Project Documentation
Gebäude-Dokumentation

1 Abstract / Zusammenfassung

Single family house in Kearneys Spring, Queensland, Australia

1.1 Data of building / Gebäudedaten

Year of construction/ Baujahr	2020	**Space heating / Heizwärmebedarf**	**5 kWh/(m²a)**
U-value external wall/ U-Wert Außenwand	0.283 W/(m²K)		
U-value basement ceiling/ U-Wert Kellerdecke	0.139 W/(m²K)	**Primary Energy Renewable (PER) / Erneuerbare Primärenergie (PER)**	49 kWh/(m²a)
U-value roof/ U-Wert Dach	0.251 W/(m²K)	**Generation of renewable energy / Erzeugung erneuerb. Energie**	88 kWh/(m²a)
U-value window/ U-Wert Fenster	1.57 W/(m²K)	**Non-renewable Primary Energy (PE) / Nicht erneuerbare Primärenergie (PE)**	100 kWh/(m²a)
Heat recovery/ Wärmerückgewinnung	78 %	Pressure test n_{50} / Drucktest n_{50}	0.11 h-1
Special features/ Besonderheiten	Low cost build method. Rainwater utilisation.		

1.2 Brief Description ...

16 Sorrento - A Passive House Plus

This project was the Pilot Project of the LAB Design Construction System and fully funded by LAB Design. The Construction system was leaned to the minimum components with radical simplicity of the airtight detail to reduce complexity onsite for the first time Passive House builder, Nathan Peters of Titanium Homes. The aim of the project was to demonstrate that Passive House was possible using only minor modifications from Australia's timber framing code which is used by most of the residential building sector.

The building was designed within the context of providing a functional family home that could be occupied by professional couples, families with children as well as retirees looking to downside into a healthy home. The house was constructed within the timeline expected of a current code compliant house. The house is entirely lightweight construction and was sited on a small 330sqm block.

The heat recovery system is complimented by a small 3.5kW reverse cycle heat pump (air-conditioner) which provides comfort throughout the entire year. During summer, the heat load is predicted to be 16W/m^2 which is approximately 10% of the load utilised by local air conditioning contractors supplying systems to standard homes.

Double glazed timber windows and a single external airtight layer were part of the solution demonstrating that Passive House certification can be achieved at a low-cost point and highlighting the importance of virtual prototyping.

The project used the Passivhaus tools and methodology not only during the design phase but throughout the build by maintaining a live PHPP which allowed decisions to be made with the implications of the decisions known.

1.2 Kurzbeschreibung der Bauaufgabe

Passivhaus Plus – 16 Sorrento

Dieses Projekt war das Pilotprojekt des LAB Design Construction System und wurde vollständig von LAB Design finanziert. Das Konstruktionssystem wurde auf ein Minimum an Komponenten mit einer radikalen Einfachheit der luftdichten Details ausgerichtet, um die Komplexität auf der Baustelle zu reduzieren - zum ersten Mal wurde das Passivhaus von Nathan Peters von Titanium Homes gebaut. Ziel des Projekts war es, zu zeigen, dass ein Passivhaus mit nur geringfügigen Modifikationen des australischen Fachwerkgesetzes, das vom größten Teil des Wohnbausektors verwendet wird, möglich ist.

Das Gebäude wurde im Kontext eines funktionalen Familienhauses entworfen, das von Berufspaaren, Familien mit Kindern sowie von Rentnern, die sich nach unten in ein gesundes Zuhause zurückziehen wollen, bewohnt werden kann. Das Haus wurde innerhalb des Zeitrahmens errichtet, der von einem den geltenden Vorschriften entsprechenden Haus erwartet wird. Das Haus ist vollständig in Leichtbauweise gebaut und wurde auf einem kleinen 330 Quadratmeter großen Block errichtet.

Das Wärmerückgewinnungssystem wird durch eine kleine 3,5 kW Umkehrzyklus-Wärmepumpe (Klimaanlage) ergänzt, die das ganze Jahr über Komfort bietet. Während des Sommers wird die Wärmelast voraussichtlich 16 W/m2 betragen, was etwa 10% der Last entspricht, die von lokalen Klimaanlagenherstellern, die Systeme für Standardhäuser liefern, verbraucht wird.

