PASSIVHAUS PRELIMINARY REPORT

[redacted]

SUMMARY 1/2

TABLE 1 - PROJECT DETAILS	
PROJECT	[redacted]
ADDRESS	[redacted]
CLIMATE DATA	AU1032a-Moorabbin (Melbourne)
ALTITUDE	3 meters
CLIENT	[redacted]

PASSIVHAUS PRELIMINARY REPORT

[redacted]

SUMMARY 2/2

TABLE 2 - PROJECT SUMMARY	
DOES THE PROJECT MEET THE PASSIVHAUS STANDARD?	Yes
IF NOT COMPLIANT, WHICH CRITERIA DOESN'T MEET THE REQUIREMENTS?	Not applicable
WHAT IMPROVEMENTS ARE RECOMMENDED?	The following recommendations have already been considered in this thermal performance simulation: (i) Wall Service cavity should be insulated with R1.0 wall insulation batts. (ii) Ground floor structure to be increased to 300mm LVL and insulation increased to R8.0. (iii) Ceiling insulation to be increased to R8.0. Considering the project is very close to the Passivhaus limit for the heating requirement, the following actions should also be considered: (i) Reducing the width of windows 15, 16, 17 and 18, to reduce heat loss. (ii) Changing the operable to fixed ratio of windows 19, 20, 21 and 22, so that less window area is covered by insect screens. (iii) Upgrading - totally or partially - the windows to triple glazed systems.

maxa design

Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449

info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 1/12

TABLE 03 – KEY CHARACTERISTICS OF THE PROJECT		
PARAMETER	**UNIT**	**VALUE**
TREATED FLOOR AREA (TFA)	m^2	227.20
THERMAL ENVELOPE AREA	m^2	670.74
BUILDING FOOTPRINT	m^2	146.00
VENTILATION VOLUME (Vv)	m^3	568
NET AIR VOLUME (Vn50)	m^3	640
FORM FACTOR	m^2/ m^2	3.00
WINDOW AREA/TFA RATIO	%	0.26

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 2/12

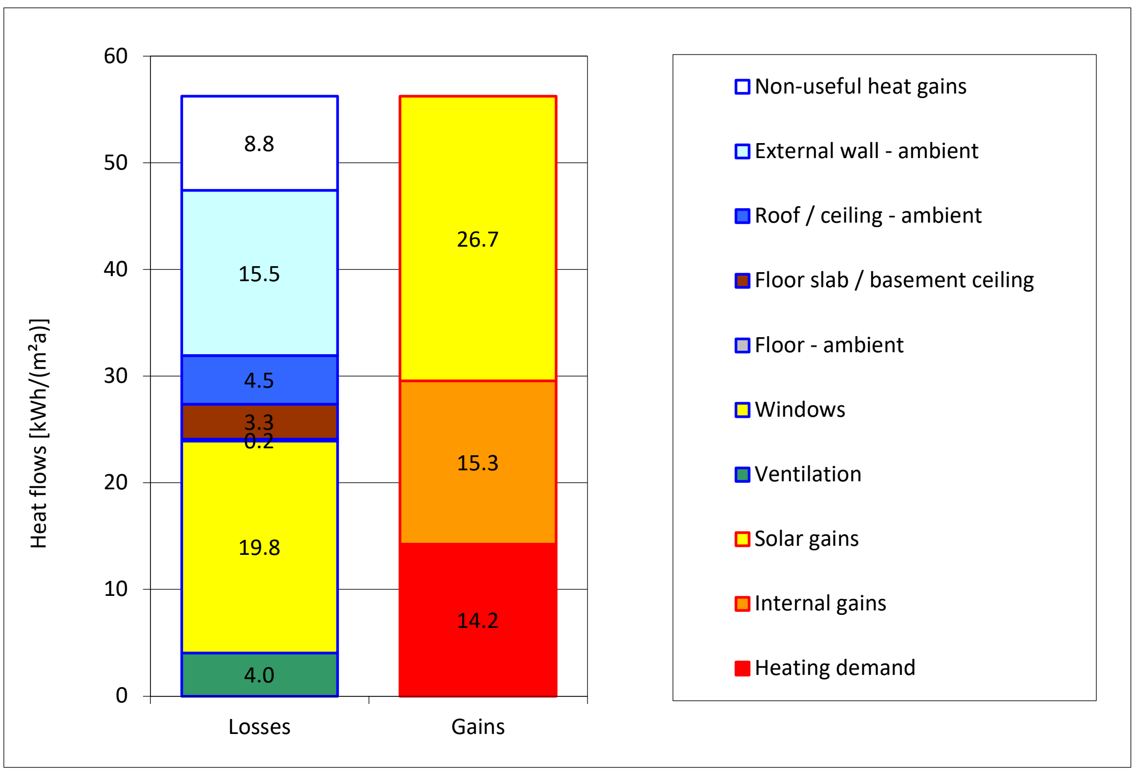
TABLE 04 – RESULTS AGAINST THE PASSIVHAUS STANDARD BENCHMARKS			
CRITERIA	**UNIT**	**RESULTS**	**PH BENCHMARKS**
HEATING DEMAND	kWh/m²a	14	15
HEATING LOAD	W/m²	11	10
COOLING AND DEHUMIDIFICATION DEMAND	kWh/m²a	1	15
COOLING LOAD	W/m²	14.62	N/A
FREQUENCY OF OVERHEATING	% (>25°c)	0.40%	10
FREQUENCY OF EXCESSIVELY HIGH HUMIDITY	% (>12g/Kg)	0.17%	20
AIRTIGHTNESS	kWh/m²a	0.6	0.6
PRIMARY ENERGY RENEWABLE (PER)	kWh/m²a	57	60

