An EnerPHit Certified Retrofit

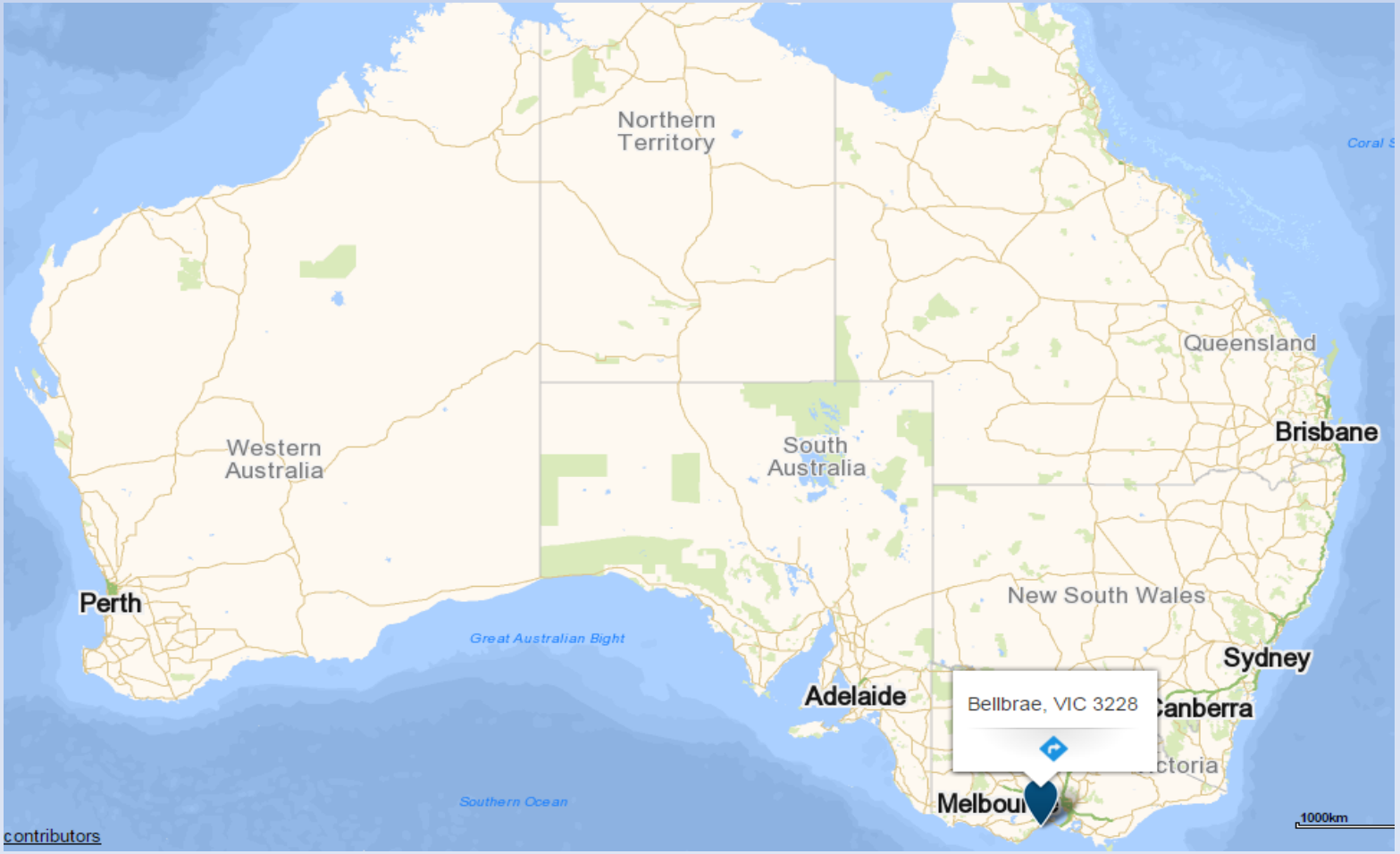
Joel Seagren

FANTECH Intelligent Ventilation

AphiProjects

Images courtesy of Dale Roberts & Phil Hines

Project Location



Bellbrae Project

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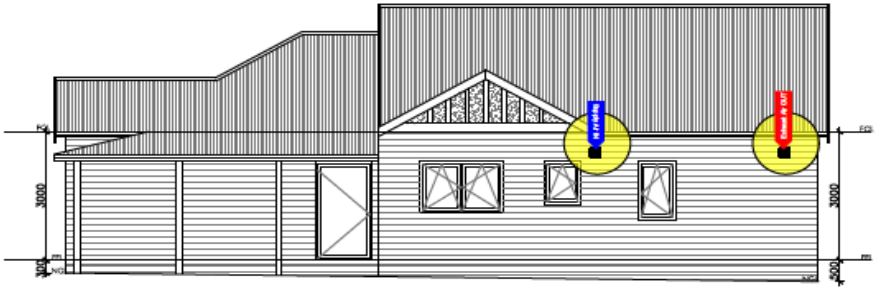
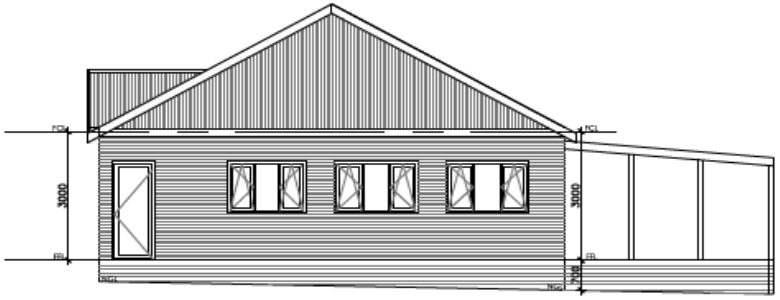


South Elevation

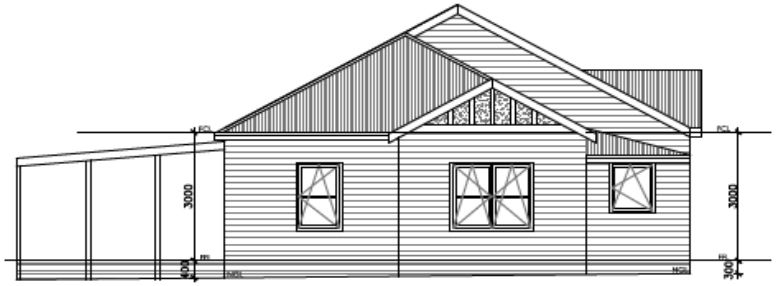


East Elevation