Doppelt verglaste Holzfenster und eine einzige luftdichte Außenschicht waren Teil der Lösung, die zeigt, dass die Passivhaus-Zertifizierung zu einem kostengünstigen Zeitpunkt erreicht werden kann, und die die Bedeutung des virtuellen Prototypings unterstreicht.

Das Projekt nutzte die Passivhaus-Werkzeuge und -Methodik nicht nur während der Entwurfsphase, sondern während des gesamten Baus, indem es ein Live-PHPP unterhielt, das es ermöglichte, Entscheidungen mit den Auswirkungen der bekannten Entscheidungen zu treffen.

Übersetzt mit www.DeepL.com/Translator (kostenlose Version).

1.3 Responsible project participants / Verantwortliche Projektbeteiligte

Architect/ Entwurfsverfasser	Scott Stewart, LAB Design www.labdesign.com.au
Implementation planning/ Ausführungsplanung	Madonna Stewart, LAB Design www.labdesign.com.au
Building systems/ Haustechnik	Scott Stewart, LAB Design www.labdesign.com.au
Dynamic Moisture Analysis (WUFI®)/ Baustatik	Enrico Bonilauri, Emu Systems emu.systems
Building physics/ Bauphysik	Scott Stewart, LAB Design www.labdesign.com.au
Passive House project planning/ Passivhaus-Projektierung	Scott Stewart, LAB Design www.labdesign.com.au
Construction management/ Bauleitung	Nathan Peters, Titanium Homes www.titaniumhomes.com.au

Certifying body/ Zertifizierungsstelle	Clare Parry, HIP V. HYPE HIPVHYPE.COM	
Certification ID/ Zertifizierungs ID	28172_CP_PH_20201009_CP (www.passivehouse-database.org) 28172_CP_PH_20201009_CP (www.passivehouse-database .org)	6650

Author of project documentation / Verfasser der Gebäude-Dokumentation	Scott Stewart, LAB Design www.labdesign.com.au www.passiv.de
Date, Signature/ Datum, Unterschrift	16 Oct 2020

2 Construction Concept

Designed by LAB Design, this project was a demonstration of the LAB Design Construction System. The envelope of the building is radically simple but draws upon the barn structures of the Darling Downs in Queensland. The four-bedroom dwelling features a large void with clerestory windows over the kitchen and dining space amplifying the feeling of space within a modest floor space.

The building is orientated on a north-south axis with an eastern street frontage and an outdoor covered entertaining space to the south west is accessed from the kitchen dining space. The site is in a new suburban sub-division in Toowoomba with few established trees. The shading for the project was provided by external deck roofs and window hoods in keeping with the style of the dwelling.