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 3/12

GRAPH 1 – ENERGY BALANCE – HEATING (MONTHLY PERIOD)



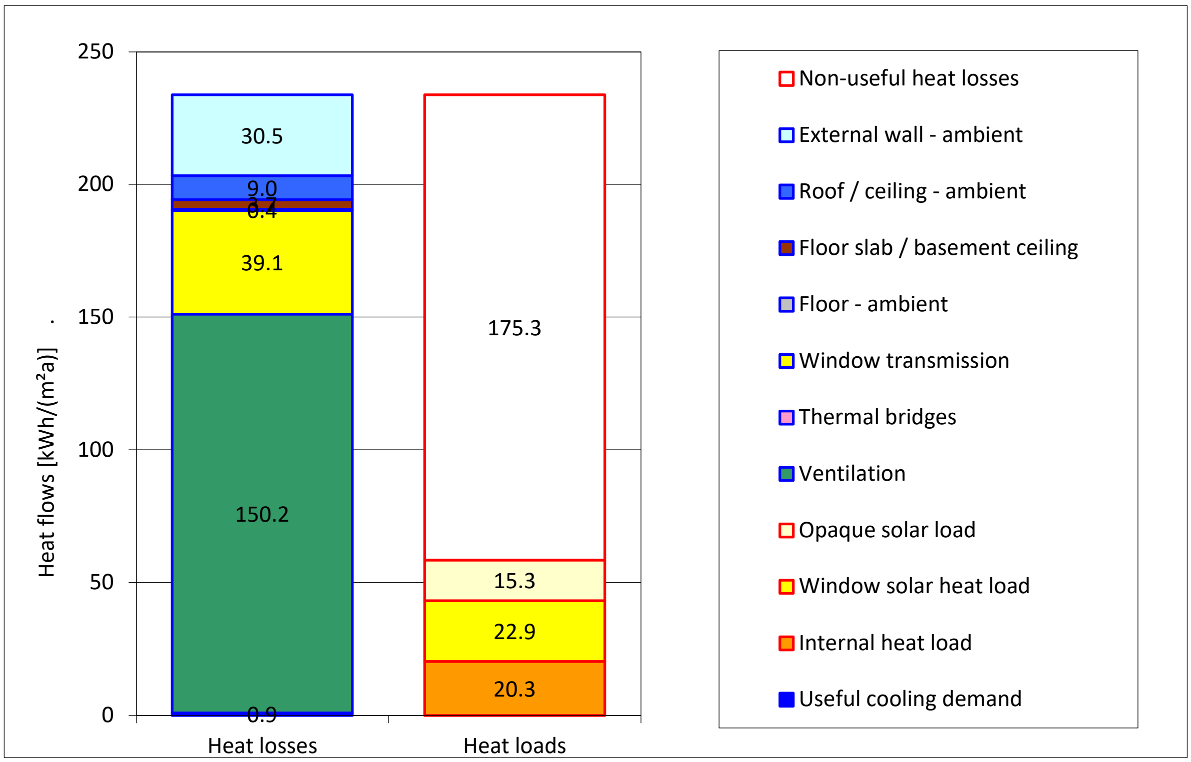
maxa design
Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449
info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 4/12

GRAPH 2 – ENERGY BALANCE – COOLING (MONTHLY PERIOD)

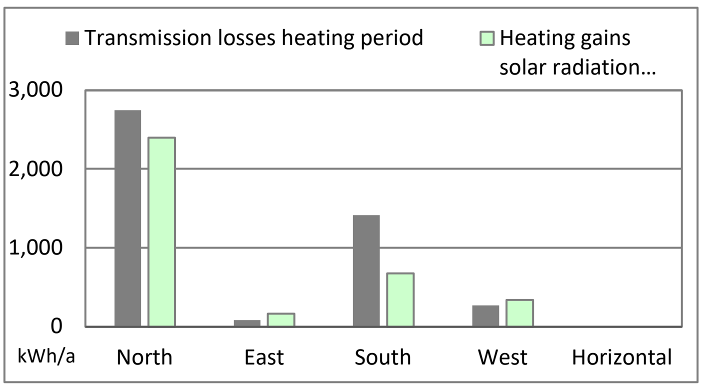


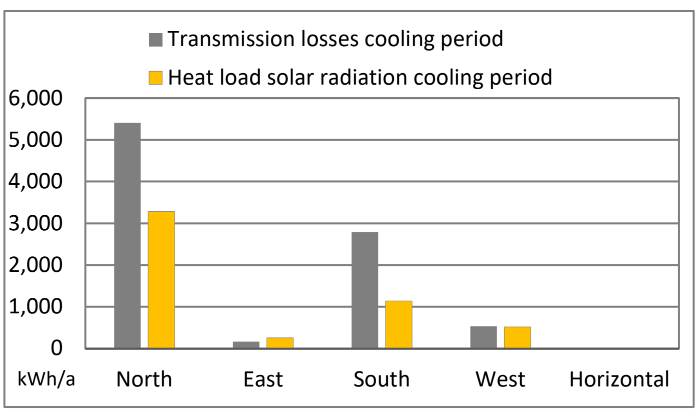
PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 5/12

GRAPH 3 – WINDOW ENERGY BALANCE





maxa design
Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449
info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 6/12

