#UKPHC18

@johnpratley



# Whole-House Retrofit

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# Passivhaus Retrofit Experience

- Parkview, Thamesmead, London, 2013-2015
  (as partner at sustainableBYdesign LLP)
- 18 social housing maisonettes within 5-storey pre-cast concrete slab-block
- Gallions Housing Association
- Gumpp & Maier Contractors
- Cost £2.7m, approx. £95k per home
- Part EU funded E2ReBuild programme – innovation in technology & construction

# Passivhaus Retrofit Experience





# Passivhaus Retrofit Experience

- Wilmcote House, Portsmouth, 2014-2018
- 107 social housing maisonettes within three 11-storey pre-cast concrete panel blocks
- Portsmouth City Council
- Keepmoat Regeneration (now Engie) Contractors
- Cost £13m, approx. £100k per home (at £920/m2)
- Part EU funded, EuroPHit project, step-by-step approach to EnerPHit

# Passivhaus Retrofit Experience





# Why Retrofit?

- Cold and damp internal living conditions created by 1960's design & construction
- All-electric heating at high costs – creating fuel poverty
- Maintenance costs driven by condensation & water ingress
- Concrete repairs to existing panels if left exposed to weather
- Security problems open deck, balcony arrangement
- Decant & demolition considered too expensive & disruptive to residents

# Why Retrofit?

- 2016 UK Government policy for Regeneration of Council Estates
- “Regeneration and intensification of housing estates”
- Knocking down the existing housing stock and starting again
- Alternative approach to housing estate regeneration
- Focus on refurbishing existing buildings
- Retrofit upgrading to modern, energy efficient and comfort standards
- Allowing residents to stay in their homes during the refurbishment process

# Deep, Whole-House Retrofit Strategy

- Fabric First, super-insulated thermal and weather-proofing over-cladding concept
- Improved Air-tightness
- Efficient mechanical ventilation with heat recovery (MVHR)
- Integrated Passivhaus whole-house approach incorporating thermal performance, air-tightness & ventilation
- Enclosed secure balconies and walkways
- Retained, reduced electric heating
- Resident Benefits: extra space, very low bills, health & comfort
- Improved visual appearance, more 'looked-after'

# Why Passivhaus?

- Passivhaus Build Quality: extending the life of an existing building
- Integrated EnerPHit approach: better thermal performance, air-tightness & ventilation
- Resident Benefits: very low energy bills, improved health & comfort
- Business Case: retrofit build cost £920/m2, compare with new-build housing to similar density & quality
- On-Site Regeneration: no resident community displacement caused by decant and demolition (verses resident disruption caused by on-site construction)

# EnergieSprong Retrofit Pilot

- Mundon Road, Maldon, Essex, 2017-2019
- 5 social housing semi-D houses
- Moat Housing Association
- Engie Contractors (& Energy Suppliers)
- Cost approx. £75k per home
- Part EU funded, E=0 project supporting EnergieSprong pilots

# What is EnergieSprong?

EnergieSprong is an approach to housing regeneration and refurbishment using the following principles for whole-house retrofit **to create desirable, warm, affordable & healthy homes for life**:-

- **ASSURED QUALITY**

Net-zero energy homes with long performance warranties

- **NON-INTRUSIVE**

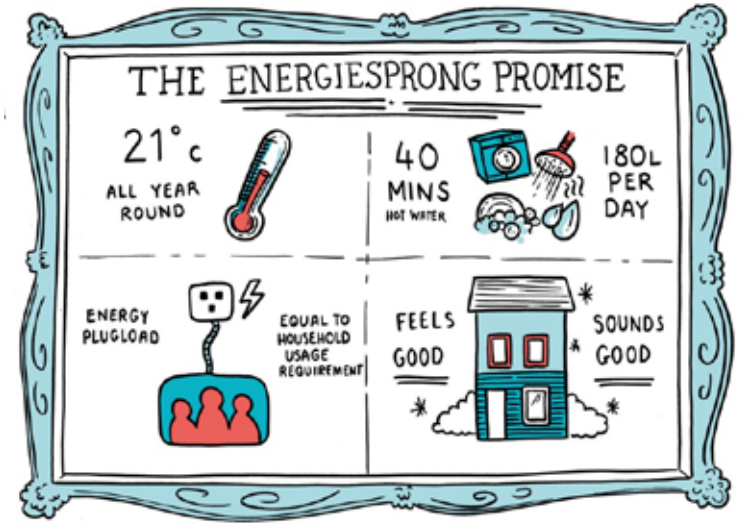
Refurbishment within a limited time on site