linea weatherboards

corrugated cladding

North Elevation



West Elevation

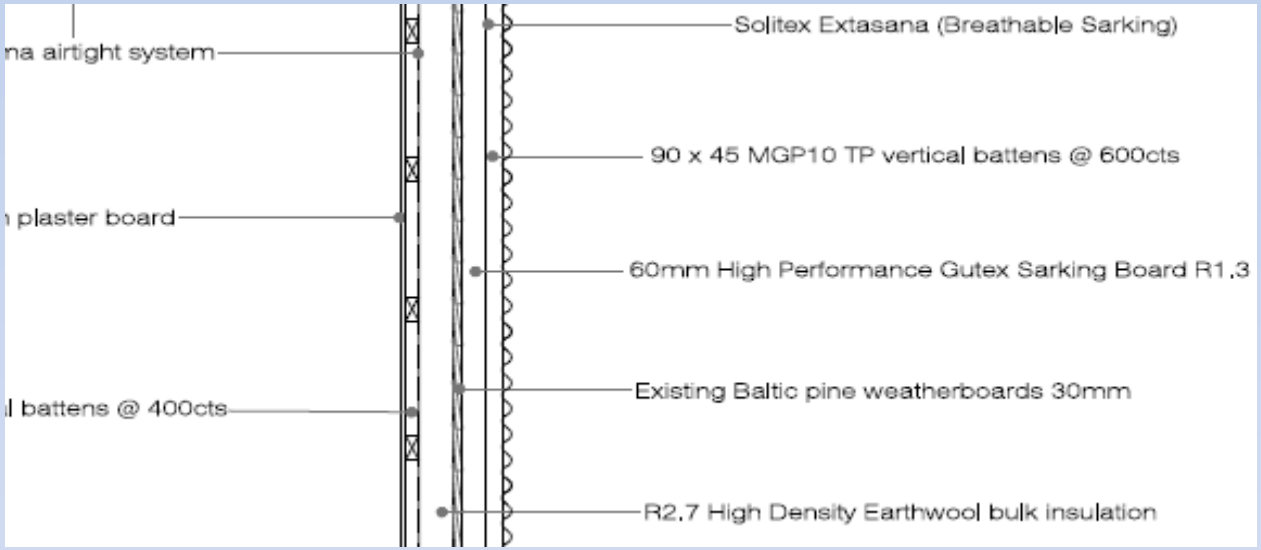
Decision Process

- New Build v's Retrofit
  - Maintain family connection to building
- Extent of works
  - Complete strip down to frame and weatherboard cladding (except 2 bedrooms where wall remained intact)
- Budget - $3.5K/sqm across 130 sqm
  - although executed on cheaper family rates :)
  - $50K of structure retained

