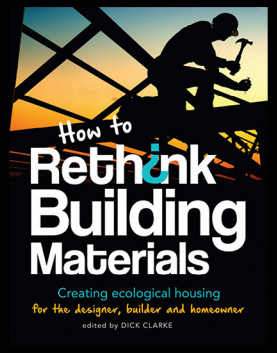
Is Passive House relevant for Sydney?

Andy Marlow

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017



Envirotecture

Passive House EnerPHit requirements (Sydney)

- 20-25ºC year round
- 1 ACH/50Pa
- Heating 20kWh/m2/yr
- Cooling 15kWh/m2/yr
- Total energy use 60kWh/m2/yr

Passive House Institute

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

Perceptions

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

102

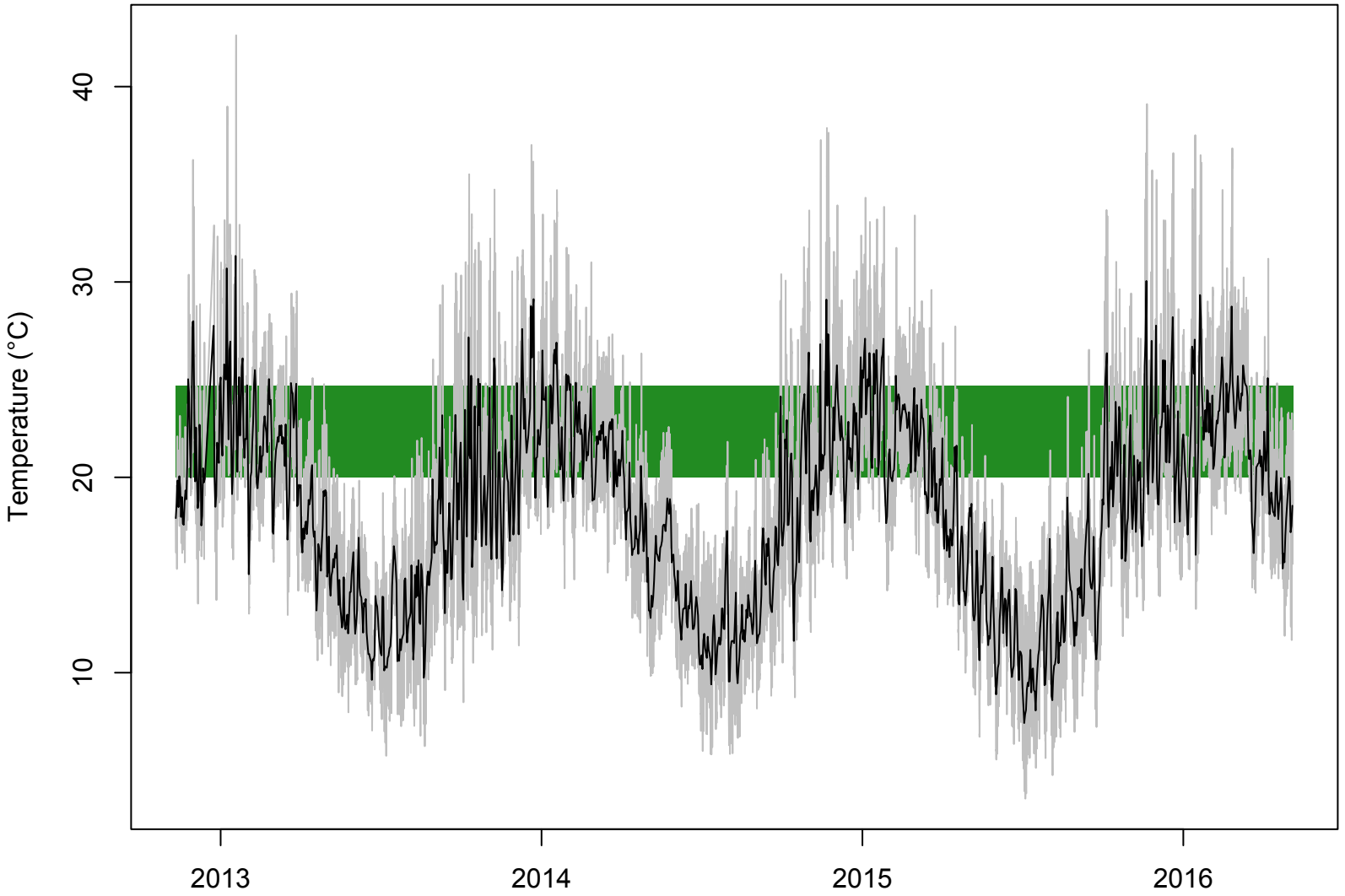
Super efficient terrace housing?

