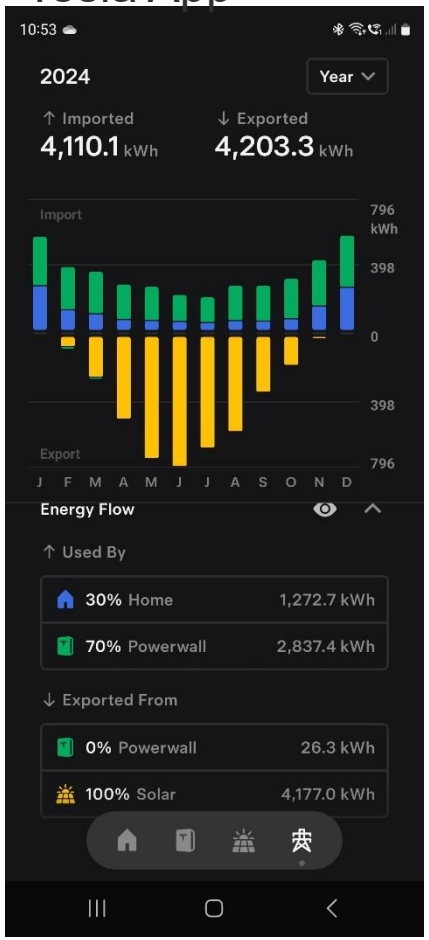
## Tinytag Loggers



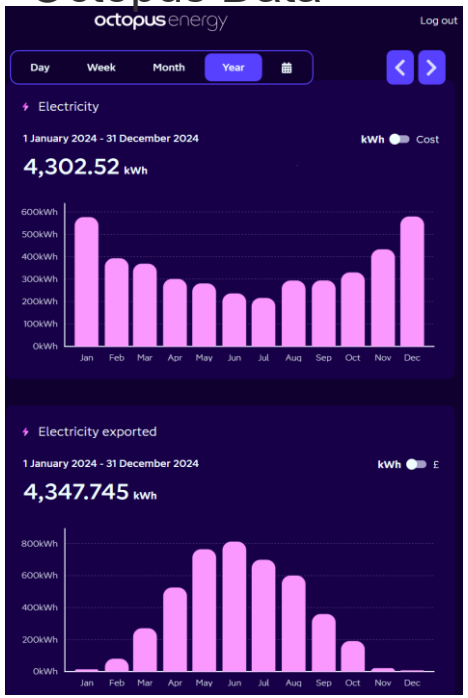

## MELCloud Data



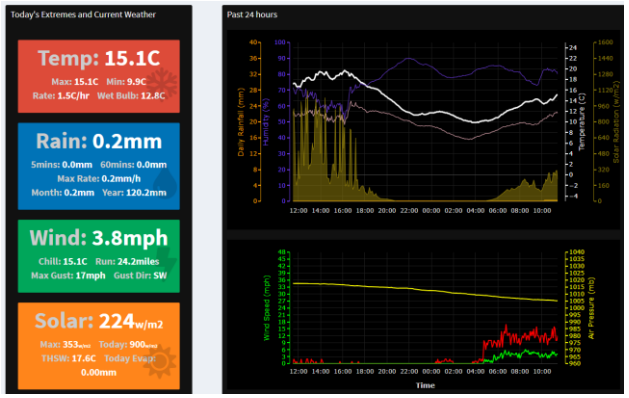

## Tesla App




## Octopus Data




## Nearby Weather Station



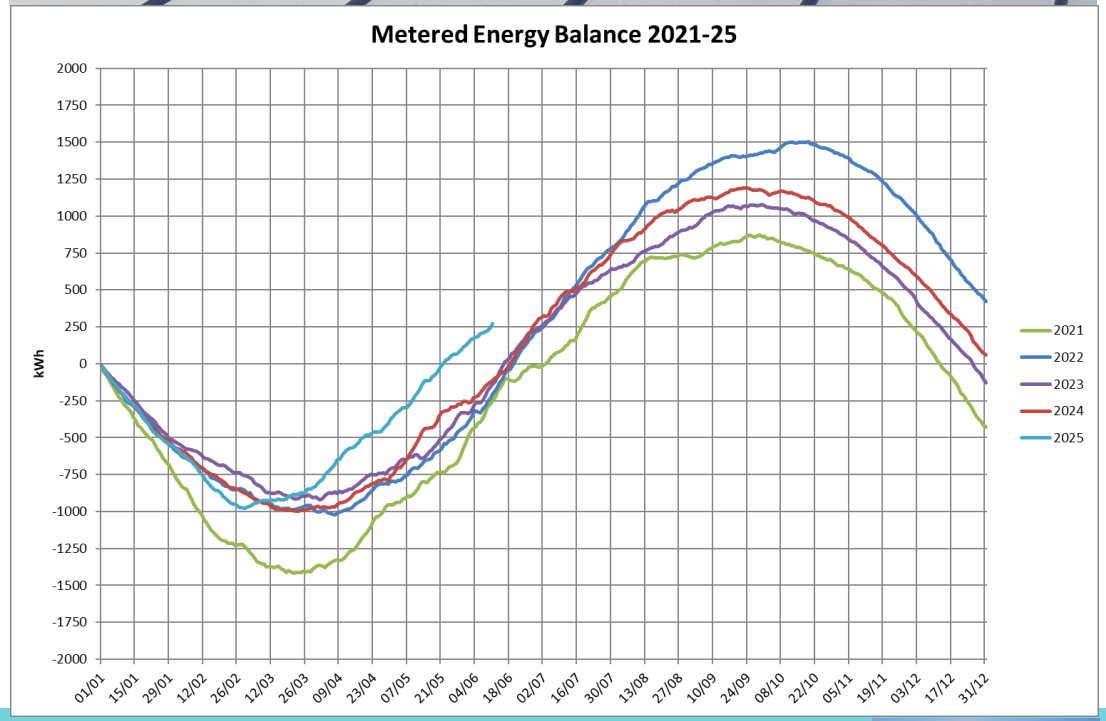



# Energy

| | Demand | Generation |
|---|---|---|
| PHPP | >22.5* | 30.4 |
| 2021 | 27.6# | 29.9 |