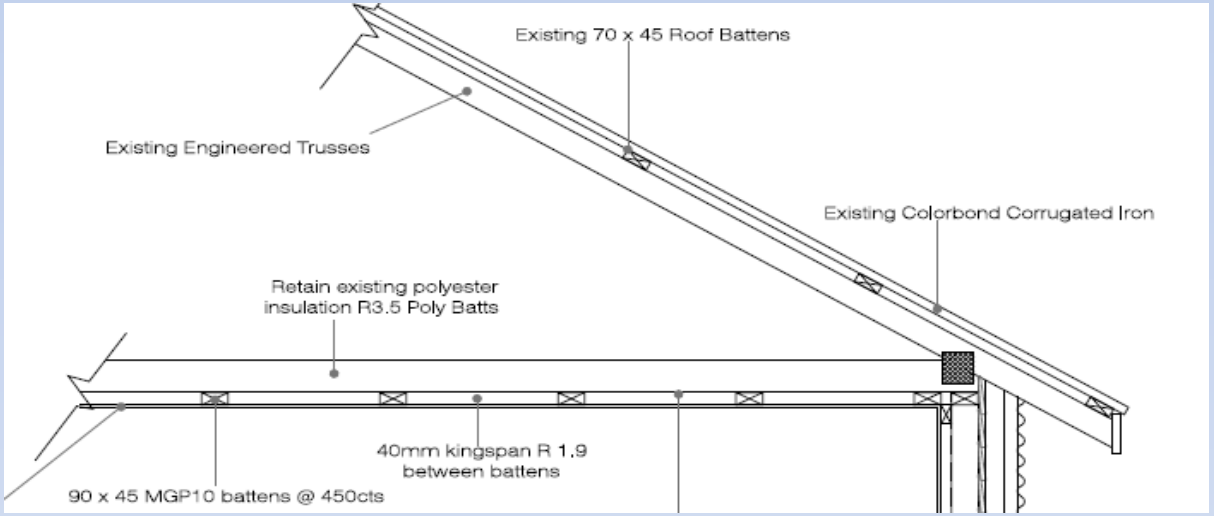
PHPP Design

- EnerPhit certification intent from outset
- Fully stripped areas
  - high confidence in insulation and airtightness
- 2 unstripped bedrooms (budget driven)
  - creates uncertainty