- **AFFORDABLE**

Financeable from energy cost and maintenance savings

- **LOOK & FEEL**

Attractive and comfortable homes



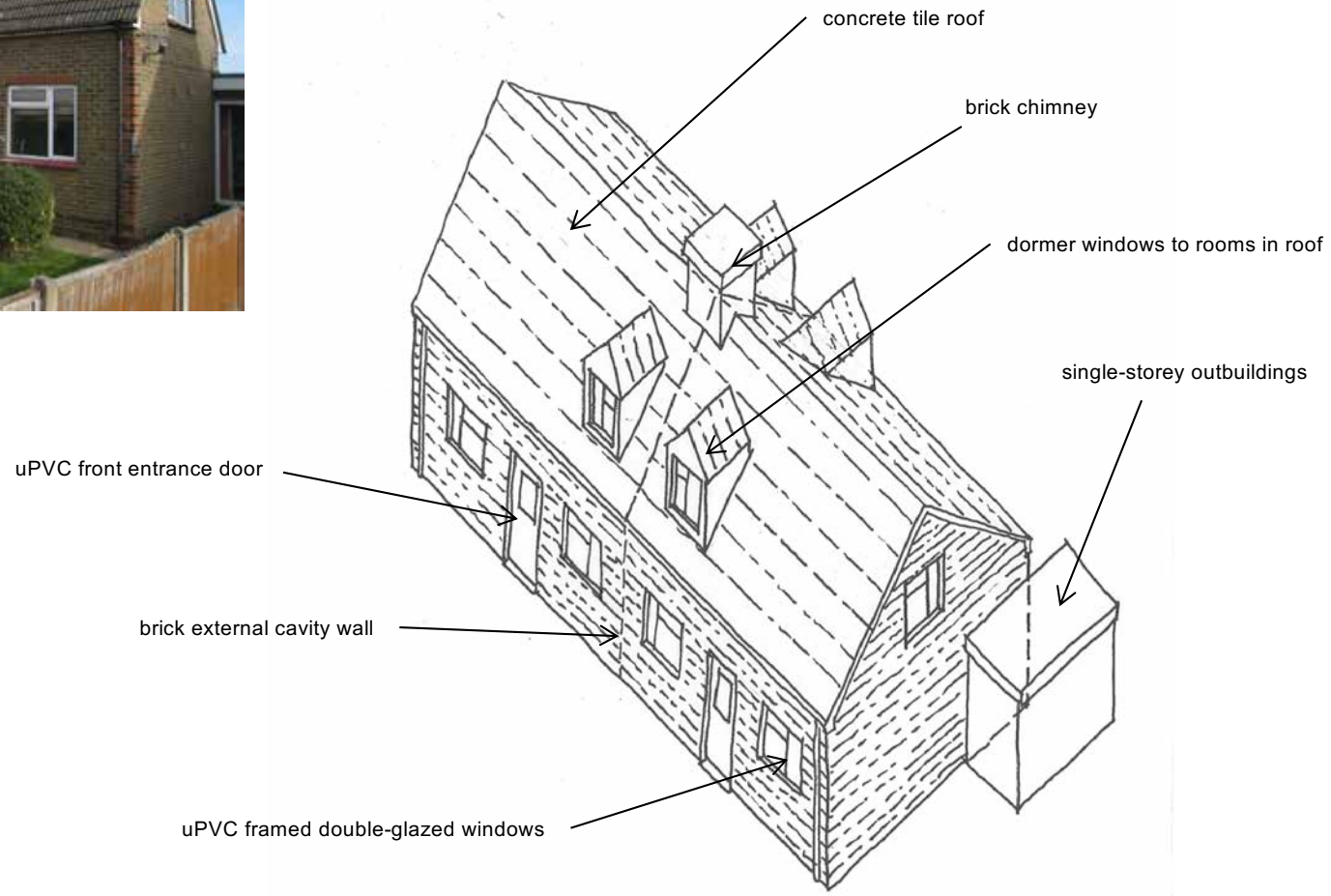
# Moat Homes, Social Housing Provider

- Moat is keen to see how the EnergieSprong concept links in with their own strategy to develop environmentally friendly homes that prevent fuel poverty for their residents, reduce carbon footprints and wish to test innovative solutions that result in significant on-site energy generation which can then be replicated elsewhere to provide heat, light and hot water to homes using renewable sources of energy.

- Moat is also looking to enhance the appearance and comfort of their homes as they want their customers to love where they live. It is equally important that their homes are affordable to run and are able to display tangible benefits to the health and wellbeing of their residents.

# Existing House

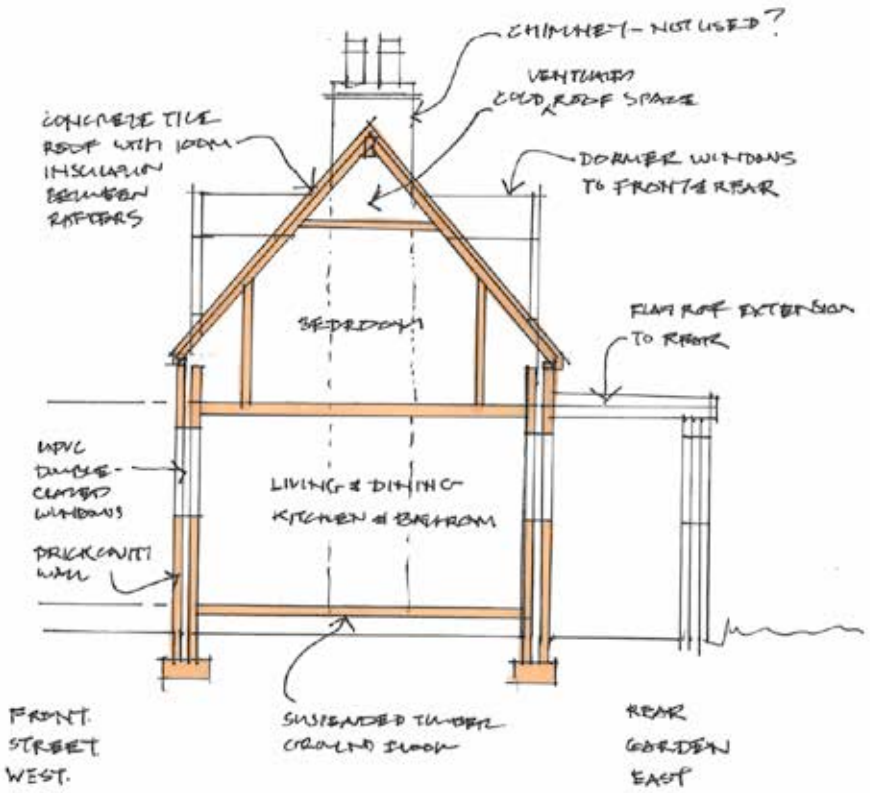
External Appearance



# Before & After Retrofit

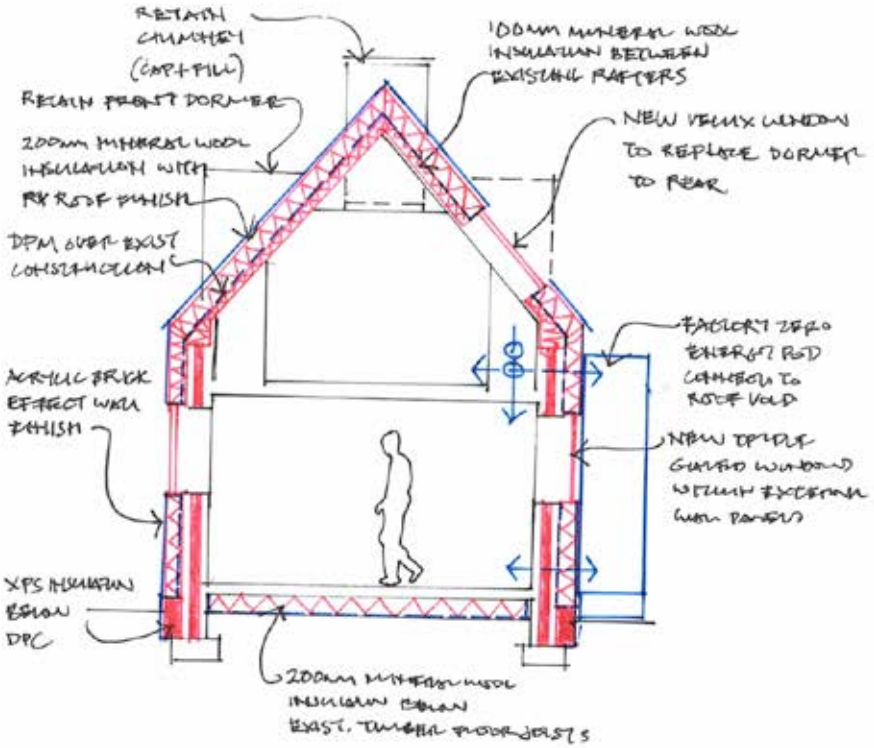
Before Retrofit:

- Poor insulation
- Draughty
- Expensive to heat
- Difficult to control ventilation




After Retrofit:

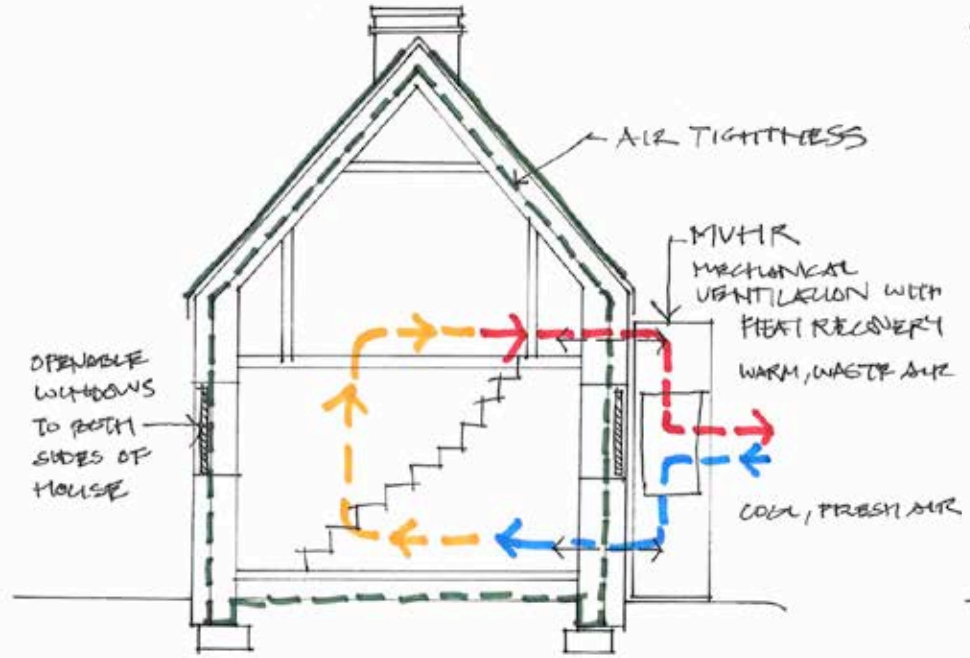
- Insulated over-cladding
- Air-tight membrane
- Reduced heating costs
- Consistent controllable ventilation



# Ventilation & Energy

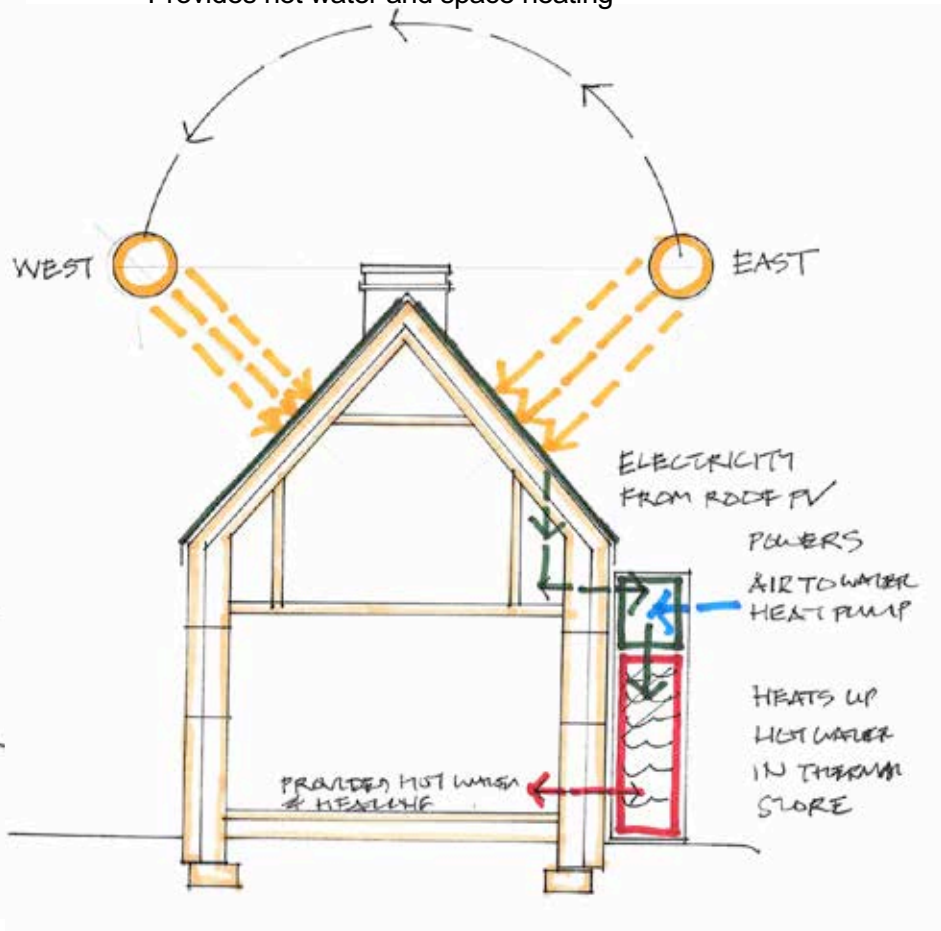
Whole House Ventilation:

- New Air-tight building fabric - less draughts
- Continuous background 'trickle' ventilation
- Energy efficient MVHR – fresh air in, waste air out
- Openable windows – when extra ventilation is required




Net Zero Energy:

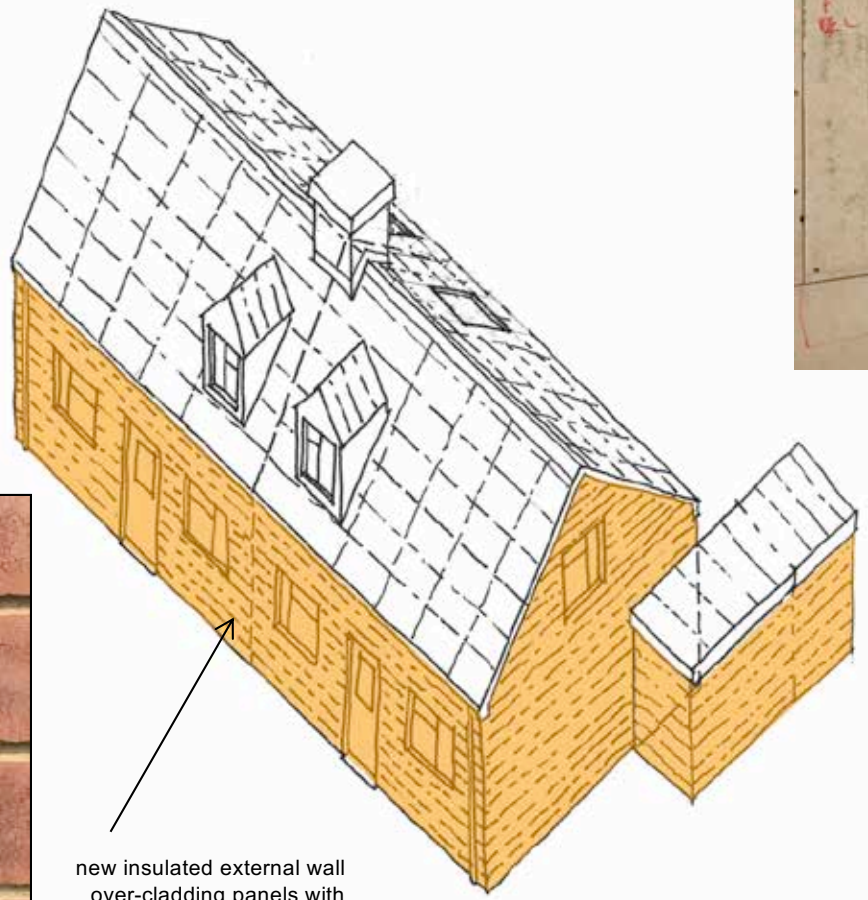
- Home generates it's own renewable energy
- Solar PV panels on the roof generate electricity
- Electric powered Air Source Heat Pump
- Provides hot water and space heating