Floor area (m2)	74
Electricity (kWh/day)	6
Gas (MJ/day)	15.4
Gas (kWh/day)	4.2
Total energy (kWh/day)	10.2
Total energy (kWh/m2/yr)	50

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

Thermal Comfort



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

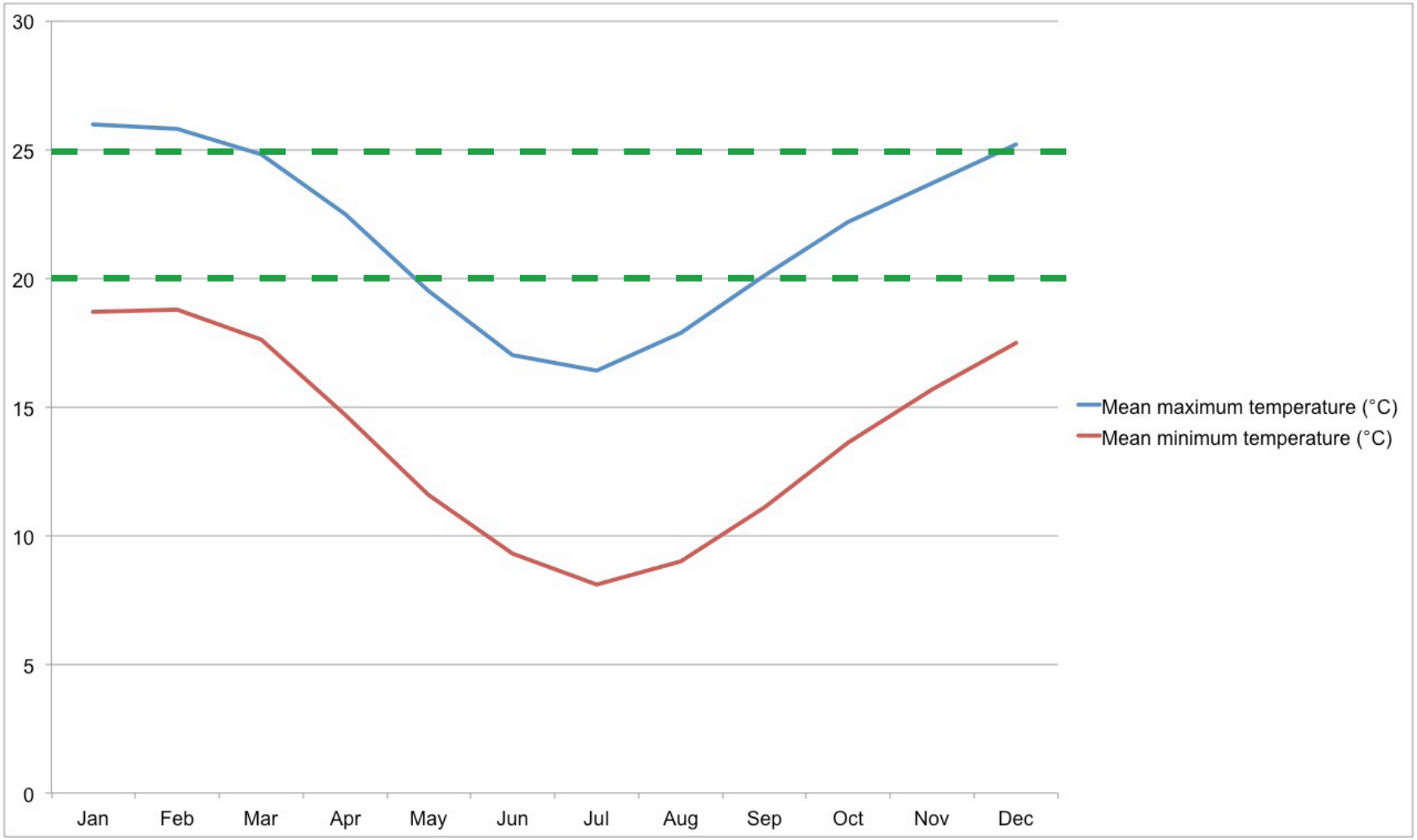
Low Energy – Low Comfort

	Select the active variant here >>>>>>>	1-EXISTING BUILDING