Insulation - walls



Insulation - ceiling

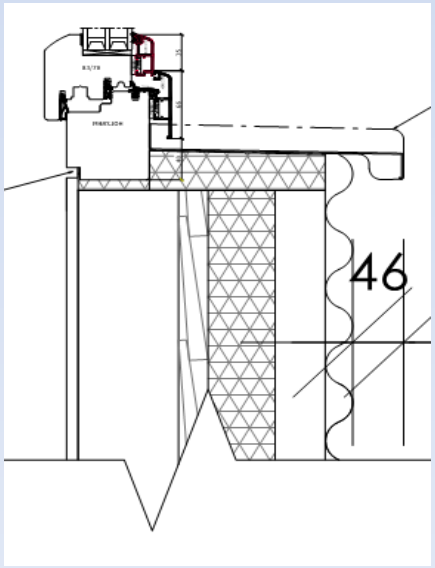


Air Tightness = taped XPS board

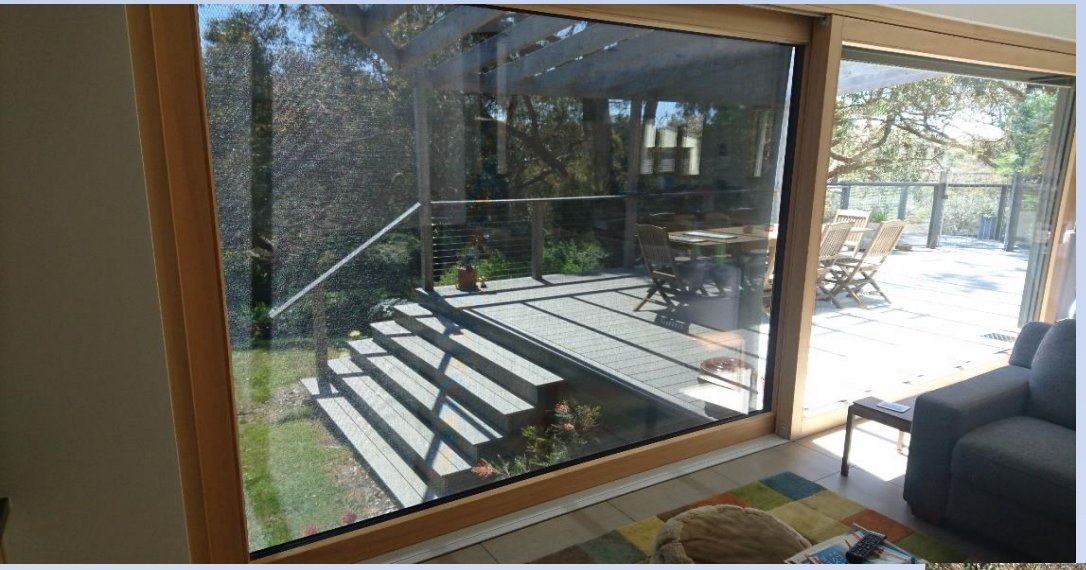
Thermal Bridges

- Full wall wrap in insulated board

Thermal Bridges

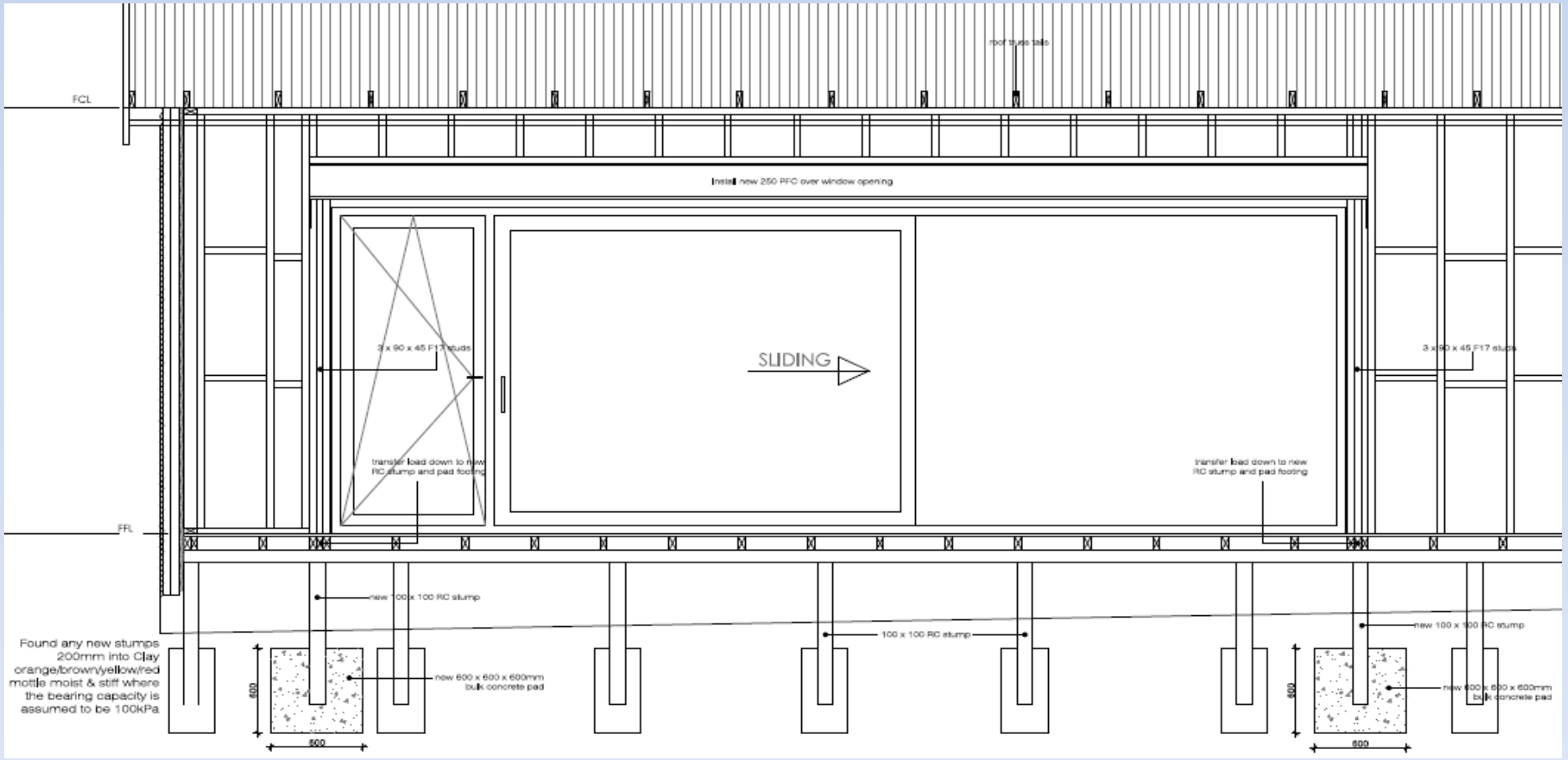


Glazing



- Triple Glazed
- U_W 0.90-0.95 W/m^{2}K (total window)