CONSTRUCTION ASSEMBLIES

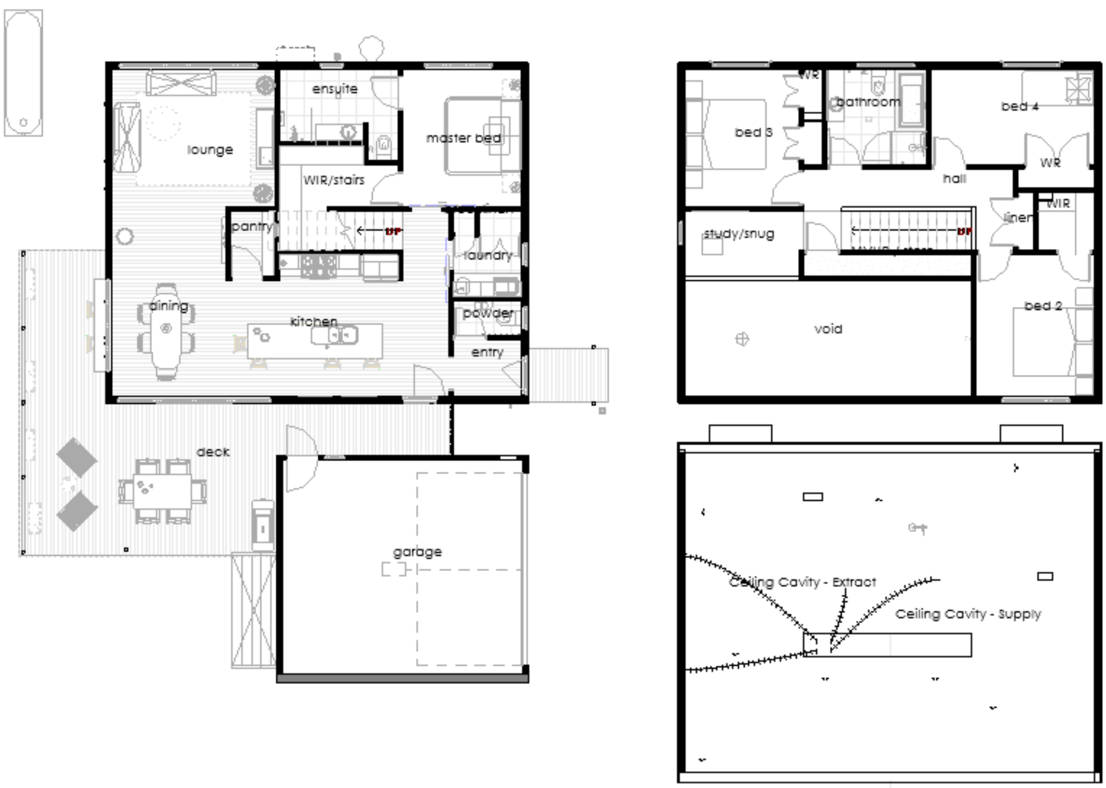

Figure 1 - Floor plan and areas

Assemblies:

WALLS; The LAB Design Construction System was used which used a 90mm MGP10 timber frame IAW AS1684 with the addition of an additional 45mm batten resulting in a total of 135mm of 0.035W/K thermal insulation, in this case Knauf Superfil Insulation was used. A single external combined weather resistant barrier / air tightness layer (WRB/ATL) was installed with simplified detailing. ProClima Extasana Memto Plus was chosen for durability and its 4 layer construction in combination with the blow-in insulation.

FLOORS; A 300mm suspended timber I-Beam framed floor (with some steel beams, required to cantilever over a sewer easement) wrapped under with Proctorwrap RW to secure the insulation and act as a wind barrier. The entire cavity was filled with 0.035W/K thermal insulation Knauf Superfil for ease of securing the wrap to the underside of the I-Beams. This was not the optimal use of the material as the U-value achieved was far in-excess of that required and updates to the floor system will be explored for the next project. The airtight layer was yellow tongue 19mm particle board glued and taped at joints. The nail holes were not taped.

ROOF; A standard truss roof with a 140mm top chord was used with a continuous (WRB/ATL) ontop of the truss. A cross batten system was installed over the breathable membrane. A blow-n blanket was secured under the top chord and 140mm 0.035W/K thermal insulation Knuaf Superfil filled the cavity. This method was not optimal for installation and batts will be used for the next project.

AIRTIGHTNESS; ProClima Extasana Memto Plus was chosen for durability and its 4 layer construction in combination with the blow-in insulation for the wall and roof. 19mm Yellow tongue particle board was used for the floor airtightness with the joins taped and glued. The nail penetrations were not taped. For future projects the initial blower door test will be conducted with the yellow tongue glued with a flexible glue and not taped to potentially further lean the construction.