	Units	1
Heating demand	kWh/(m²a)	**52.4**
Heating load	W/m²	**68.5**
Cooling & dehum. demand	kWh/(m²a)	**14.0**
Cooling load	W/m²	**44.0**
Frequency of overheating (> 25 °C)	%	
PER demand	kWh/(m²a)	**61.0**
EnerPHit Classic?	yes / no	**no**

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

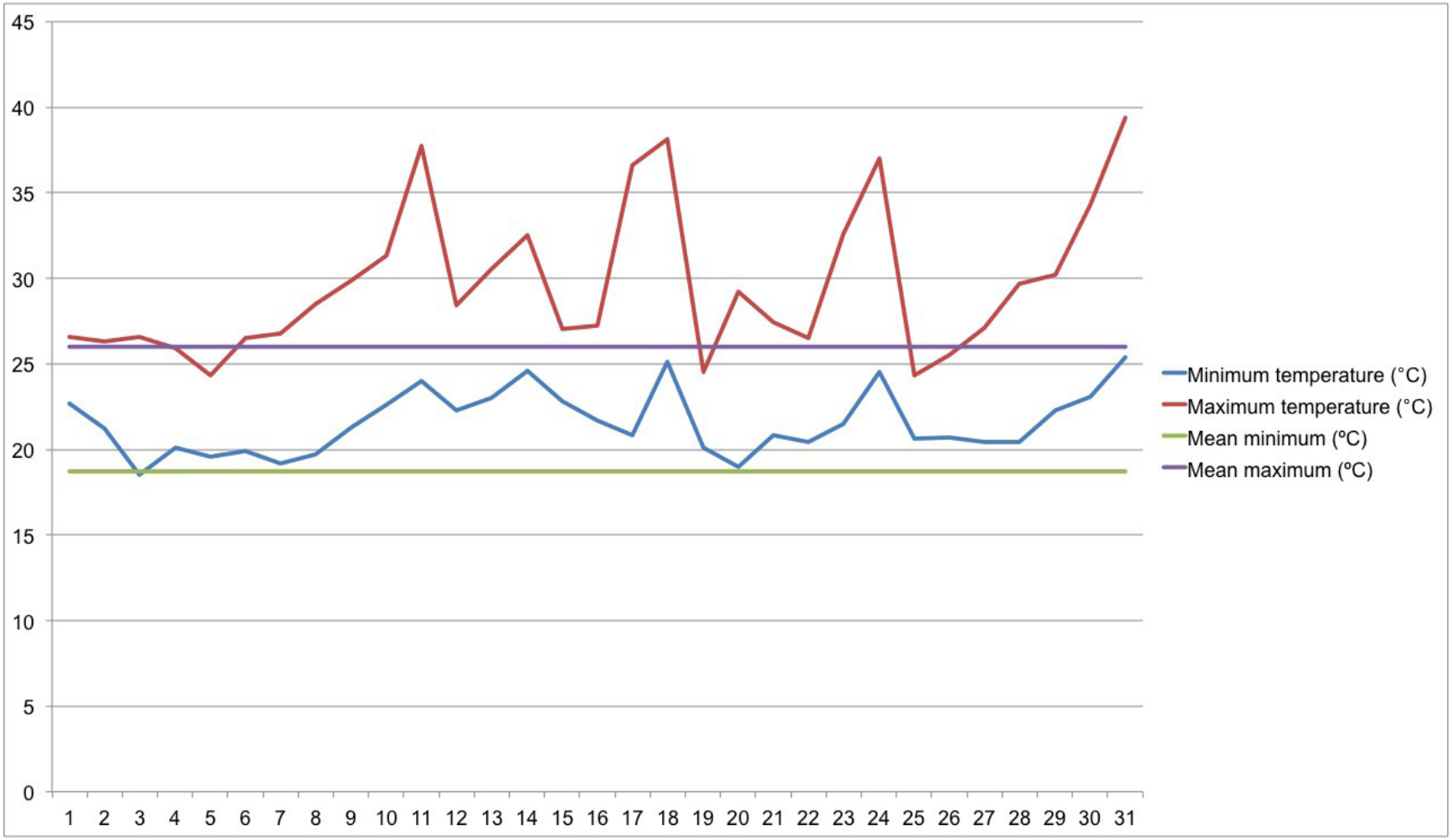
How comfortable?