Glazing



Additional stumps added to support window weight

Air Tightness

- Main leakage via 2 unstripped bedrooms
- Some ceiling contribution

Combined Test Data

	Results
Air flow at 50 Pa, Q_{50} [m^3/h]	426.5
Air changes, n_{50}	0.96
Equivalent leakage area at 50 Pa [cm^2]	212.5
Permeability at 50 Pa [$m^3/h/m^2$]	0.997

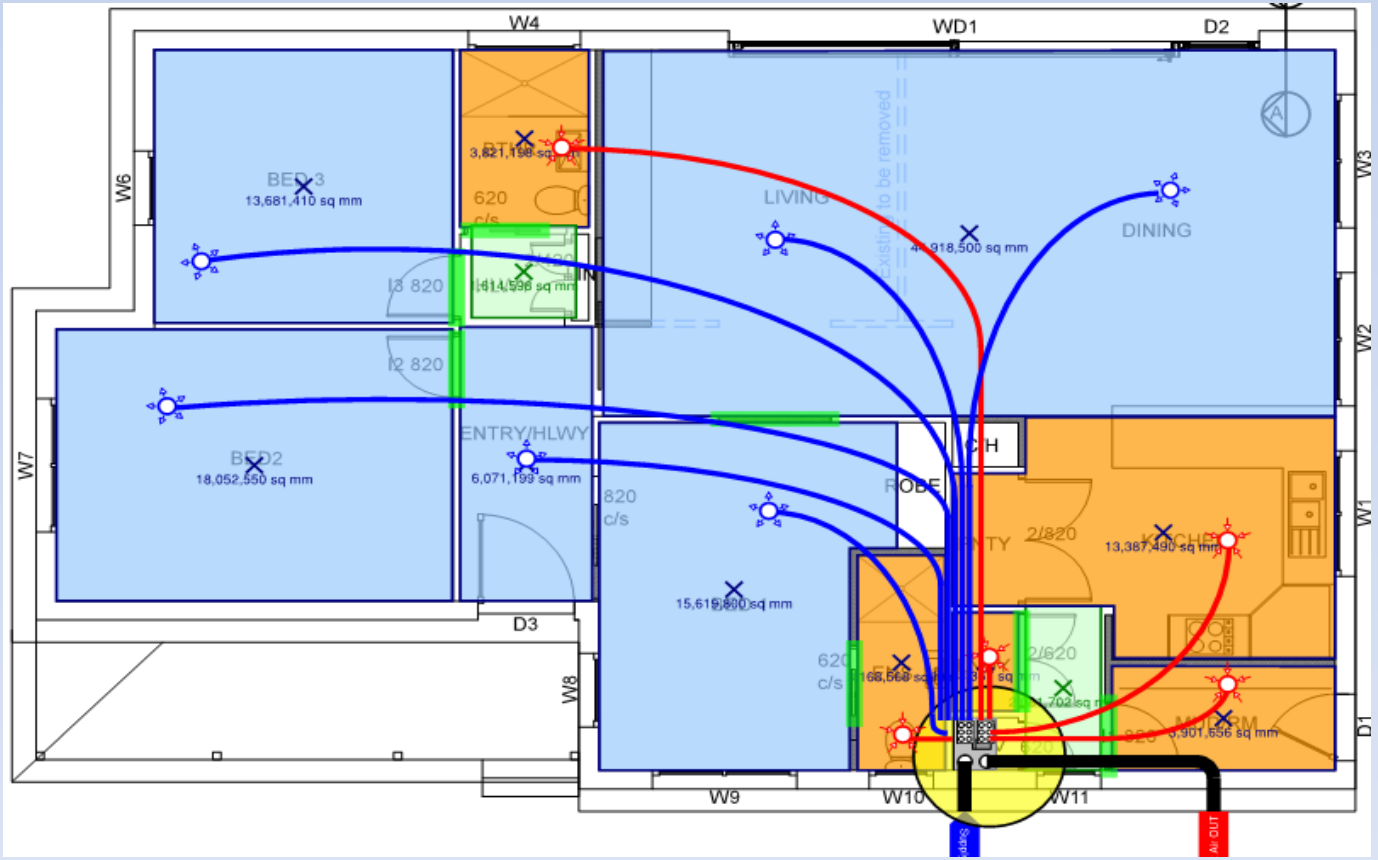
Ventilation System

- Passive House Methodology
  - EN13779 – IDA3

  22-36 m3/h of fresh air / person => 600-1000ppm CO2 increase compared outside air. Maintains acceptable IAQ