| 2022 | 26.7 | 31.4 |
| 2023 | 26.9 | 28.6 |
| 2024 | 25.1 | 27.3 |

Chart excludes battery losses
* data incomplete, figure a little low
# early heating issues

Positive balance possible because
Passivhaus construction
means that demand is low




**Energy demand** kWh/(m²·a) based on 230m² GIA

# Electricity

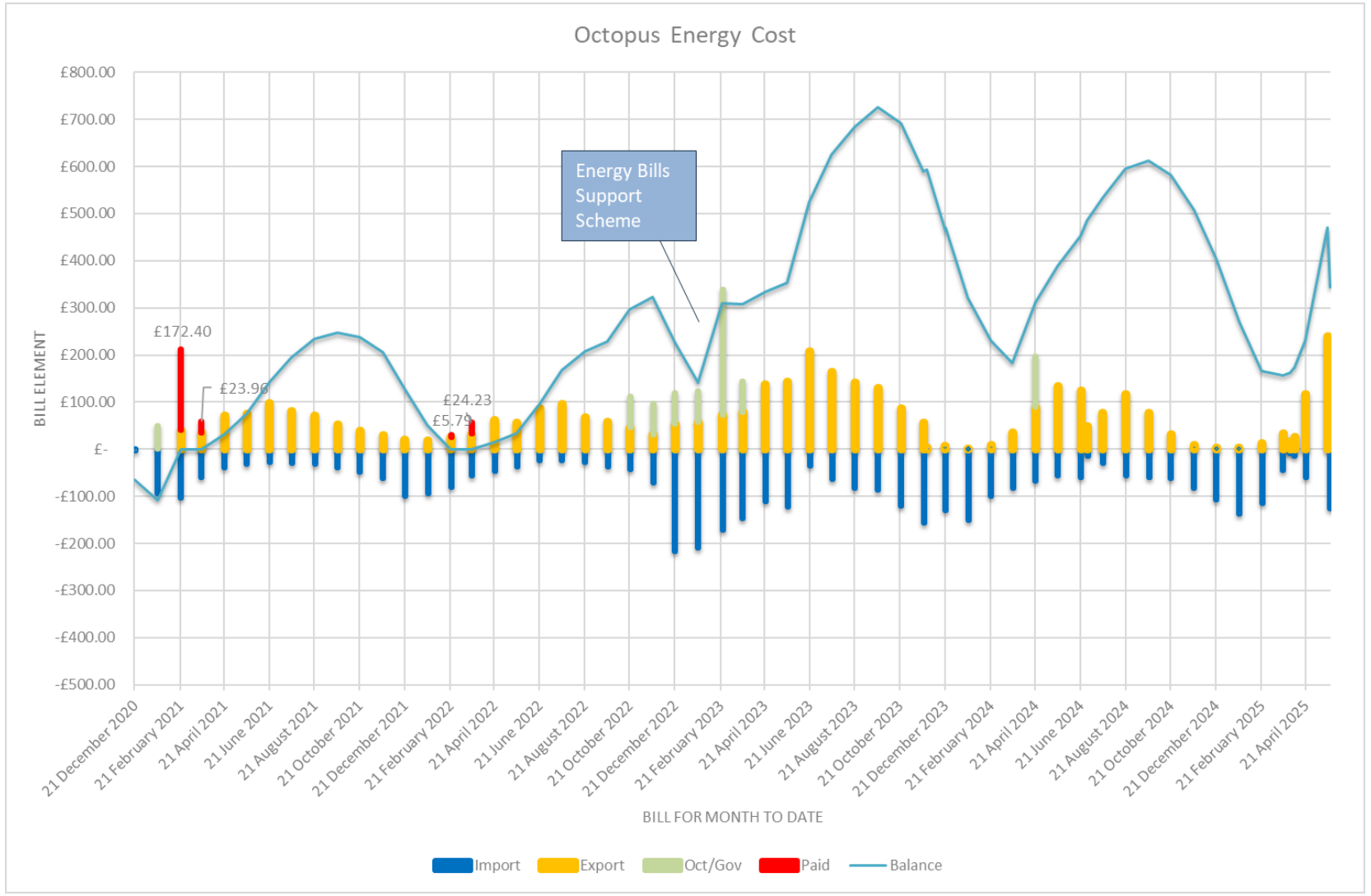
In 4.5 years:

| | |
|---|---|
| We've paid | £226, |
| Gov't | £600, |
| Balance > | £343 |

Over 2024 our balance fell £15/month

Tariff significant

Heating < £80 pa.



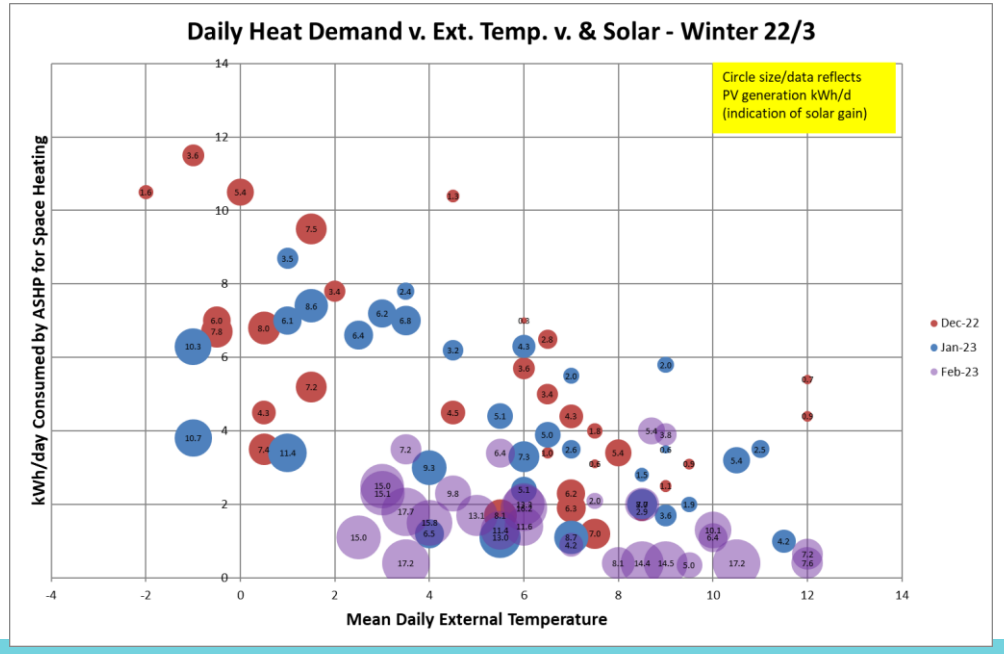


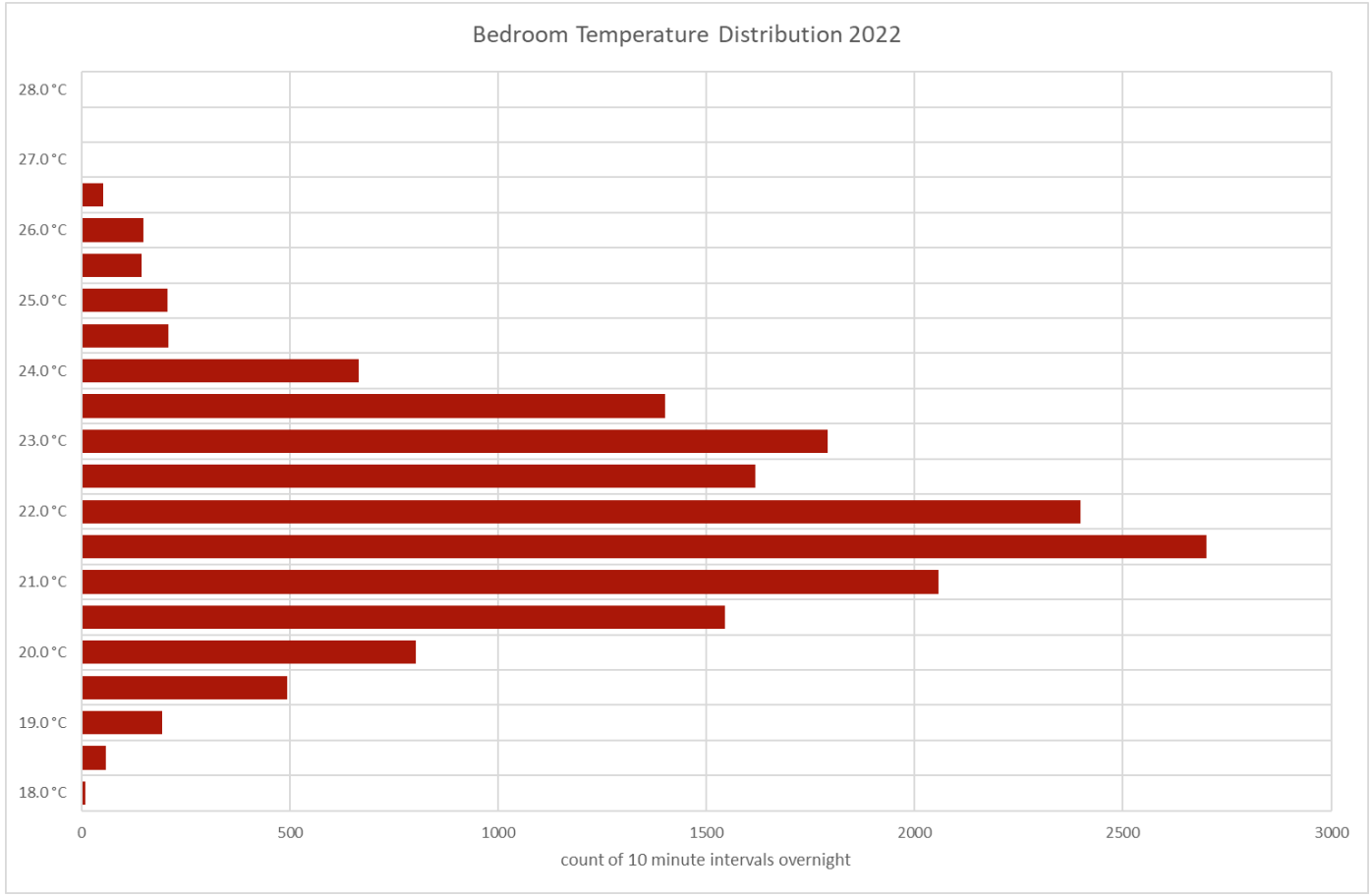

# Comfort: Temperature

comfortable throughout.

very rarely below 19°C

Infrequent overheating (>25°C)
2.3% in 2024.






# Summer comfort:

**% Overheating/year:**
**2.2% (from PHPP v9.6)**

Design:

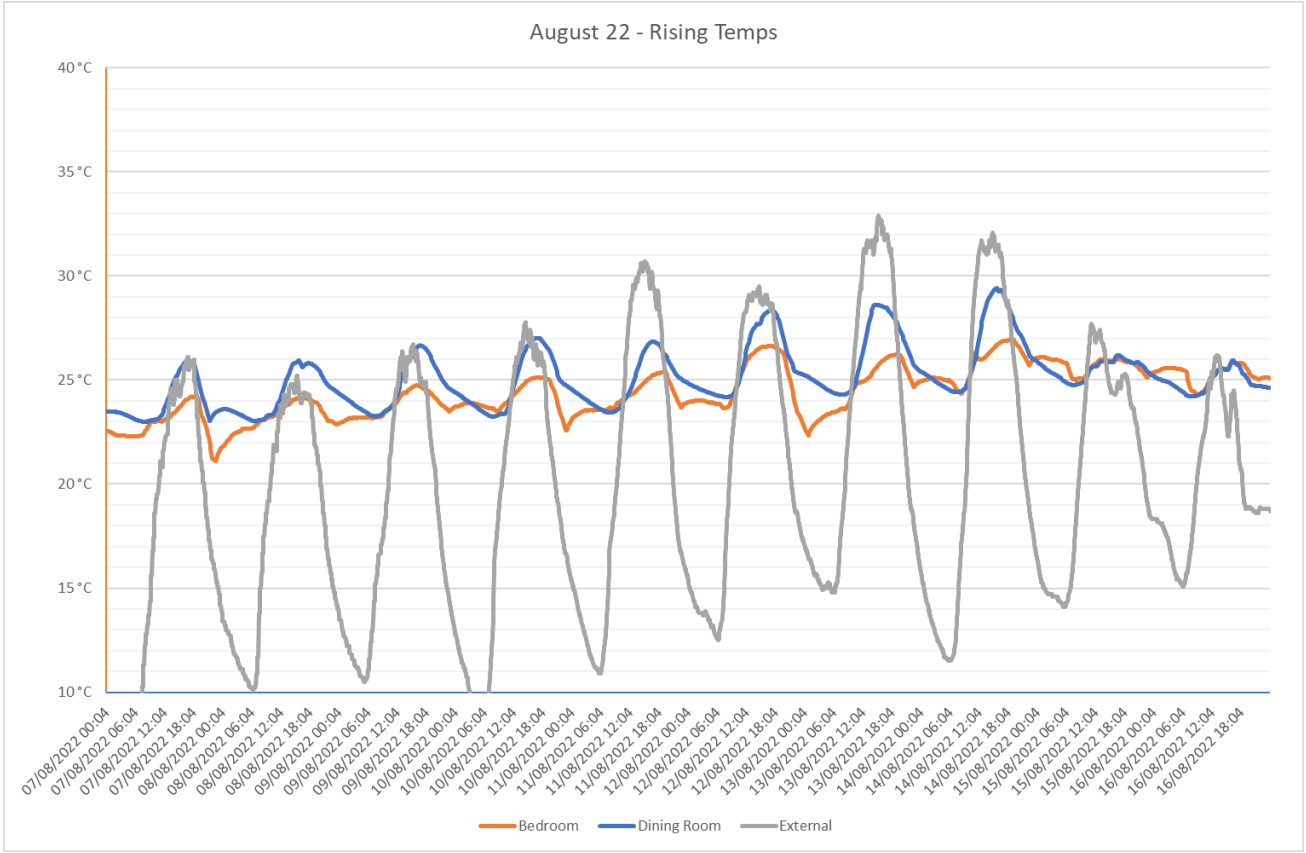
- High levels of insulation.
- Triple-glazed windows.
- Overhangs.
- MVHR:  which automatically enters bypass mode and ‘coolth’ recovery.
- Internal blinds and curtains.
- External temporary sails & parasol.



# Summer comfort in practice:

## Interventions:

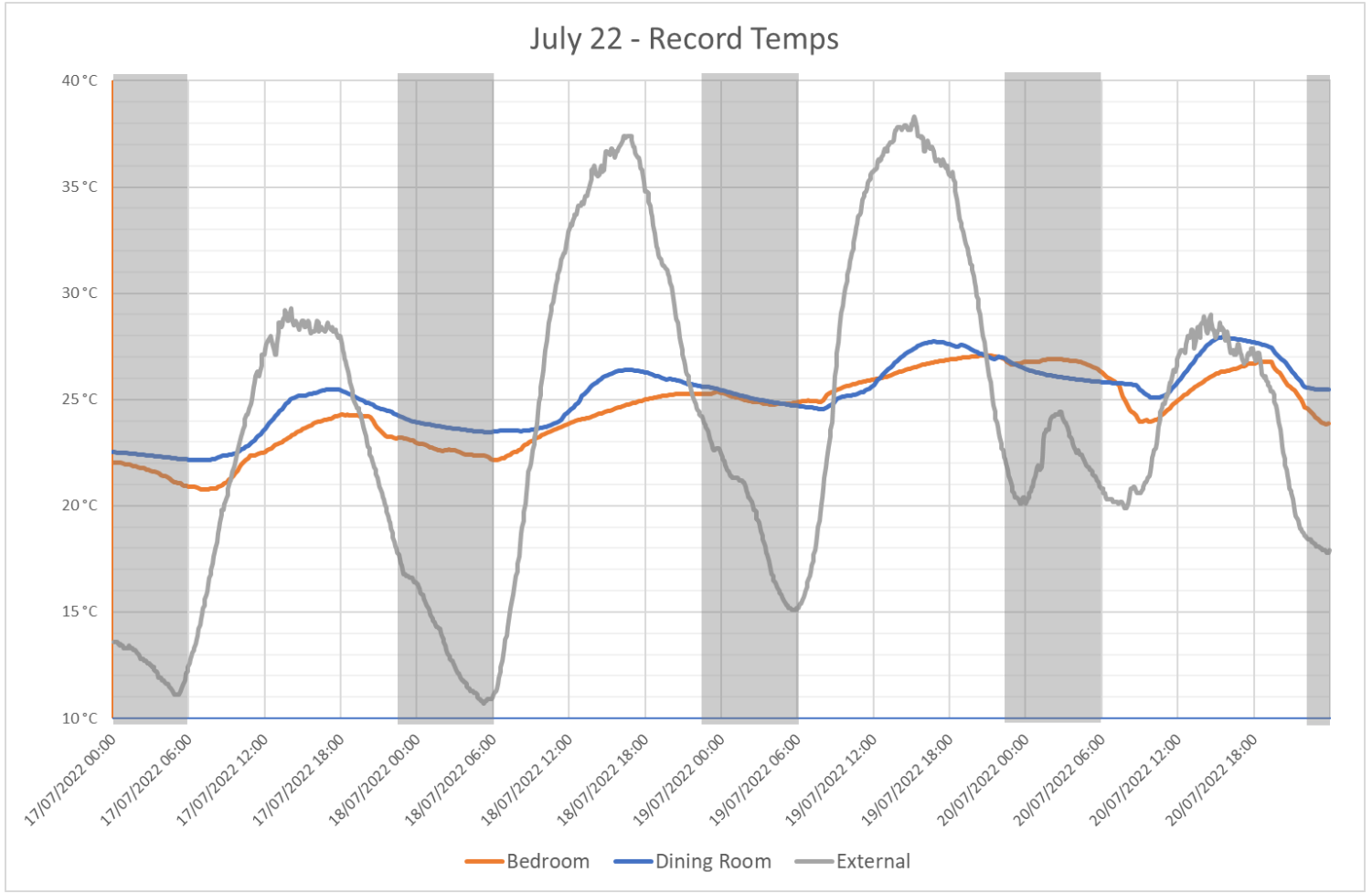
- Window opening fine: quiet rural location
- “Cool evening” forecast:
  - reduce the heat gains
  - When cooler outside throw open windows.
- “Hot evening” forecast:
  - take all possible measures to limit heat gains. close windows, blinds and curtains, put up the sail, and minimise warming activities.
  - Our home will then remain cool
  - Purge ventilate when possible.