# External Wall

Mauer External Wall System

Mauer system build-up, brick effect detail



new insulated external wall over-cladding panels with lightweight, brick effect finish

Mauer system fixing back to existing brick wall

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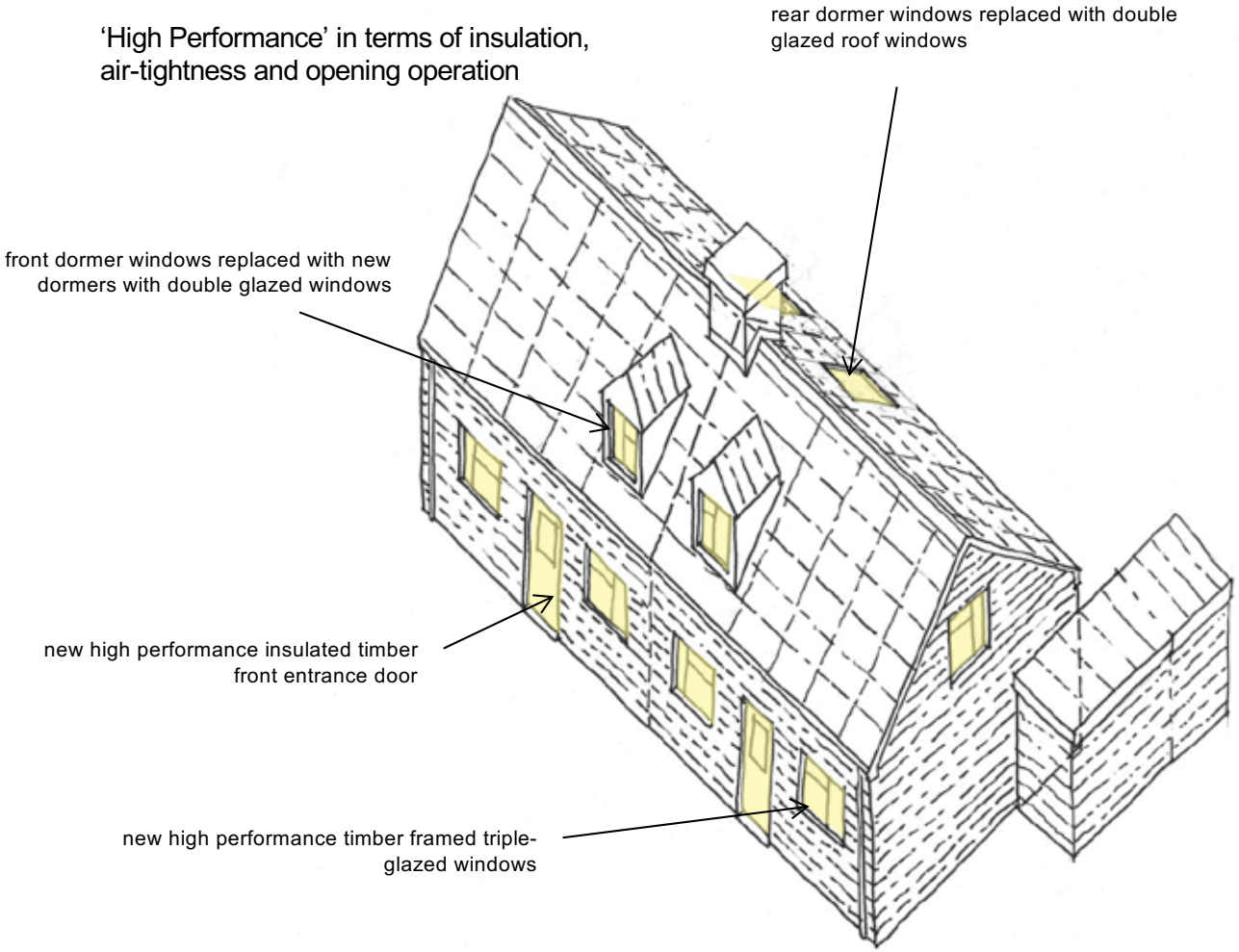
# Windows & Doors