  20-30 m3/h adopted per person across the whole building
  - Tested & proven in residential buildings
  - Minimum of 0.3 ach (air changes/hour) for building

Ventilation Layout



MVHR Energy Consumption

35 Watts @ 150 m3/h

Maintaining air balance

Rangehood Extraction

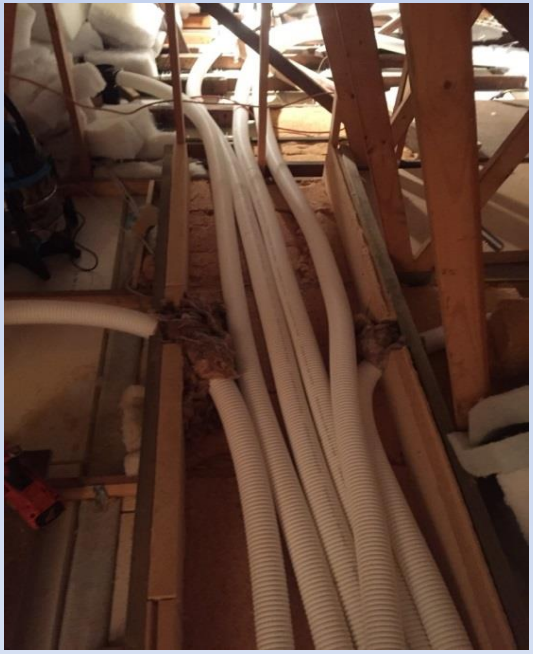
- In bench style
- Recirculation (with carbon filters.)

Combustion Heating

High efficiency wood heater

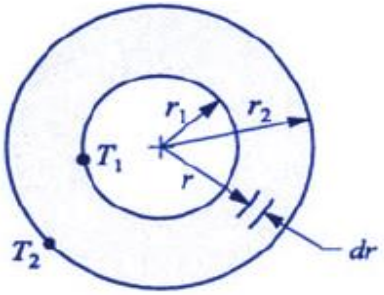
- Tested 71% therm. eff
- 7kW radiant output (fuel dependant!!)
- Self contained supply air via base /rear

Retrofitting MVHR duct



Insulated ductwork outside thermal envelope

$$q = \frac{2\pi k L(T_1 - T_2)}{\ln(r_2/r_1)}$$



- 25mm thick R1 insulation
- 90mm pipe
- 45 C roof space
- 8m avg duct length x 16 runs (supply & extract)