	Depressurization	Pressurization	Average
Test Results at 50 Pascals:			
q_{50}: m³/h (Airflow)	63 (+/- 4.2 %)	63 (+/- 4.6 %)	63
n_{50}: 1/h (Air Change Rate)	0.11	0.11	0.11
q_{F50}: m³/(h·m² Floor Area)	0.67	0.67	0.67
q_{E50}: m³/(h·m² Envelope Area)	0.15	0.15	0.15
Leakage Areas:			
ELA_{50}: m²	0.0019 (+/- 4.6 %)	0.0019 (+/- 4.6 %)	0.0019
ELA_{F50}: m²/m²	0.0000205	0.0000205	0.0000205
ELA_{E50}: m²/m²	0.0000044	0.0000044	0.0000044
Building Leakage Curve:			
Air Flow Coefficient (C_{env}) m³/(h·Paⁿ)	5.3 (+/- 32.7 %)	7.8 (+/- 23.2 %)	
Air Leakage Coefficient (C_L) m³/(h·Paⁿ)	5.2 (+/- 32.7 %)	7.6 (+/- 23.2 %)	
Exponent (n)	0.636 (+/- 0.089)	0.540 (+/- 0.066)	
Coefficient of Determination (r²)	0.98530	0.98150	

Test Standard:	ISO 9972
Test Mode:	Depressurization and Pressurization
Type of Test Method:	Method 2 - Test of Building Envelope
Purpose of Test:	passive house certification n50 ≤ .6 1/h

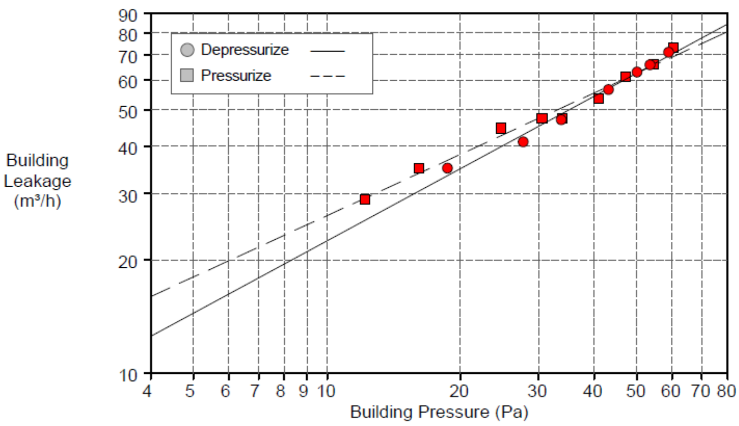

Figure 2 - Airtightness Testing Final Result (left) Image of the initial blower door test (right)

WINDOWS & INSTALLATION; Windows are HF68 solid timber windows supplied by Kneer Suedfenster with double glazing;

- $U_{f\ average}$ = 1.53 W/m²K

- U_g = 1.1 W/m²K

- g value $_{average}$ = 0.64

- $U_{w\ average}$ = 1.57 W/m²K

- Window Area = 17.85m²

The window installation method utilised standard Australian application of a reveal attached to the frame. The window was double taped from the outside. Initially using Ilbruck ME300 membrane tape and then Extora 150mm tape.