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

How comfortable?



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

0 1 2 3 4 5
SCALE (METRES)

Land Size: 120sqm

N

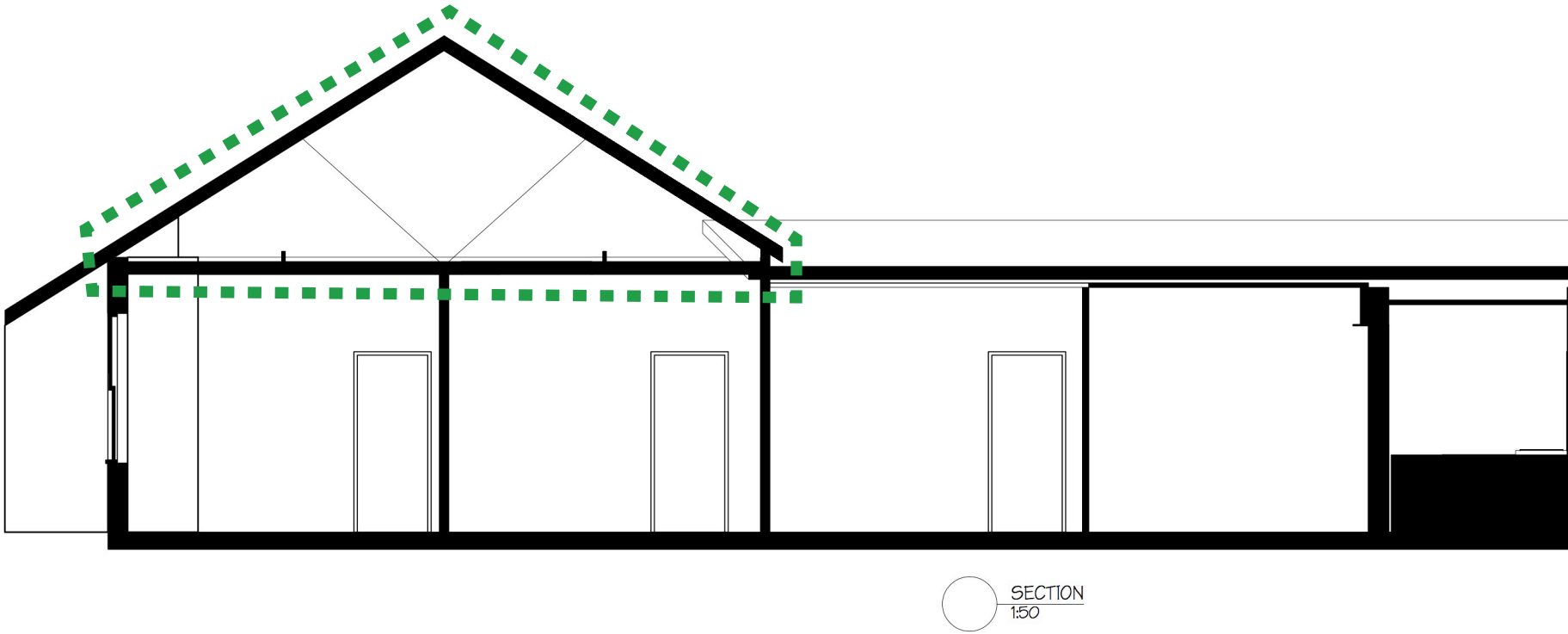
This entire document has been prepared as a guide only. Neither the agent, Cheapen Pty Ltd trading as LJ Hooker Newtown or the vendor give any warranty as to its accuracy and all parties must rely on their own enquires. Please refer to the contract for exact square metreage.