- High Performance Triple-glazed Windows
- High Performance Insulated Doors

'High Performance' in terms of insulation, air-tightness and opening operation

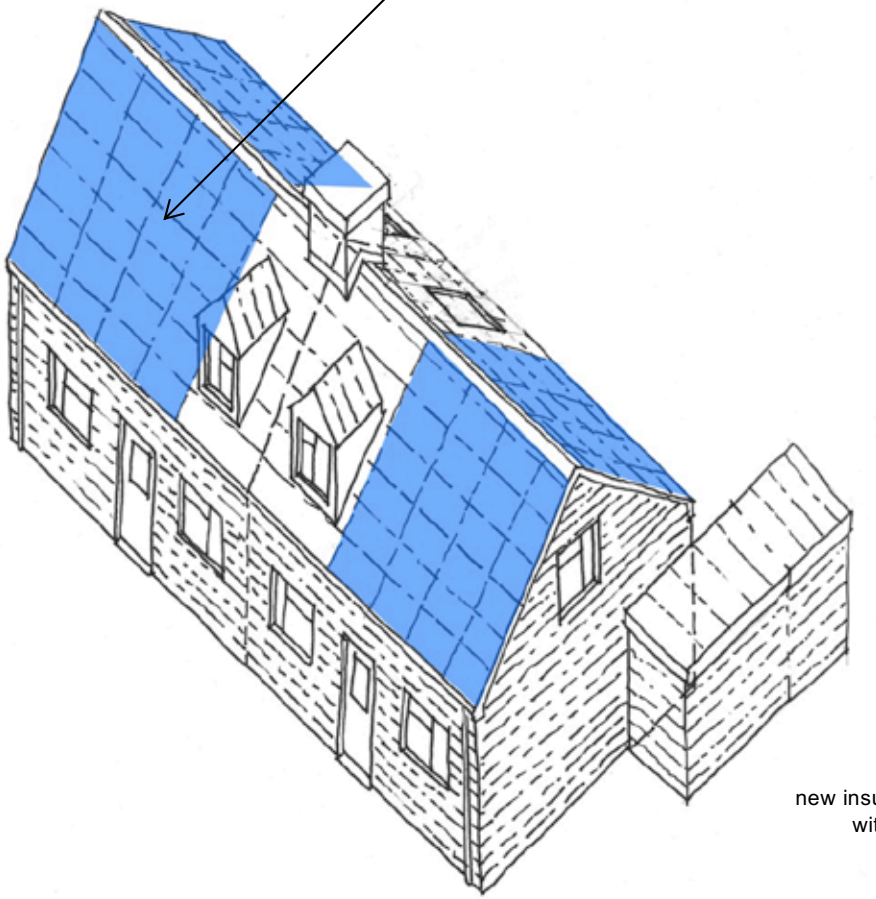



Window & Doors installed in Thamesmead Retrofit

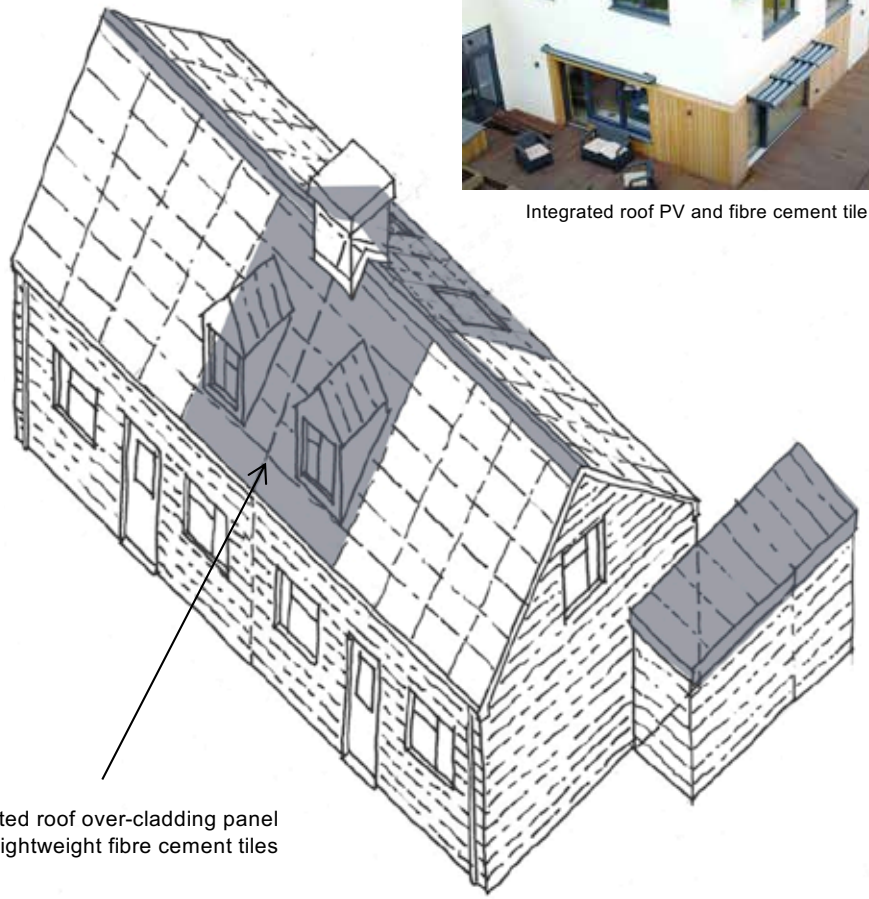
Window Sample

# Roof

- PV Solar Panels
- Fibre Cement Roof Tiles:



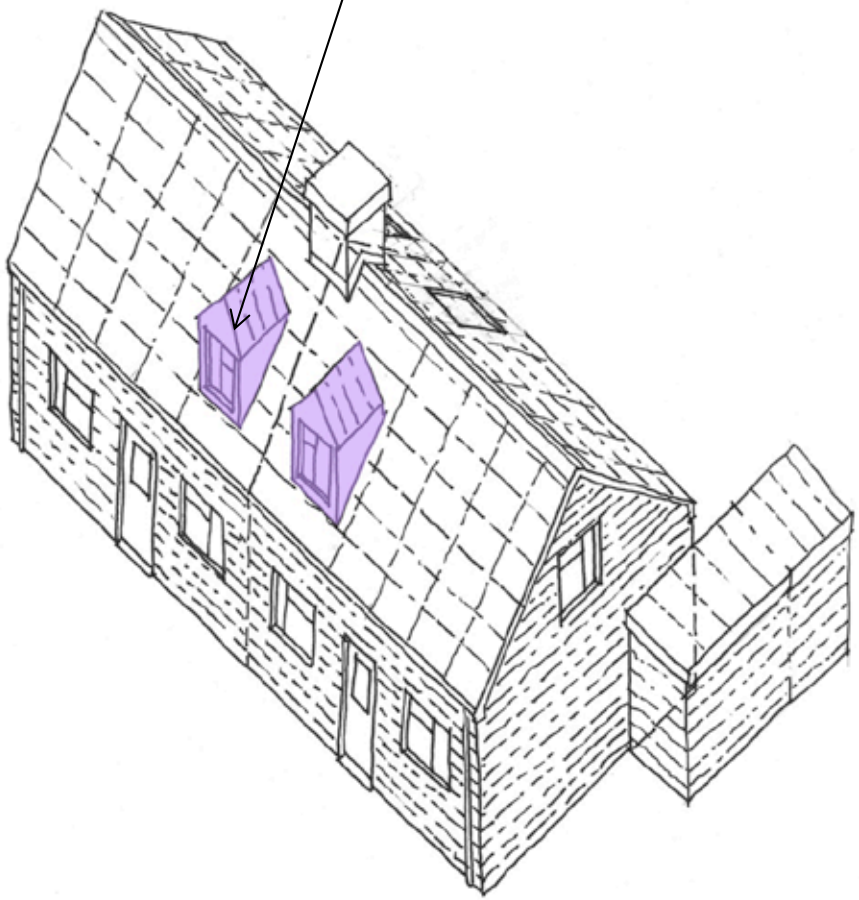

Integrated roof PV and fibre cement tile examples



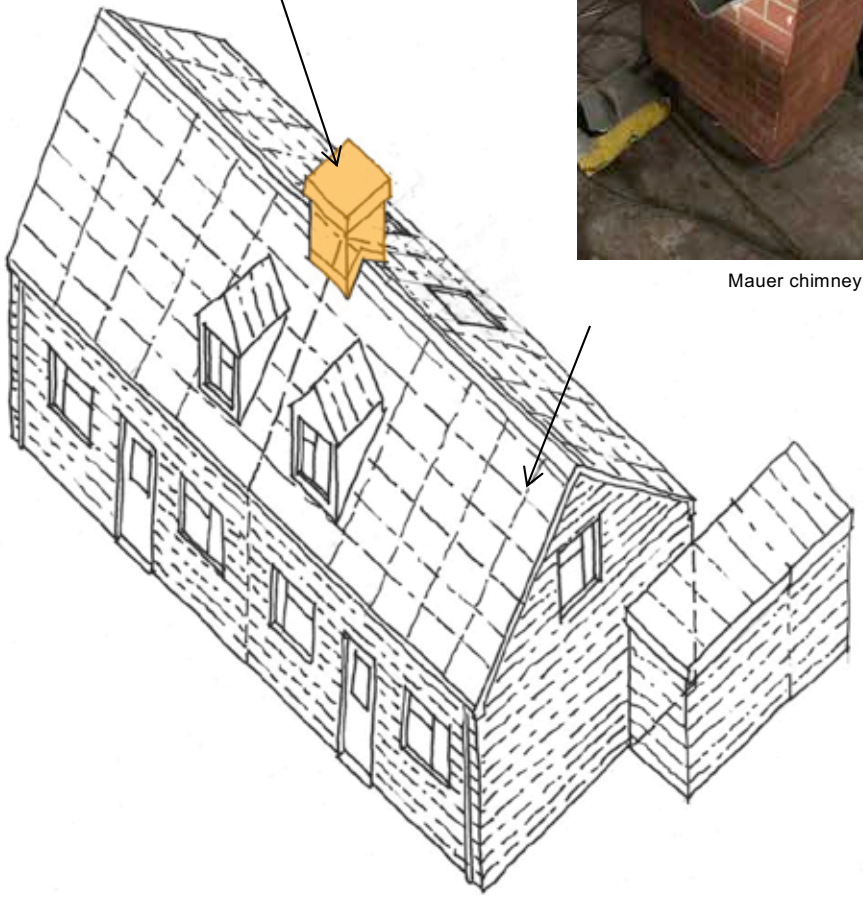
# Dormers & Chimneys

Pre-formed dormers and retained, sealed chimney

front dormer windows replaced with new dormers with double glazed windows



redundant brick chimney retained, capped and sealed

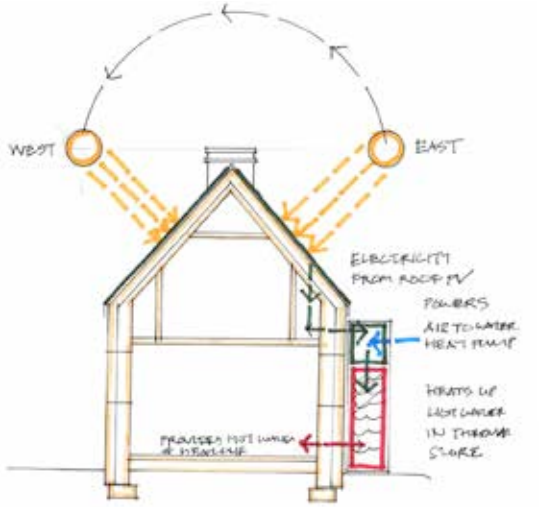


Mauer chimney panel

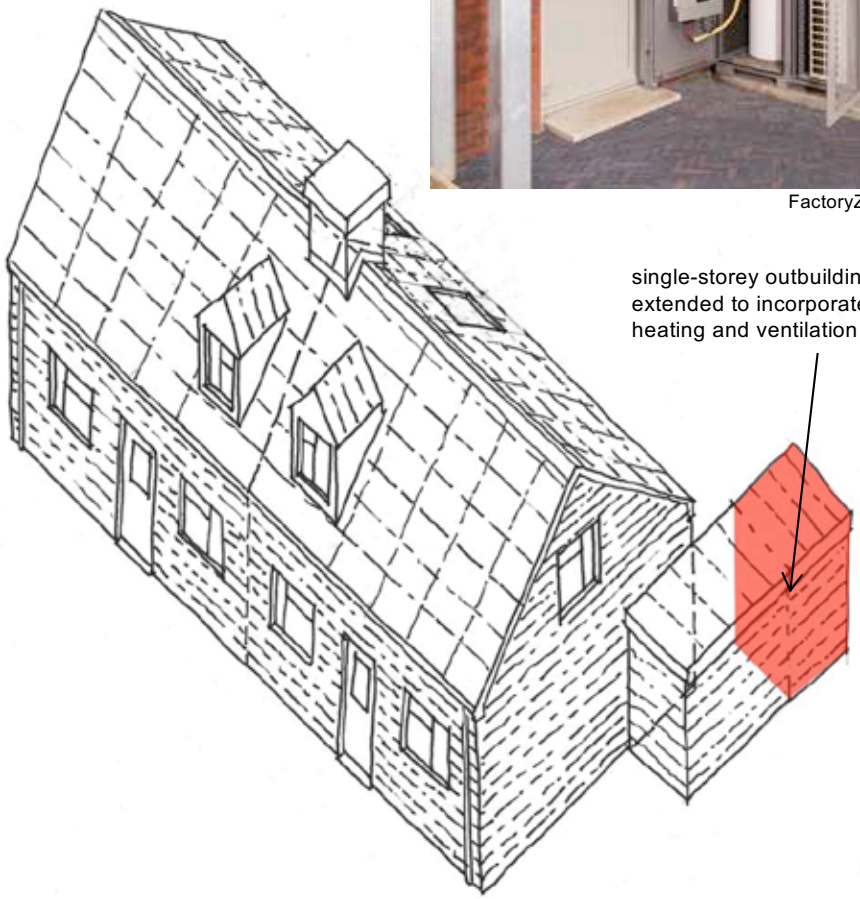
# Energy Pod

FactoryZero Energy Pod:

- PV Electrical Converter
- Air-to-Water Heat Pump
- Hot Water Storage Cylinder
- MVHR unit