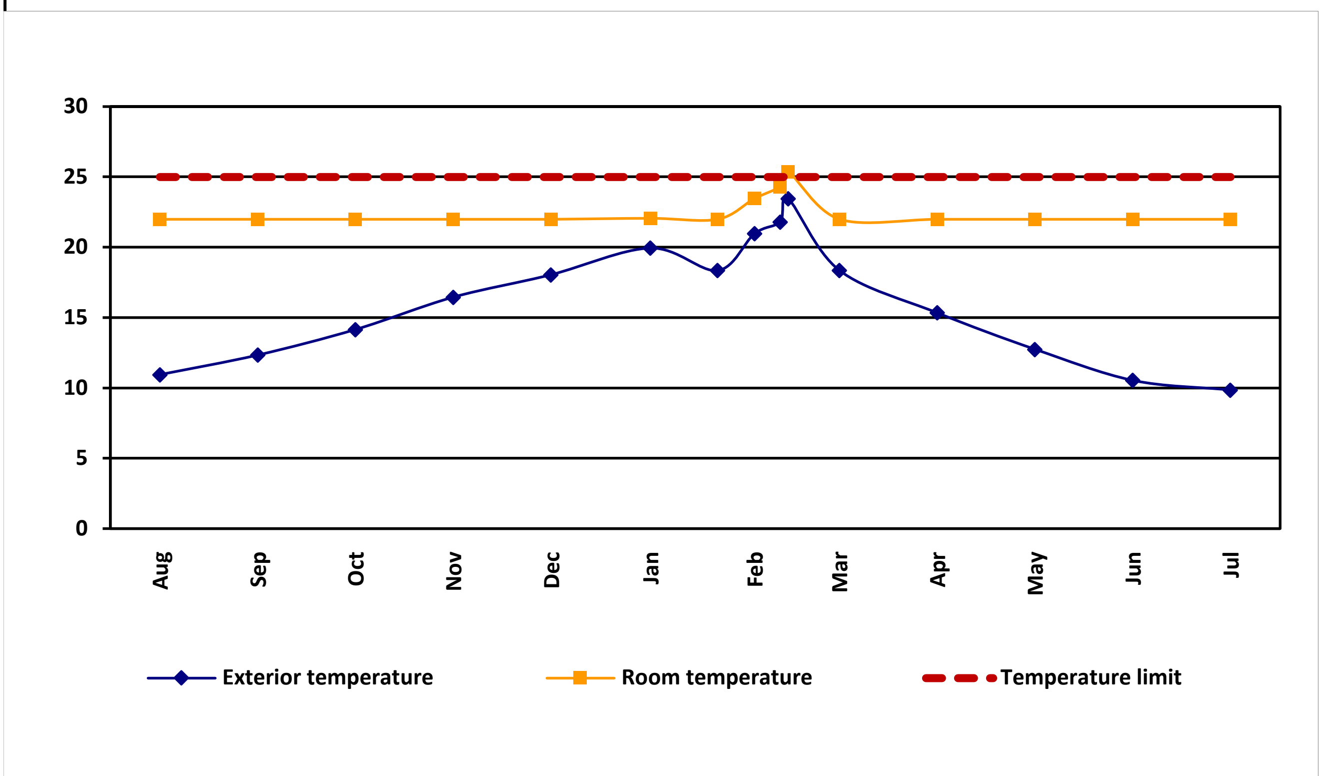
TABLE 05 – SUMMER THERMAL PERFORMANCE				
CRITERIA	**UNIT**	**RESULTS (NO WINDOW VENTILATION)**	**RESULTS (WITH WINDOW VENTILATION)**	**RECOMMENDED**
FREQUENCY OF OVERHEATING	%	11%	0%	< 5%
DAILY TEMPERATURE FLUCTUATION	° C	2.0	2.1	< 3° C
OVERHEATING DEGREE HOURS	Kh	1142.9	15.6	-
COOLING AND DEHUMIDIFICATION DEMAND	kWh/m^2a	5.1	0.9	0
PEAK COOLING LOAD	W/m^2	3298	3321	N/A
WINDOW VENTILATION RATE - DAY	1/h	0.0	0.0	-
WINDOW VENTILATION RATE - NIGHT	1/h	0.0	1.0	-
(i) The table above shows the thermal performance of your home without the impact of the cooling system.				

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 7/12

GRAPH 4 - TEMPERATURE ANALYSIS



(i) The dwelling is modelled as a single zone. Temperature stratification between rooms is not well captured as the model averages this effect out across the dwelling. However, it should be noted that for high performance buildings the variation in temperatures between rooms will be lower than in conventional code-compliant buildings.