- 1917 construction
- poor solar access
- adjoining neighbours
- assumed 20 ACH

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

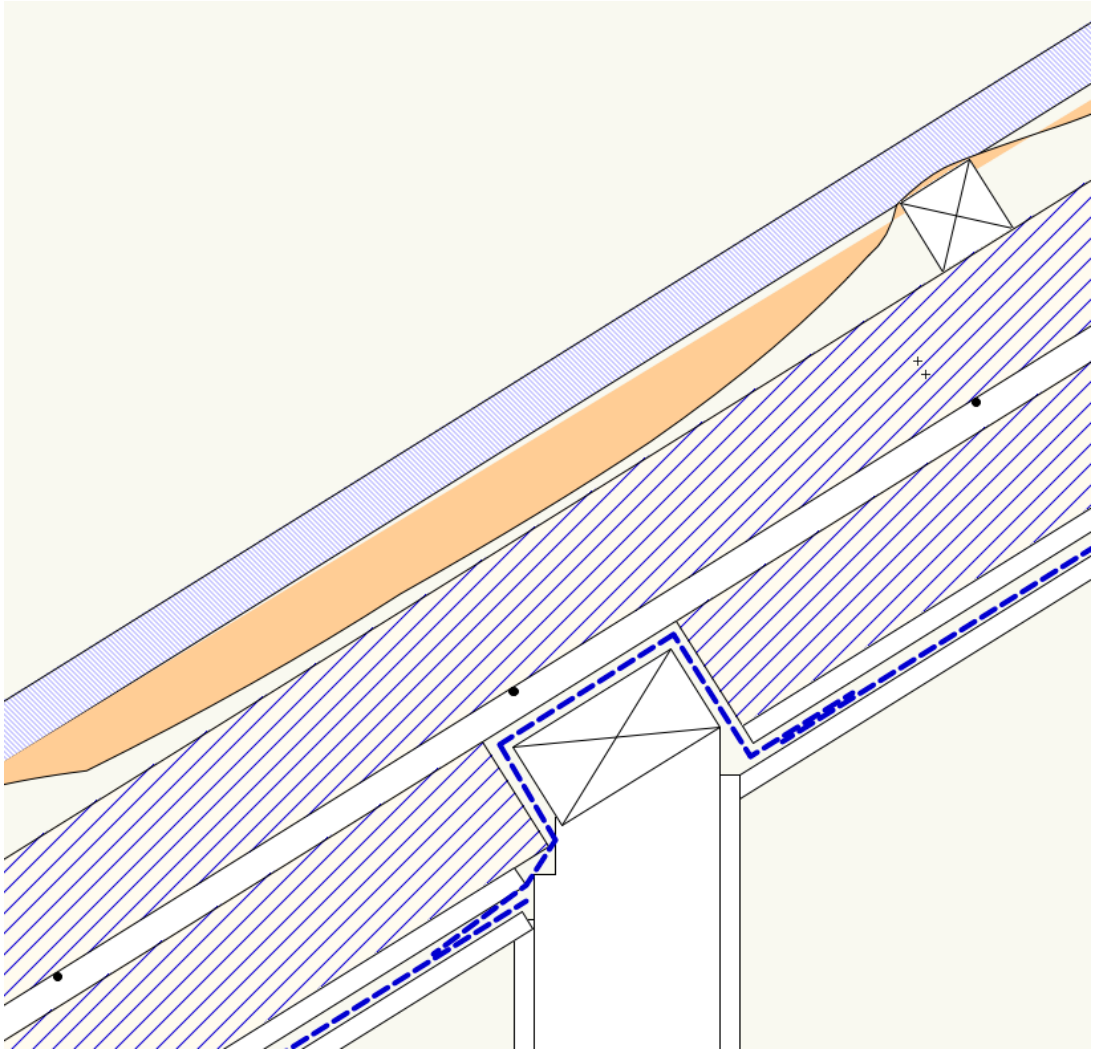
EnerPHit Step-by-Step Retrofit



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Attic conversion



- remove whirly birds
- existing roof sheets
- existing anticon
- existing structure
- 50mm K10
- air gap
- 50mm K10
- batten
- air tight membrane
- lining

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

Attic conversion