FactoryZero Energy Pod installation



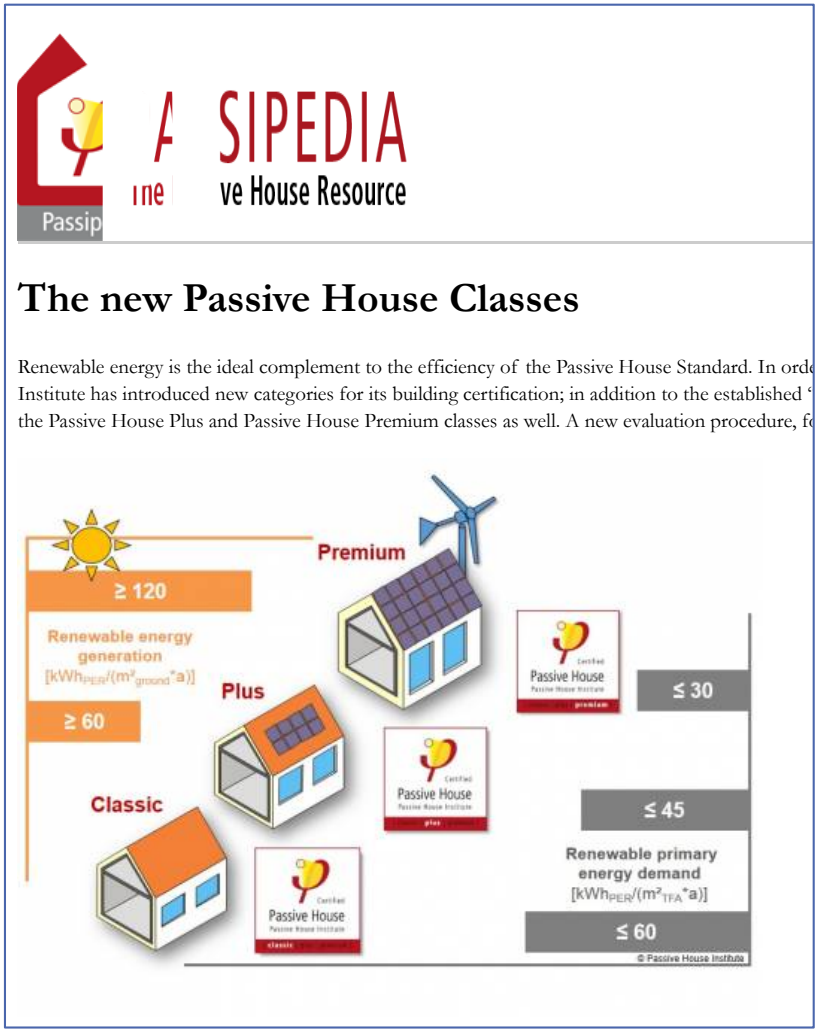
single-storey outbuilding re-clad and extended to incorporate new hot water, heating and ventilation unit

# Front Street View

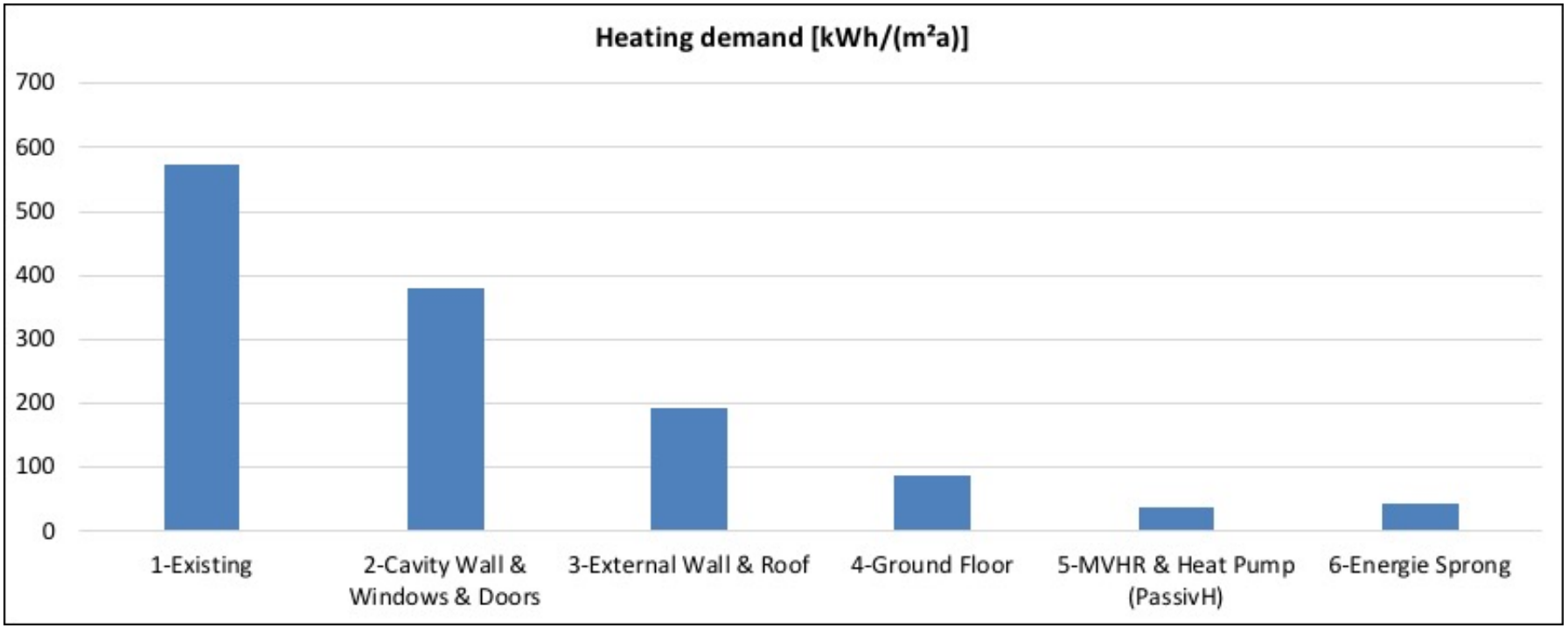
# Rear Garden View

# Passivhaus Energy Modelling

- Although not required by the EnergieSprong approach.
- Using PHPP modelling as a design tool to ‘prove’ the energy and carbon savings from the whole-house retrofit proposals.
- Passivhaus Classes allow the calculation of the energy savings and renewable energy generated for each home.