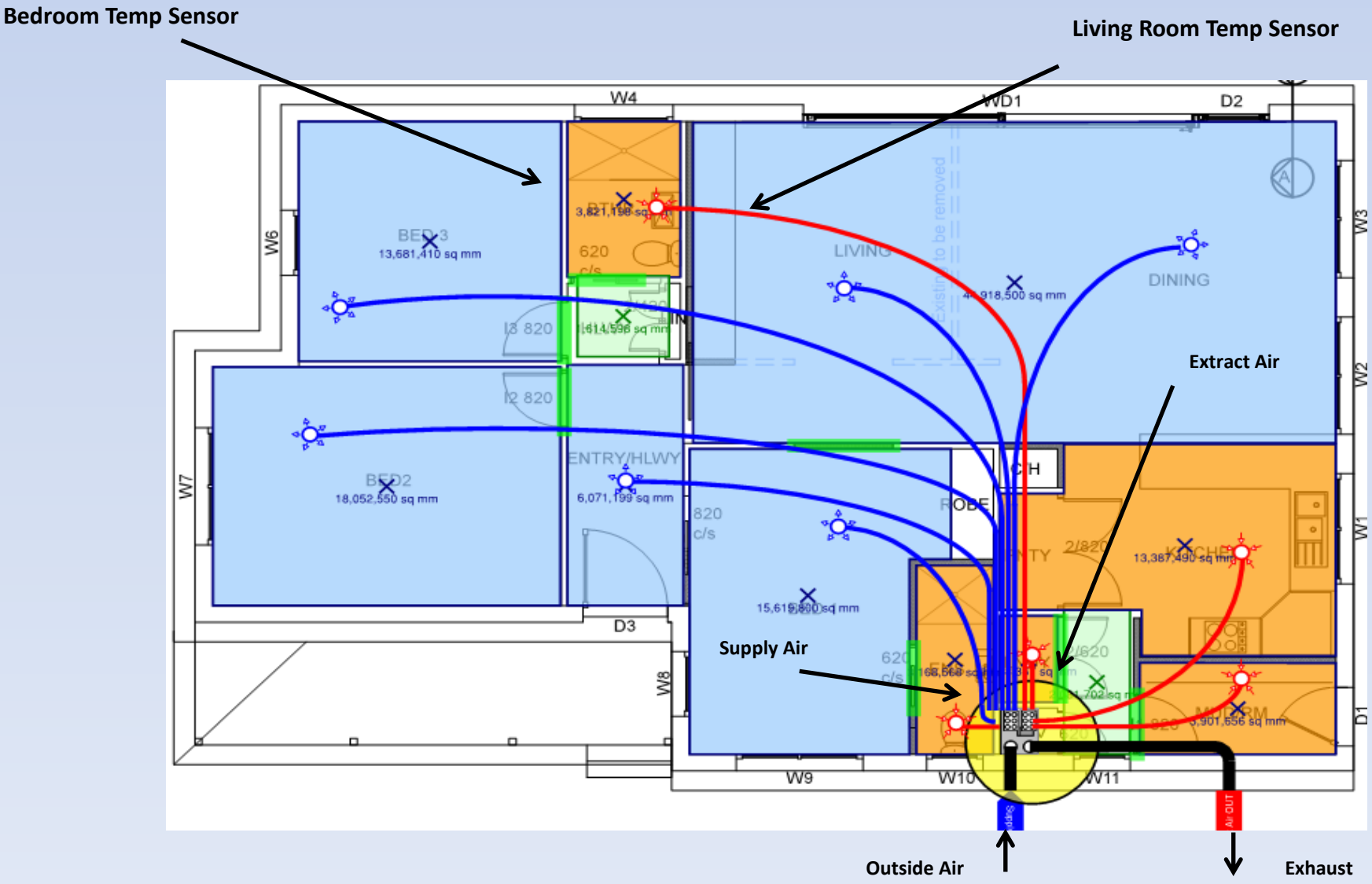
→ **Up to 1 kW heat again!**

Building Performance

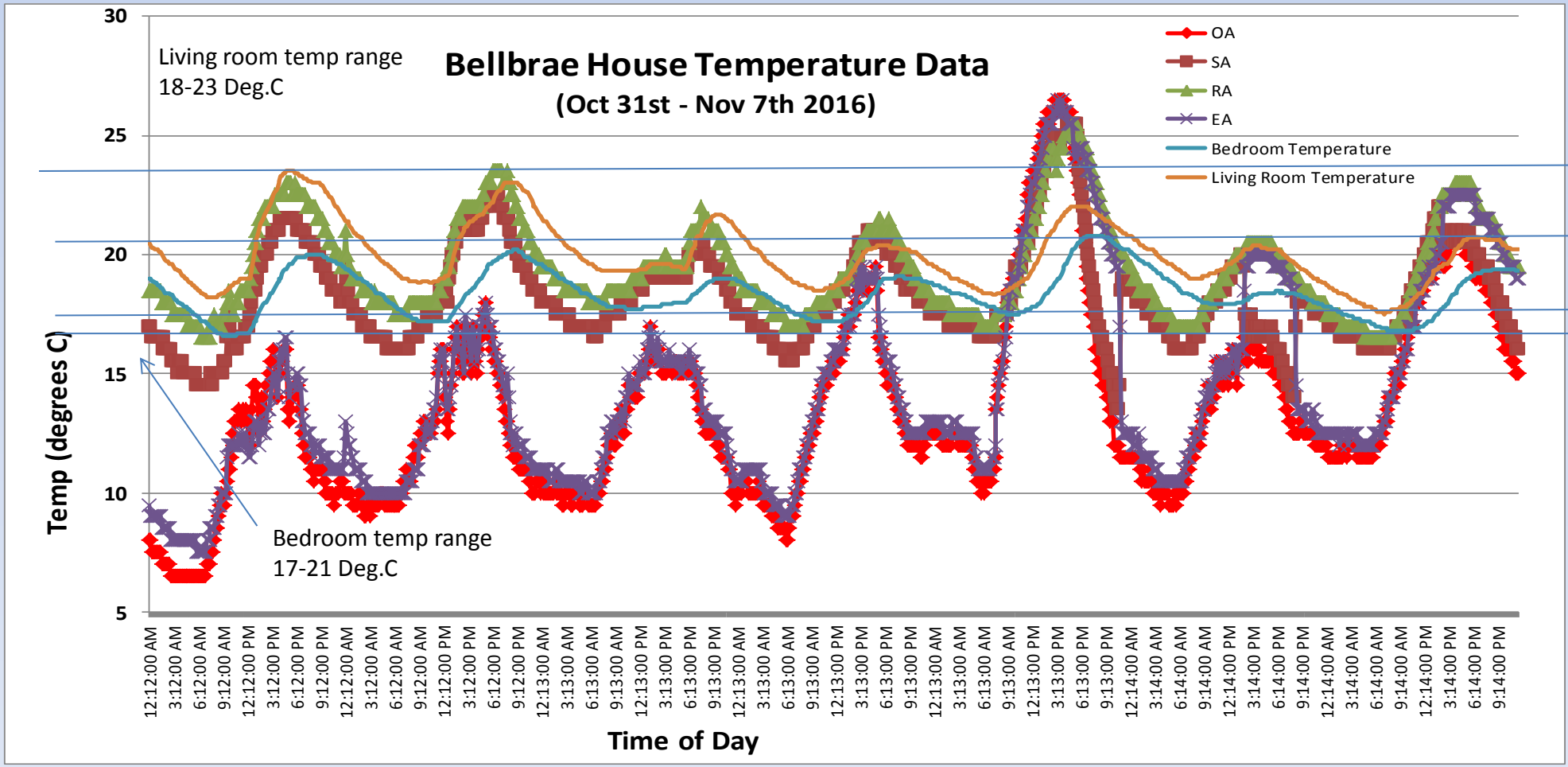
- Occupant Feedback
  - Very pleased with project
  - Proposing to build 2 more small PH buildings
  - 2 unstripped bedrooms are not as comfortable