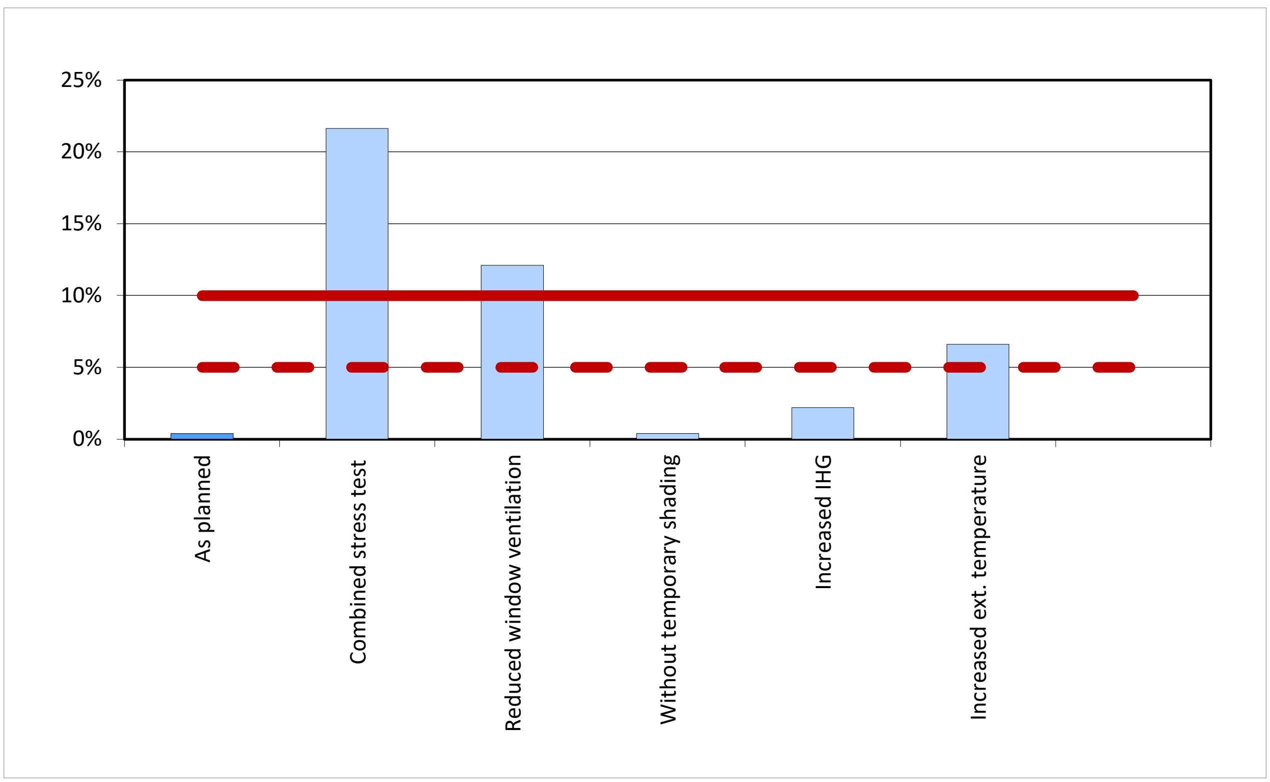
(ii) The graph above shows the thermal performance of your home without the impact of the cooling system.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 8/12

GRAPH 5 - SUMMER STRESS TEST (FREQUENCY OF OVERHEATING)



(i) Frequency of overheating is below the 10% limit, but this result is dependent on leaving some of the windows open when the conditions are favourable in Summer. If windows are left shut, frequency of overheating rises to 12.09 % , which is above the Passivhaus threshold
(ii) the graph above shows the thermal performace of the project without the impact of the cooling system.

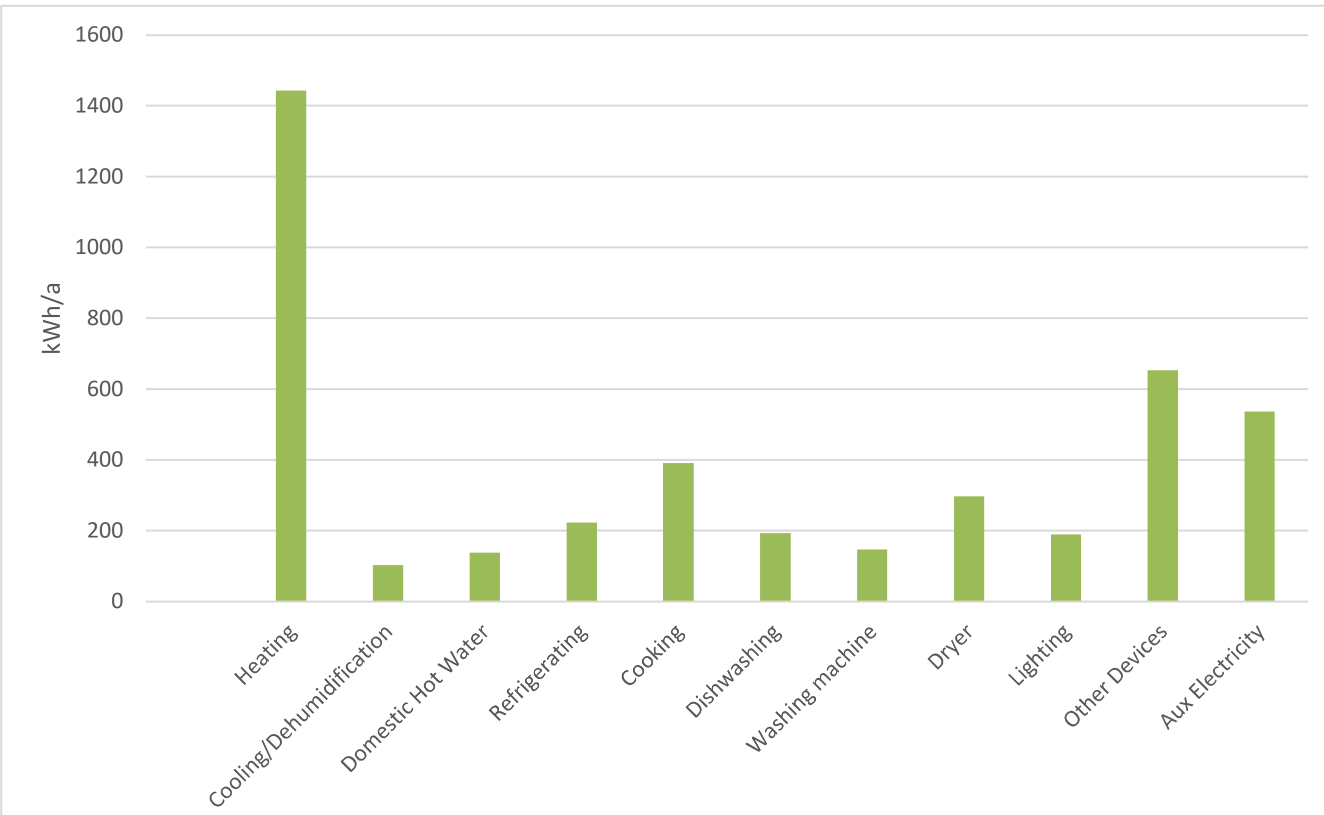
maxa design
Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449
info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 9/12