# July 22 Record Temperatures

- Hot evenings were expected on 18th and 19th.
- Sought to keep the heat out.
- Outside 38°C  Inside 28°C.
- Late eve before cooler outside than in.
- Bedroom temperatures remained uncomfortably warm
  but given record temps...





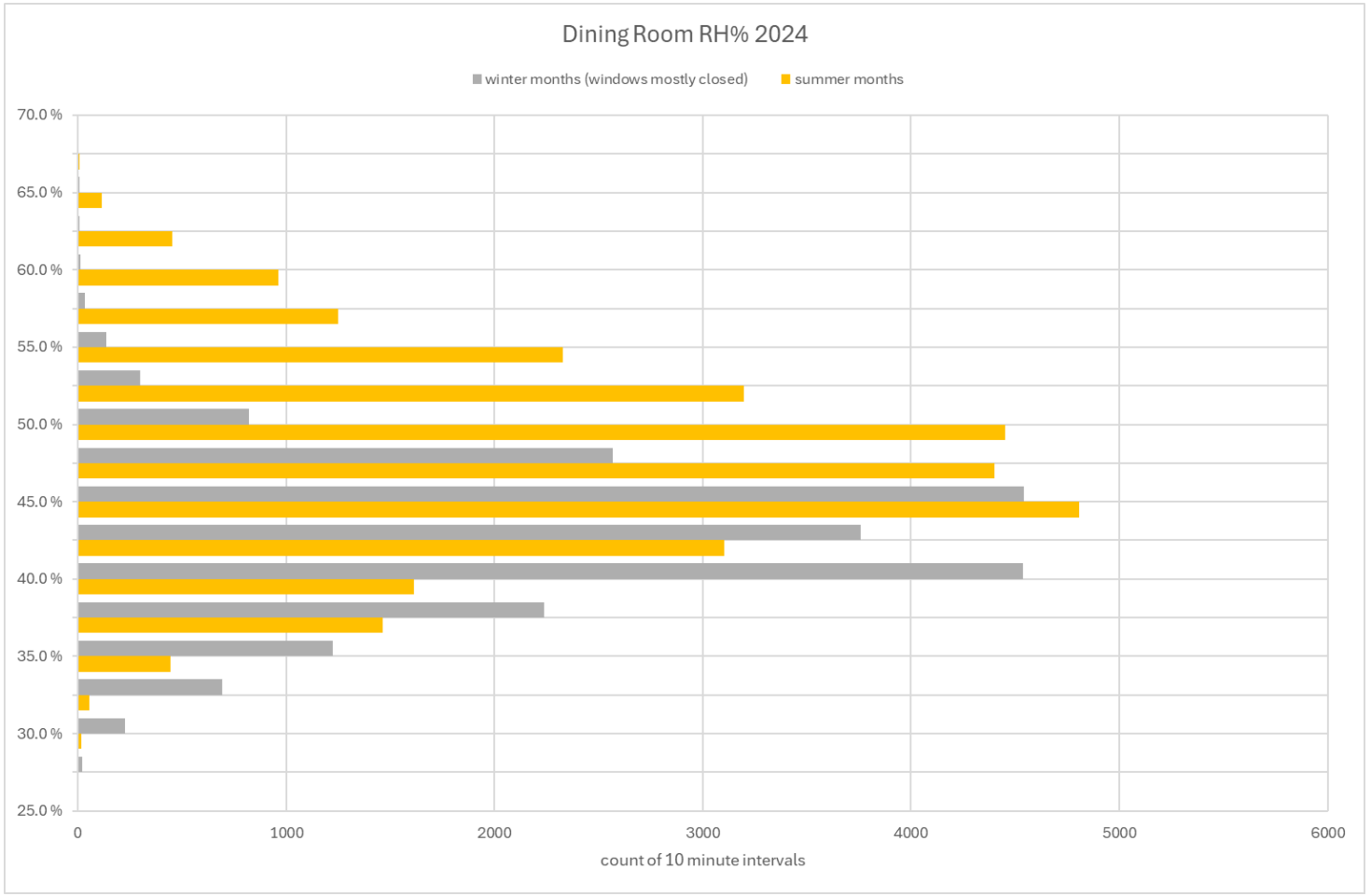

# Comfort: Humidity

Comfortable throughout.

2024 dining room was mostly between 37% and 56% RH.

Summer higher when windows open
Winter lower.

Adding house plants.

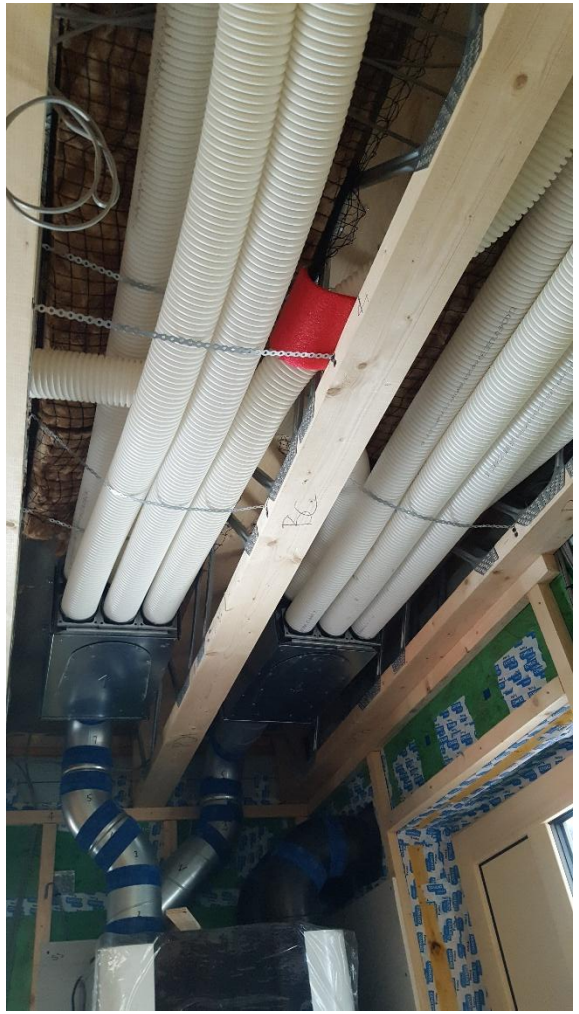





# Comfort: air quality

Ventilation system:

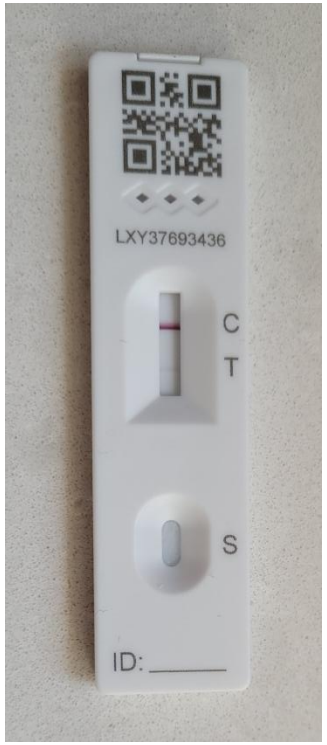
- Designed by Alan Clarke
- Supplied and commissioned by 21°(GBS)
- Regular inspection, cleaning and replacement of the filters and cleaning of terminals, attenuators and fans.





# Costs:

- £2,374 /m$^2$ GIA
- More than we had budgeted
- PH element: Insulation, windows etc. a factor
- Covid cost us extra – rates, prices, delays
- Choices of internal and external finishes, fixtures and fittings
- PV and battery






# Embodied carbon:

- Aspiration: use natural materials:
  - timber frame, cellulose insulation
  - avoid structural steel
- Material choices:
  - Aluminium and Zinc: poor upfront but reclaimable. Longevity and low maintenance.
  - ASHP: no low GWP devices available.
  - Ash staircase and bamboo flooring (no fitted carpets)
- Post-build calculation unreliable:
  - EPDs for elements such as the ASHP were not available
  - where our SunPower PV panels had been made.
  - Approach inherently low carbon.
  - Other MBC build and research with Lincoln University low values.