Image: Pro Insulation Dublin

Temperature Data Logging



Temperature Data



EnerPHit Certification

Certificate

Certified retrofit
'EnerPHit Classic'
(Climate zone: Warm)

Mead: Energy & Architectural Design Ltd.
3 Harvey Road, London, N8 9PD

Authorised by:
Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany

Bellbrae House
635 Gundrys Rd, 3228 Bellbrae, Australia

EnerPHit
Certified Retrofit
Passive House Institute
classic | plus | premium

Client	Allan Roberts 635 Gundrys Rd 3228 Bellbrae , Australia
Architect	APHI Projects Pty Ltd P.O. Box 5157 3219 East Geelong, Australia
Building Services	Fantech Pty. Ltd 42 - 62 Pound Road West 3175 Dandenong South, United Kingdom/ Britain
Energy Consultant	Grunconsulting L2, 360 Bourke St 3000 Melbourne, Australia

Buildings retrofitted to the EnerPHit Standard offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned building meets the criteria defined by the Passive House Institute for modernization to the 'EnerPHit Classic' standard.

Building quality			This building		Criteria	Alternative criteria
Heating	Heating demand	[kWh/(m²a)]	14	≤	15	-
Cooling	Cooling + dehumidification demand	[kWh/(m²a)]	3	≤	15	15
	Cooling load	[W/m²]	24	≤	-	10
Airtightness	Pressurization test result	(n_{50})	1.0	≤	1.0	
Non-renewable primary energy (PE)	PE demand	[kWh/(m²a)]	69	≤	120	
Component quality						
	Building envelope to ambient air (U-value)	[W/(m²K)]	0.22	≤	-	
	Building envelope to ground (U-value)	[W/(m²K)]	0.29	≤	-	
Windows/Exterior doors	U_w	[W/(m²K)]	0.72	≤	-	
	Glazing (g-value)	[-]	0.60	≥	-	
	Glazing/shading (max. solar load)	[kWh/(m²a)]	369	≤	-	
	Ventilation (effect. heat recovery efficiency)	[%]	80	≥	-	

The associated certification booklet contains more characteristic values for this building.

##
Certifier: Kym Mead, MEAD: Energy & Architectural Design Ltd

www.passivehouse.com 13826_MEAD_EP_20160713_KM

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Heating	Heating demand	[kWh/(m²a)]	14	≤	15
Cooling	Cooling + dehumidification demand	[kWh/(m²a)]	3	≤	15
	Cooling load	[W/m²]	24	≤	-
Airtightness	Pressurization test result (n_{50})	[1/h]	1.0	≤	1.0
Non-renewable primary energy (PE)	PE demand	[kWh/(m²a)]	69	≤	120

Lessons Learnt

- Underfloor insulation
  - Insulation board difficult to work with overhead
- Ventilation system time consuming to fit
  - Roof space insulation time consuming
  - Ceiling height reduction would have allowed duct runs inside thermal envelope
- 2 unstripped bedrooms
  - weak points in the envelope (insulation and airtightness)
  - Should have stripped as per rest of building