GRAPH 6 - ELECTRICITY DEMAND



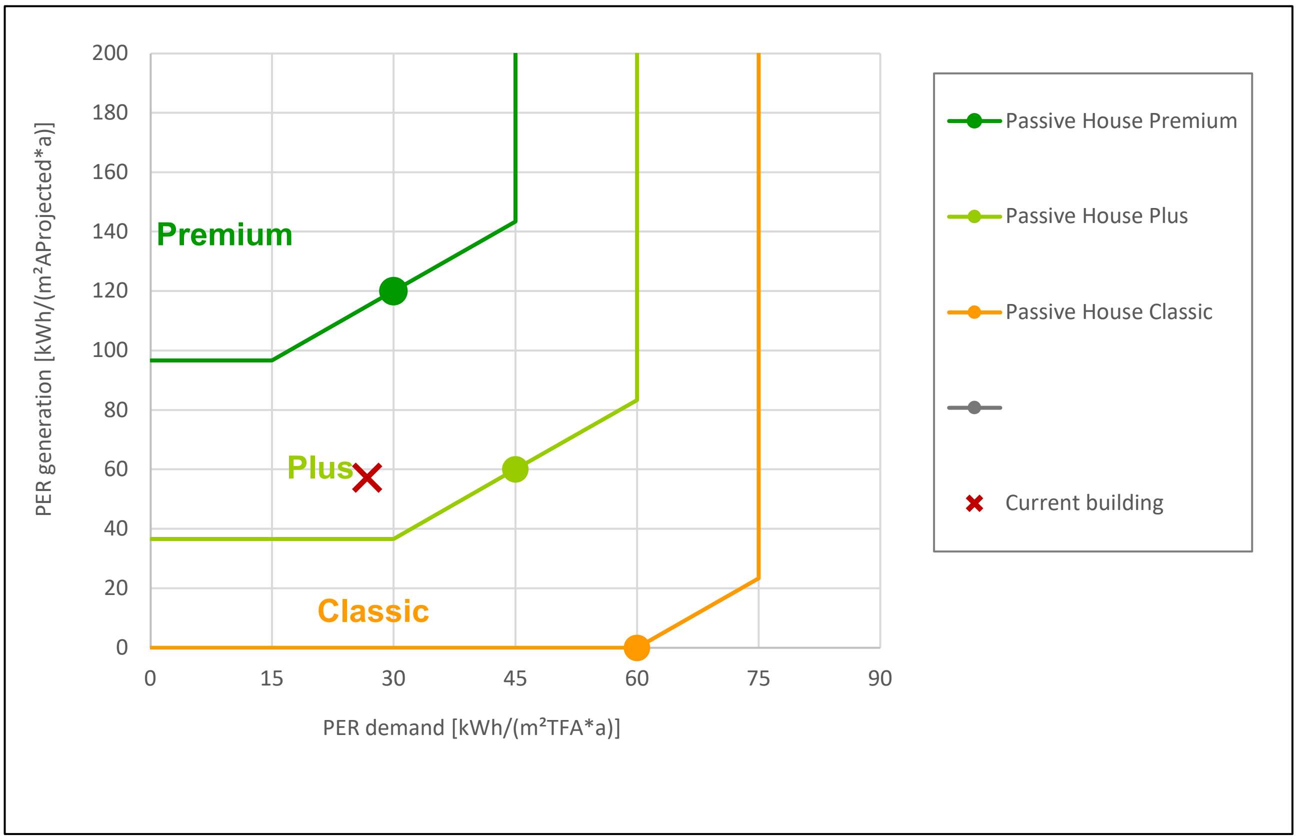
maxa design
Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449
info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 10/12