	Select the active variant here >>>>>>>	Active: 2-ATTIC CONVERSION	EXISTING BUILDING
	Units	2	1
Heating demand	kWh/(m²a)	39.3	52.4
Heating load	W/m²	55.1	68.5
Cooling & dehum. demand	kWh/(m²a)	12.4	14.0
Cooling load	W/m²	37.6	44.0
Frequency of overheating (> 25 °C)	%		
PER demand	kWh/(m²a)	53.6	61.0
EnerPHit Classic?	yes / no	no	no
		-	-
		-	-
Frequency of overheating:		16.5%	18.1%
Frequency of exceeded humidity:		14.3%	13.7%

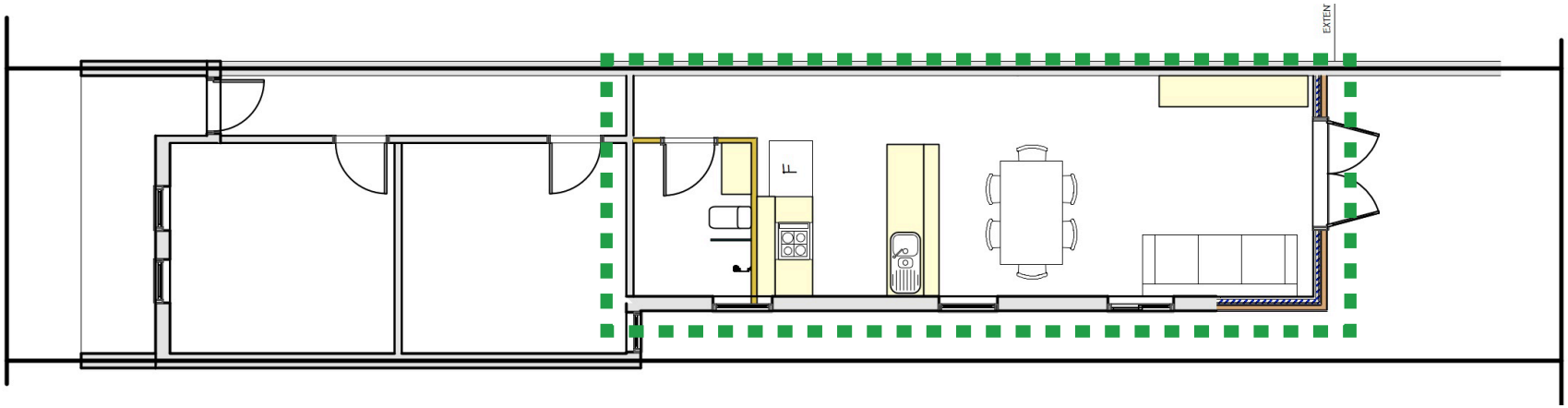
- roof insulation
- gable wall insulation
- assumed 15ACH