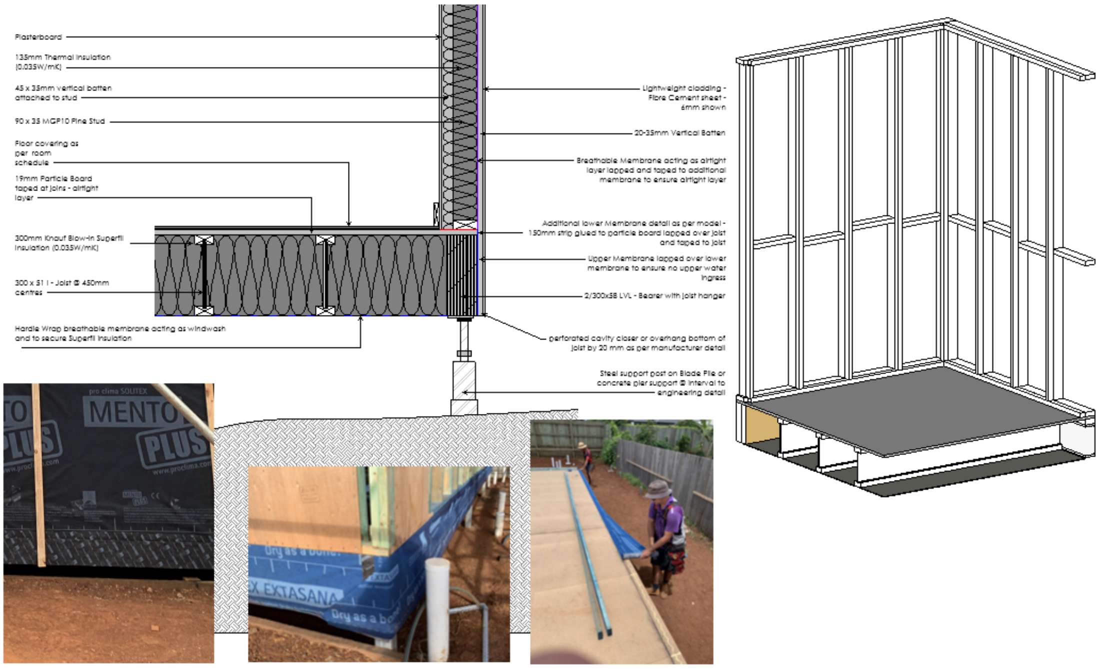

Figure 3 - Floor Wall Junction

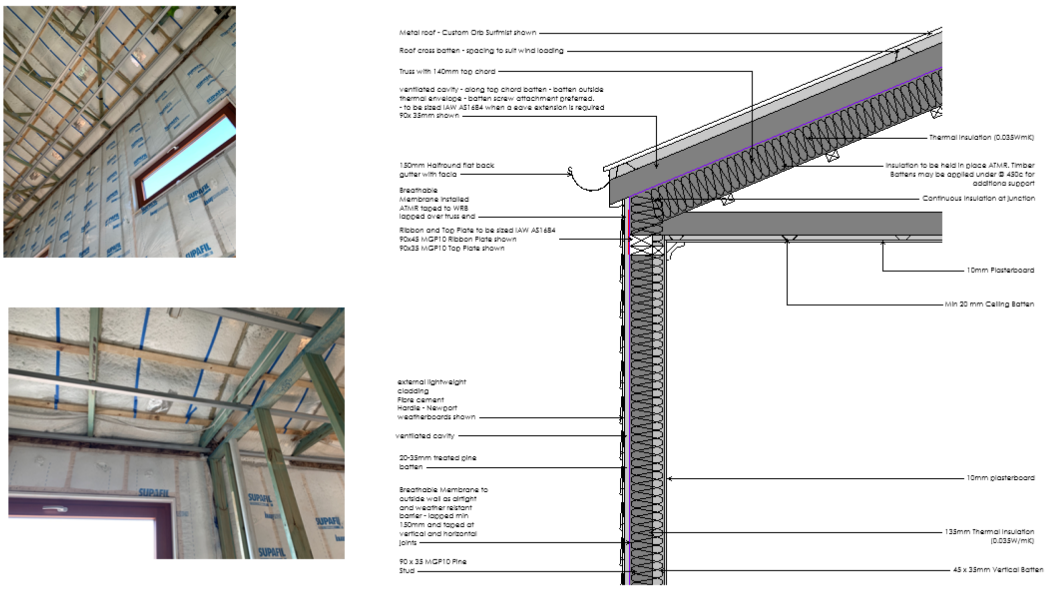

Figure 4 - Roof Wall Junction

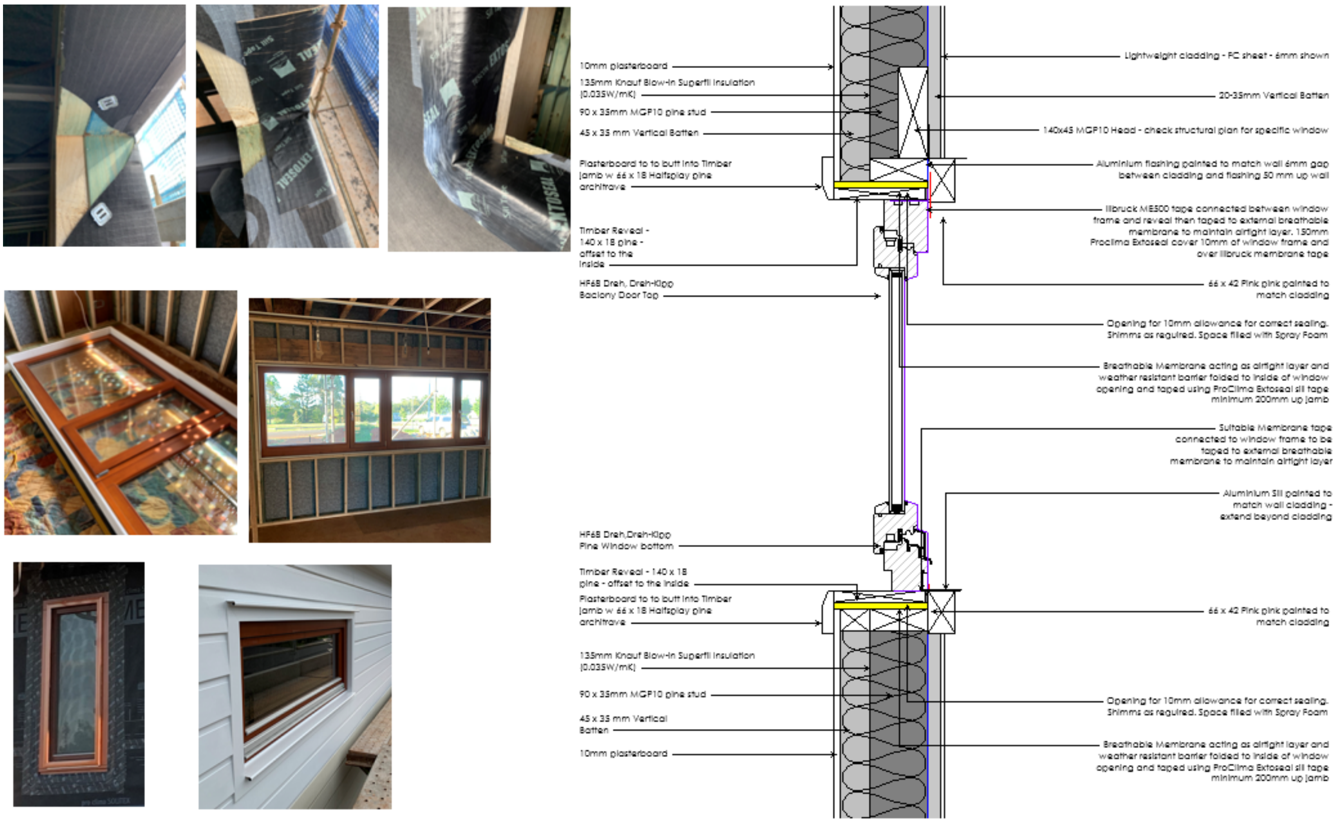

Figure 5 - Window Installation

VENTILATION SYSTEM; A Brink Renovent Air Excellent 300 (84% efficiency, sensible only, 0.26 Wh/m^3) was installed in the home in a dedicated mech cupboard. Since the ceiling cavity was entirely inside the thermal envelope the duct runs were relatively easy to run for the first floor and then through dedicated risers for accessing the ground floor ceiling cavity minimising cuts in structural members and not requiring further drop ceilings. The kitchen, which is in a two story void uses an Ilve range hood with charcoal filters recirculating to the void above the kitchen.