GRAPH 7 - PRIMARY ENERGY RENEWABLE (PER) DEMAND



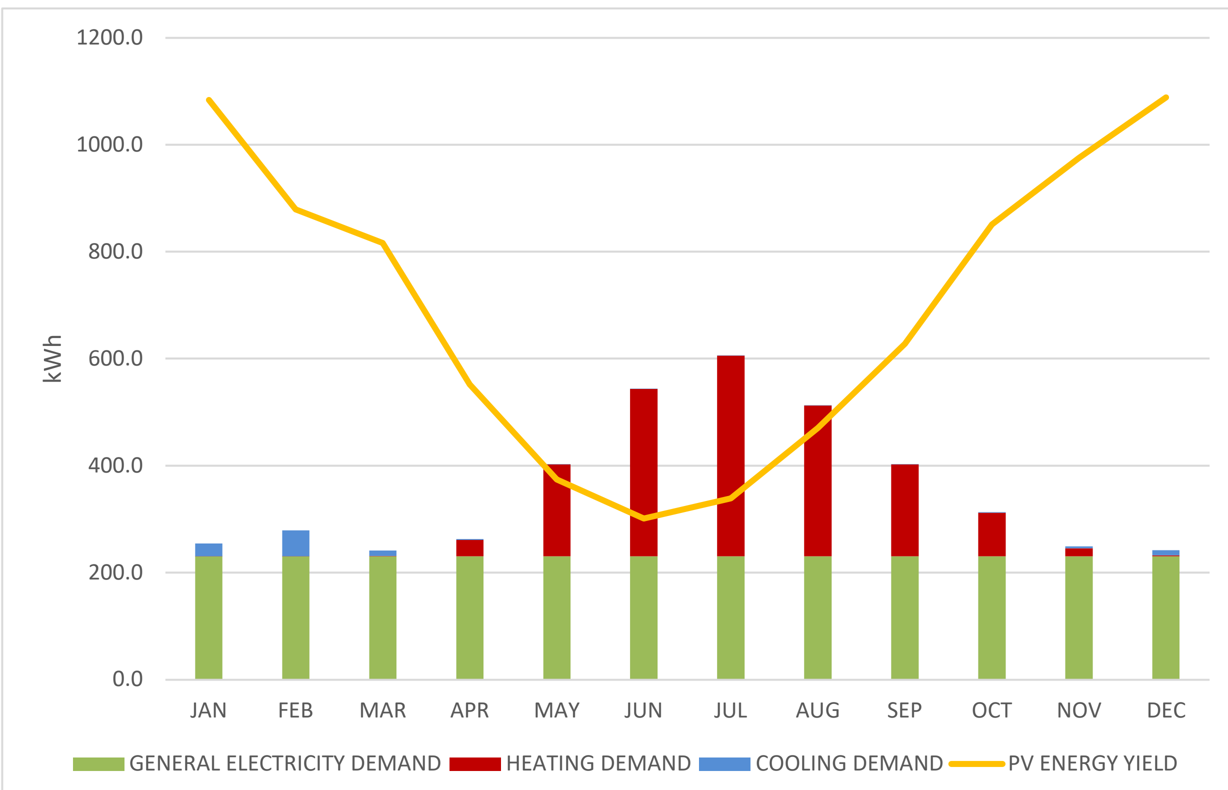
(i) The building currently achieves the Passivhaus Classic requirement. The project could be upgraded to the Passivhaus Plus or Premium standard by increasing the onsite energy generation. Please check the RECOMMENDATIONS section of this report for more information.
(ii) the current position marked in the graph simulates the impact of 20 Mono-si solar photovoltaic panels.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 11/12

GRAPH 8 - ENERGY DEMAND AND SOLAR PV ENERGY GENERATION



maxa design
Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449
info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RESULTS 12/12

TABLE 06 – ANALYSYS
(i) The thermal performance of the project was first calculated considering the following building configuration (i) 240 mm timber floor structure with R5.0 insulation, (ii) 140mm timber wall frame with R4.0 insulation and (iii) ceiling trusses with R6.0 insulation. With this configuration the proposed residence was not able to meet the heating requirement of the Passivhaus standard. (ii) The model was optimized: R1.0 wall insulation was inserted in the wall service cavity, the floor structure was increased to 300 mm to accomodate 2xR4.0 (2x140mm) wall insulation, and the ceiling insulation was increased to R8.0 (2x140mm). With this configuration the proposed residence just meets the Passivhaus Standard. (iii) Further optimization actions are recommended in order to create a buffer from the Passivhaus heating limit, those options are listed in the recommendations section of this report. (iv) In the summer months, if the external conditions are favourable, it is essential to leave some of the windows open during the night to avoid overheating. Graph 5 shows that, if this window ventilation strategy is not applied, the occupants might experience some overheating. (v) Most of the windows on the north side are already protected from the summer solar radiation by eaves. However, there will be still some marginal benefits for the cooling performance if external shading devices are installed on the Windows 5, 10, 17, 18, 19, 20, 21 and 22.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 1/7

TABLE 07 – THERMAL PERFORMANCE OPTIMISATION - DATA						
		PASSIVHAUS BENCHMARK				
SCENARIO	DESCRIPTION	HEATING DEMAND	HEATING LOAD	COOLING DEMAND	COOLING LOAD	OVERHEAT
		kWh/m²a	W/m²	kWh/m²a	KW	%
0	As planned	17.56	12.41	1.10	3479	0.40%
1	Insulating wall service cavity R1.0	15.89	11.71	1.00	3380	0.40%
2	Increasing ceiling insulation to R8.0	15.23	11.42	0.90	3307	0.40%
3	Increasing floor insulation to R8.0	14.23	11.19	0.90	3321	0.40%
4	Narrowing windows 15, 16, 17 and 18 to 750mm and changing operable to fixed ratio in windows 19, 20, 21 and 22 to 2/3.	14.17	11.16	0.90	3310	0.40%
5	Changing all windows to triple glazed system, except north side windows	13.23	10.64	0.80	3137	0.30%
6	Changing all windows to Triple Glazed system	13.00	10.34	0.60	2958	0.10%
This report shows the thermal performance simulation of option 3 (marked in green).						