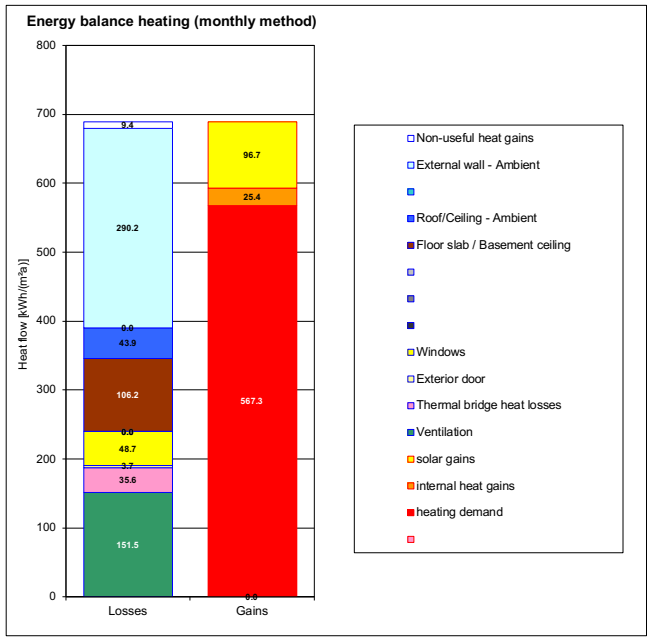


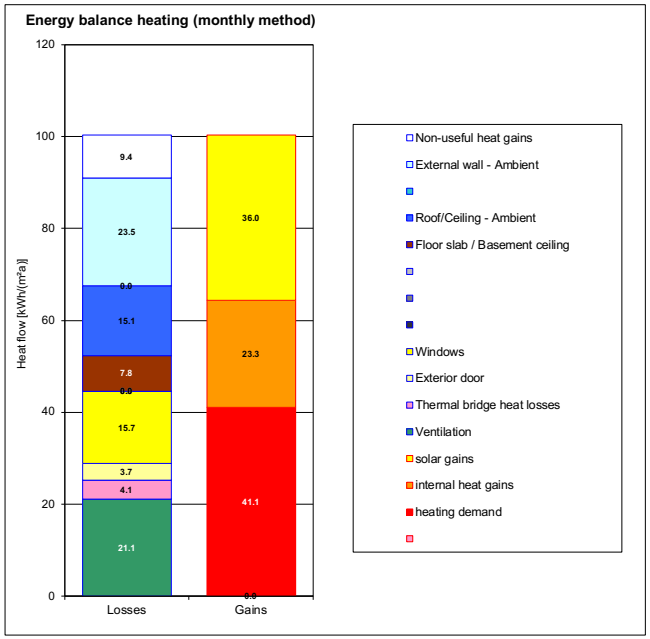
# Passivhaus Variants – Step By Step




- Aim for Passivhaus Plus and EnerPHit standard first.
- EnergieSprong target = net-zero energy and performance back-stops, with 30 year monitoring as proof of performance.

# Energy Balance: Before & After



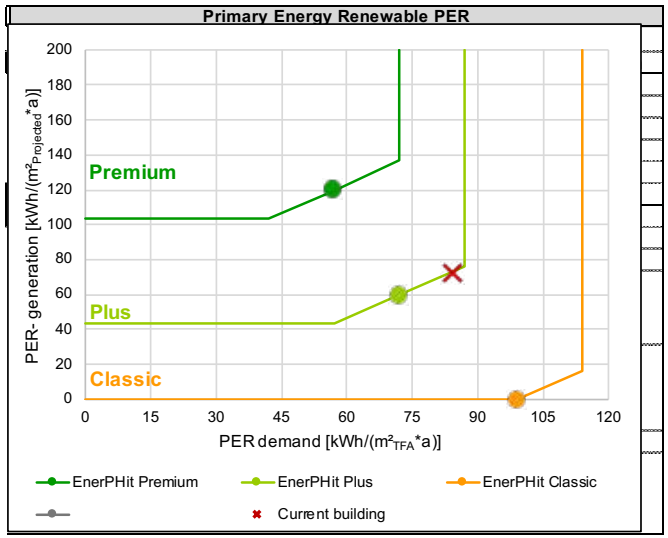

- Space heating demand reduces from:
- 567 kWh/m2/yr Before Retrofit, to
- 41 kWh/m2/yr After Retrofit
- 33,300 kWh energy saving per year!

- Current Gas + Electricity Bill = £1,490/yr
- New Engie Electricity Bill £450/yr + New Engie Energy Plan £360/yr = £810/yr
- Resident Saving = £680/yr
- (If current electric only = £5,485/yr, resident saves £4,675)

# Net Zero Energy/Carbon

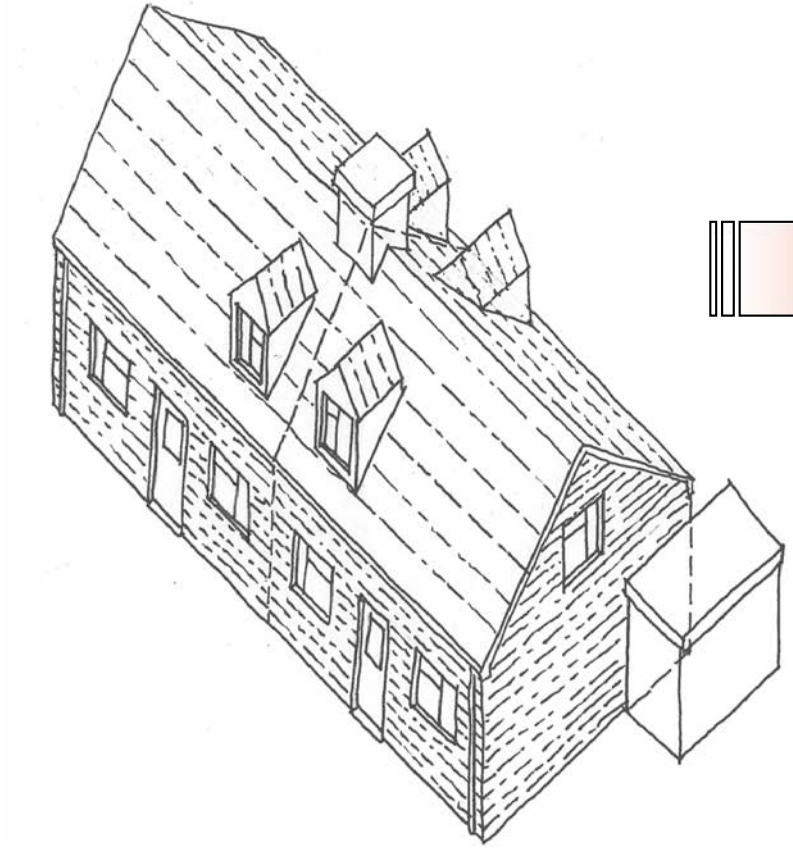
| Summary<br><br>Though, from the scientific point of view, not entirely correct, different energy carriers will be added together here. This is done to meet the criteria of other energy standards. | Final energy<br><br>MWh/a | PER specific value<br><br>MWh/a | PE value<br><br>1-PE factors (non-renewable) PHI Certification<br>MWh/a | CO2eq emissions<br><br>1-CO2 factors GEMIS (Germany)<br>kg/a | $CO_2$eq substitution balance<br><br>1-CO2 factors GEMIS (Germany)<br>kg/a |
|---|---|---|---|---|---|
| **Demand** | **3.9** | **5.3** | 11.85 | 2053 | 2053 |
| **Generation** | **-4.1** | **-4.1** | 0.00 | 532 | -1646 |
| **Demand, cumulative generation (annual balance)** | -0.24 | 1.17 | 11.85 | 2585 | 406 |
| **Demand w/o household electricity** | **2.9** | **4.0** | 8.91 | 1544 | 1544 |
| **Demand w/o household electricity, cum. generation** | -1.19 | -0.08 | 8.91 | 2076 | -103 |

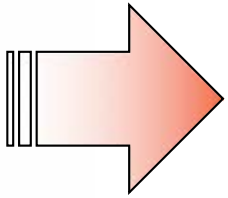
- Final Energy/Carbon Equation
- Passivhaus Primary Energy Renewable (PER)
- Net Zero Energy/CO2 emissions (in use)
- Passivhaus vs EnergieSprong recalibration



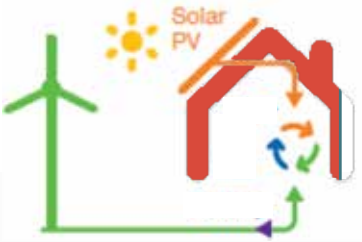
# EnergieSprong = Energy Leap

Existing House





EnergieSprong House

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## Thank you…

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