# Industry & Community Impacts

- We delivered the build in good time
  - through a pandemic
  - subsequent builds would be easier
- Most elements were straightforward.
- delivering an ‘almost Passivhaus’ can be done
- An exemplar for the local community.
- Visits - 4 couples have taken inspiration for their own builds
- building and living in the property, has taught many lessons applied on other timber frame projects.
- share the outcomes of the project
  - on LinkedIn
  - these Awards.

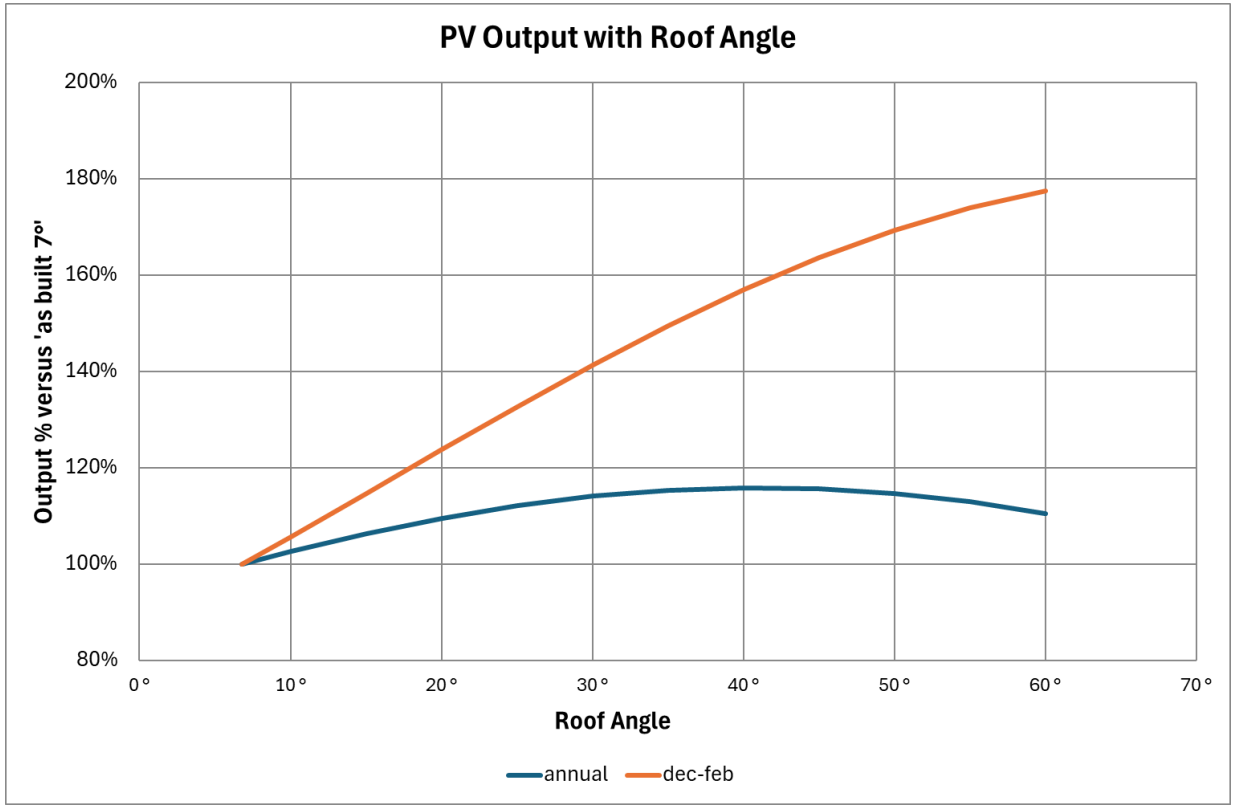
# Applicability at scale

- The off-site timber frame
  - low carbon construction
  - Energy efficient
  - at pace
  - should be used at scale.
- the design could easily
  - become semi-detached houses
  - with a little more modification, a terrace.



# Do differently

- Greater attention to embodied carbon
- Review options for heating and hot water
  - ASHP is costly for how little it is used
- Slightly smaller windows
- More modest.
- Consider a different roof shape, largely for the PV:
  - Planning requirement;
    - little impact on annual PV output,
    - more significant in winter
  - Access for cleaning is difficult
- More PV






# Rear garden early morning

Notes:

- Nature friendly
- Native hedging
- Retained grass
- Poles for sails & washing line