maxa design

Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449

info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 2/7

TABLE 08 – THERMAL PERFORMANCE OPTIMISATION - NOTES
(i) The results of the scenarios presented on table 07 are cumulative. For example, scenario 3 includes the results of scenario 1 and 2. (ii) The "as planned" scenario considers the following building configuration: (i) 240 mm timber floor structure with R5.0 insulation, (ii) 140mm timber wall frame with a R4.0 insulation and (iii) ceiling trusses with R6.0 insulation. With this configuration the proposed residence was not able to meet the heating requirement of the Passivhaus standard. (iii) Scenario 1-3 show the minimum necessary improvements to achieve the Passivhaus Benchmarks: adding R1.0 wall insulation to the service cavity, and increasing the floor insulation and ceiling insulation to R8.0. (iv) Considering that with scenario 3 the heating demand result is still very close to the Passivhaus limit, further improvements are necessary to create a safe margin for certification. Scenarios 4-6 are some of the possible optimization actions to be considered. (v) Scenarios 4 involves narrowing windows 15,16, 17 and 18 in order to reduce the glass area and its associated heat losses. It also considers a change in the ratio between the operable and fixed part of windows 19, 20, 21 and 22, so that the operable part (fitted with insect screens) is reduced. This change increases the solar gains by reducing the area of glass covered with insect screens (Operable windows are reduced from 0.75m to 0.6m, Fixed windows are increased from 0.75m to 0.9m, the total window size remais 1.5m). This scenario has marginal benefits (vi) Scenario 5 proposes upgrading the windows on the east, west and south of the proposed residence from double glzed to triple glazed systems. This option aims to reduce the heat losses from the windows, without compromising the winter solar radiation exposure. The north windows, with the exception of the sliding doors, remain as double glazed, so that the g-value remains unchanged. (vii) Scenario 6 proposes upgrading all windows to triple glazed system. Despite improving the general winter performance of the proposed residence, the performance gains from this scenario is marginal compared to scenario 5 due to the g-value reduction associated with the change from double glazed to triple glazed systems. (viii) Other potential optimization options to be considered: Changing colors of the north side to darker tones, increasing insulation in the ceiling and flooring areas that protude from the north side of the proposed residence and adding external blinds to windows 5, 10, 17, 18, 19, 20, 21 and 22.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 3/7

TABLE 09 – HEATING AND COOLING REQUIREMENTS			
IS AIR CONDITIONING REQUIRED FOR THE PROJECT?	YES		
TOTAL SIZE	4.5 kW		
LOCATION	Dining/Living and Rumpus		
HEATING AND COOLING LOADS			
PARAMETER	**UNIT**	**HEATING LOAD**	**COOLING LOAD**
RESULT	W	2543	3321
CAPACITY REQUIRED	W	3305	4317
SYSTEM SIZE	kW	3.5	4.5
RECOMMENDATIONS			
(i) To keep the internal temperature within the thermal comfort range, this project requires a total additional heating/cooling capacity of 4.5 kW. To avoid temperature stratification and considering the layout of the project, this total load can be distributed to 2 different split units in the following areas of the house: Dining/Living and Rumpus. Depending on how the occupants will use the proposed residence, the upstairs airconditioning unit could be installed in Bedroom 2 instead of in the Rumpus, considering that this bedroom is the most prone to overheating in summer (ii) These recommendations can be adapted depending on how the owners intend to use the dwelling and their perception of hot and cold temperatures.			

RECOMMENDATIONS 4/7

TABLE 10 – HEAT RECOVERY VENTILATION SYSTEM	
SELECTED UNIT	Zehnder Group Nederland B.V. - ComfoAir Q350 HRV, Comfort Vent Q350 HRV
TYPE OF UNIT	HRV
LOCATION	Inside thermal envelope
OUTDOOR AND EXHAUST AIR DUCTS	160 mm duct with 14 mm insulation
HRV EFFICIENCY	85%
RECOMMENDATIONS	
Not applicable	

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 5/7

TABLE 11 - DOMESTIC HOT WATER UNIT	
SELECTED UNIT	Sanden Eco Plus Hot Water Heat Pump System
LOCATION OF STORAGE TANK	Outside
STUB PIPES	20 mm
SEASONAL PERFORMANCE FACTOR	15.87
RECOMMENDATIONS	
Not applicable	

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 6/7

TABLE 12 – CEILING FANS		
ROOM	**QTY**	**SIZE (MM)**
DINING/LIVING	2	1400-1800 mm
BEDROOM 1	1	1400 mm
BEDROOM 2	1	1400 mm
BEDROOM 3	1	1400 mm
BEDROOM 4	1	1400 mm
BEDROOM 5	1	1400 mm
STUDY	1	1400 mm

RECOMMENDATIONS

Under the Passivhaus Standard, the thermal comfort is considered taking in consideration the internal temperature and the relative air humidity inside the house. Therefore, the inclusion of ceiling fans is not considered as a variable affecting the thermal performance of the building. However, ceiling fans can be very effective in improving the perceived thermal comfort in the cooling period, as they can be used as an aid to flush out warm air from inside the house and, at the same time, reduce the perceived temperature for occupants by increasing the air movement inside the building.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