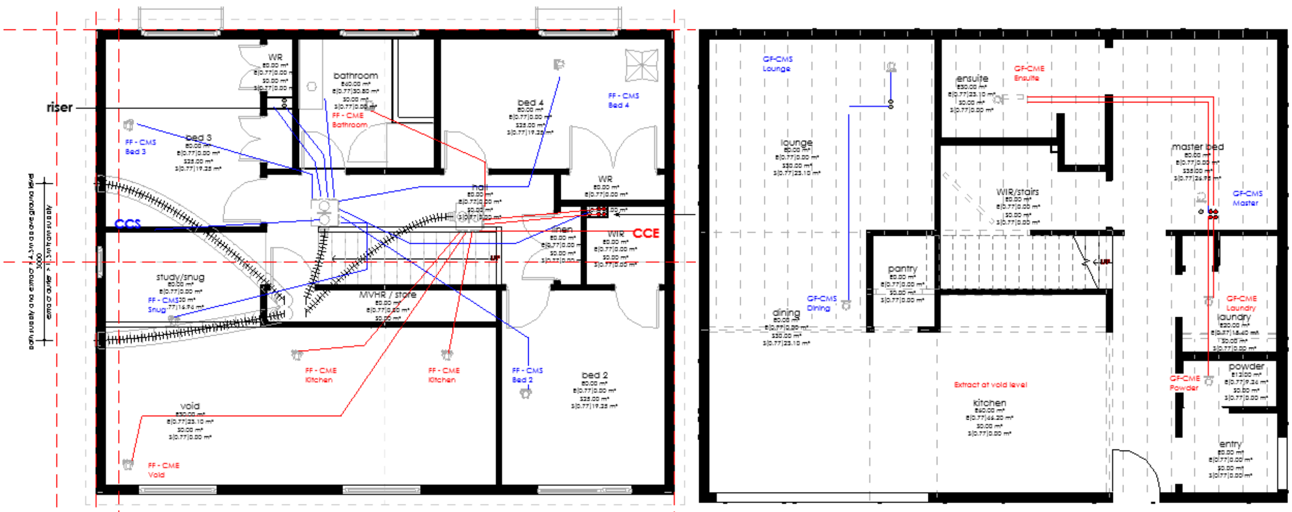

Figure 6 - MVHR Plan - Firstfloor and ceiling (left) Ground floor ceiling (right)

HEATING & COOLING; A small amount of heating is required in winter and mechanical cooling has been selected for this project. A 3.5kW Fujitsu mini-bulkhead unit was installed with the supply split into two ducts, one servicing the void area above the kitchen and dining area and the other into the upper hall area.

Figure 7 - Split ducting

EXTERIOR & INTERIOR PHOTOS

Figure 8 - Open plan kitchen and dining space with void over

Figure 9 - Entertaining Deck

Figure 10 - Western wall screening

Figure 11 - Living area through dining to entertaining space

Figure 12 - 16 Sorrento

Figure 13 - Street view facing east - north wall with window hoods

Passive House Verification

Building:	Passive House 2		
Street:	16 Sorrento Drive		
Postcode/City:	4350	Toowoomba	
Province/Country:	Queensland	AU-Australia	
Building type:	Residential		
Climate data set:	AU0008a-Toowoomba		
Climate zone:	5: Warm	Altitude of location:	669 m
Home owner / Client:	Scomad Pty Ltd		
Street:	30 Nightingale Street		
Postcode/City:	2456	Woolgoolga	
Province/Country:	NSW	AU-Australia	

Architecture:	LAB Design			Mechanical engineer:	LAB Design		
Street:	30 Nightingale Street			Street:	30 Nightingale Street		
Postcode/City:	2456	Woolgoolga		Postcode/City:	2456	Woolgoolga	
Province/Country:	NSW	AU-Australia		Province/Country:	NSW	AU-Australia	
Energy consultancy:	LAB Design			Certification:	Clare Parry - Grun Consulting		
Street:	30 Nightingale Street			Street:			
Postcode/City:	2456	Woolgoolga		Postcode/City:			
Province/Country:	NSW	AU-Australia		Province/Country:			

Year of construction:	2020	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:	2.9	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	143.0				
Space heating	Heating demand kWh/(m²a)	5	≤	15	-	yes
	Heating load W/m²	9	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	14	≤	16	16	yes
	Cooling load W/m²	16	≤	-	10	
	Frequency of overheating (> 25 °C) %	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg) %	4	≤	10		yes
Airtightness	Pressurization test result n_{50} 1/h	0.1	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	100	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	49	≤	45	49	yes
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	88	≥	60	66	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Plus? yes

Task:	First name:	Surname:	Signature:
1-Designer	Scott	Stewart	
	Issued on:	City:	
Signed pdf	04/09/20	Woolgoolga NSW 2456	

PHPP, Verification

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