RECOMMENDATIONS 7/7

TABLE 13 – SOLAR PANELS					
			UNIT		VALUE
SOLAR PANELS HOSTING CAPACITY	TOTAL AREA		m²		134.1
	USEFUL AREA (-30%)		m²		93.87
	PROJECTED BUILDING FOOTPRINT		m²		146.00
PER GENERATION			PH STANDARD		
	UNIT	MAX	CLASSIC	PLUS	PREMIUM
NUMBER OF PV MODULES	-	51	0	13	41
ANNUAL ELECTRICITY YIELD	kWH/a	21315	0	5433	17136
PER GENERATION	kWH/ m²a	146	0	37	117
RECOMMENDATIONS					
These numbers are an indicative estimation of the solar generation potential for the project, using default values for nominal power and dimensions for the PV modules, and disregarding angle exposures and shading of the solar system. To get a more accurate estimation of the potential energy yield for the project is recommend to consult a PV solar system specialist.					

maxa design

Level 1, 75 Railway Road
Blackburn Victoria, 3130
T 03 9013 0449

info@maxadesign.com.au
maxadesign.com.au
ABN: 51 109 217 138

PASSIVHAUS PRELIMINARY REPORT

[redacted]

PHPP ASSUMPTIONS 1/4

TABLE 14 – PHPP ASSUMPTIONS	
AIRTIGHTNESS	Air change rate from pressurisation test: 0.6 1/h
THERMAL BRIDGES	Only window installation thermal bridges were considered in the thermal simulation.
SHADING	Trees, neighbouring structures and building have been considered in DesignPH shading analysis. No variable shading devices were considered in this calculation. However, they are suggested as an optimisation option in the Recommendations Section.
WINDOW FRAMES	KOMMERLING C70 GOLD SYSTEM - FRAME 7507/REINFORCEMT 677 24mm for Fixed, Tilt and Turn and Hinged doors and KOMMERLING PREMIDOOR76 for the sliding doors
GLAZING	Double Glazed Viridian LightBridge - BLUE SKY for Fixed, Tilt and Turn and Hinged doors and Triple glazed 6/12A/6 - BLUE SKY for sliding doors
VENTILATION UNIT	s03-Zehnder Group Nederland B.V. - ComfoAir Q350 HRV, Comfort Vent Q350 HRV
DOMESTIC HOT WATER UNIT	Sanden Eco Plus Hot Water Heat Pump System
HEATING/COOLING SYSTEM	Standard inverter split unit(s)
SOLAR PANELS	20x Mono-si solar panels were considered in the simulation
ELECTRICAL EQUIPMENT	Combined refrigerator-freezer, electric cooking appliances, cold water connection dishwasher, cold-water connection washing machine, condensation dryer, LED lights with 110lm/W efficacy, other electronic equipment (TV, Laptop, Telephone, Router and other small devices). In-floor heating system electricity demand was not considered in the analysis.

PASSIVHAUS PRELIMINARY REPORT

[redacted]

PHPP ASSUMPTIONS 2/4

TABLE 15 – BUILDING ASSEMBLIES (1/2)		
WT1- 140 TIMBER STUD + R4.0 - IRONSTONE	PLYWOOD	12
	KNAUF R4.0 WALL BATTS	140
	KNAUF R1.3 ACOUSTIC BATTS (COMPRESSED-R1.0)	45
	PLASTERBOARD	10
WT2 - 140 TIMBER STUD + R4.0 - DUNE	PLYWOOD	12
	KNAUF R4.0 WALL BATTS	140
	KNAUF R1.3 ACOUSTIC BATTS (COMPRESSED-R1.0)	45
	PLASTERBOARD	10
WT3 - 140 TIMBER STID + R4.0 - BLACKBUTT	PLYWOOD	12
	KNAUF R4.0 WALL BATTS	140
	KNAUF R1.3 ACOUSTIC BATTS (COMPRESSED-R1.0)	45
	PLASTERBOARD	10
FT1 - 300 LVL JOIST + R8.0	KNAUF R4.0 CEILING BATTS	140
	KNAUF R4.0 CEILING BATTS	140
	AIR LAYER	19
	STRUCTURAL FLORING	19
	ENGINEERED HARDWOOD	14
CL1 - TIMBER TRUSSES + R8.0	KNAUF R4.0 WALL BATT	140
	KNAUF R4.0 WALL BATT	140
	SERVICE CAVITY	140
	PLASTERBOARD	10
CL2 - 240 LVL JOIST + R5.0	KNAUF 5.0 CEILING BATTS	210
	AIR LAYER	30
	SERVICE CAVITY	168
	PLASTERBOARD	10
FT2 - 240 LVL JOIST + R5.0 - OUTDOOR AIR	KNAUF R5.0 CEILING BATTS	210
	AIR LAYER	30
	STRUCTURAL FLORING	19
	ENGINEERED HARDWOOD	14

PASSIVHAUS PRELIMINARY REPORT

[redacted]

PHPP ASSUMPTIONS 3/4

TABLE 17 – PHPP LIMITATIONS
This analysis is intended to inform the results of the preliminary Passive House performance assessment for this project. The proposed home was modelled using DesignPH plugin with SketchUp, followed by analysis using the Passivhaus Planning Package (PHPP) modelling tool. The PHPP model was developed based on the information listed above, from which the building's predicted energy consumption has been determined. Computer building simulation provides an estimate of building performance. This estimate is based on a necessarily simplified and idealised version of the building that does not and cannot fully represent all the intricacies of the building once built. As a result, simulation results only represent an interpretation of the potential performance of the building. No guarantee or warranty of building performance in practice can be based on simulation results alone. The accuracy of the PHPP has been tested thoroughly by the Passive House Institute both against dynamic simulation tools as well as thorough broad scale longitudinal post occupancy evaluation. The PHPP is constantly refined to improve accuracy of the outputs. The Passive House certification process requires several fixed assumptions about operation of a completed building, and these may not reflect actual usage of the building.