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

The Addition

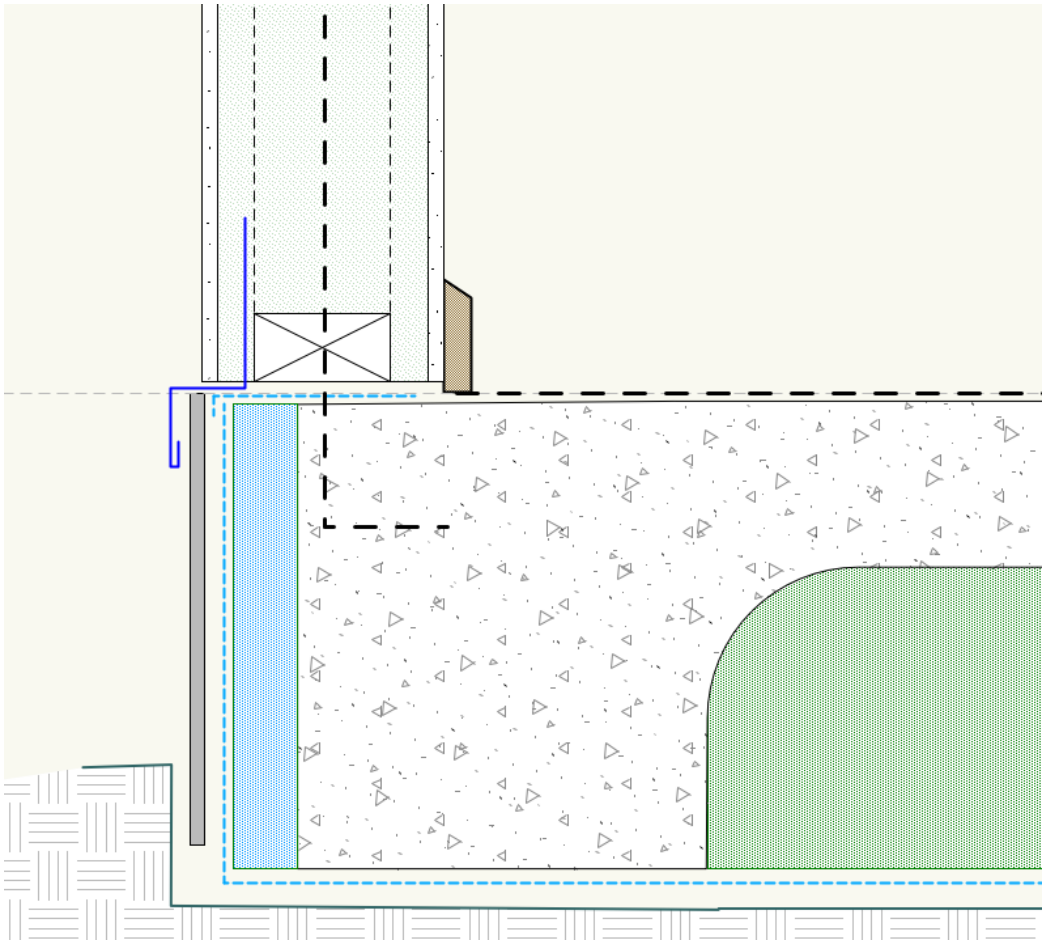
- building extended 1.8m
- indoor bathroom!



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

The Addition



- new walls - hempcrete
- 140mm thick
- 90mm embedded

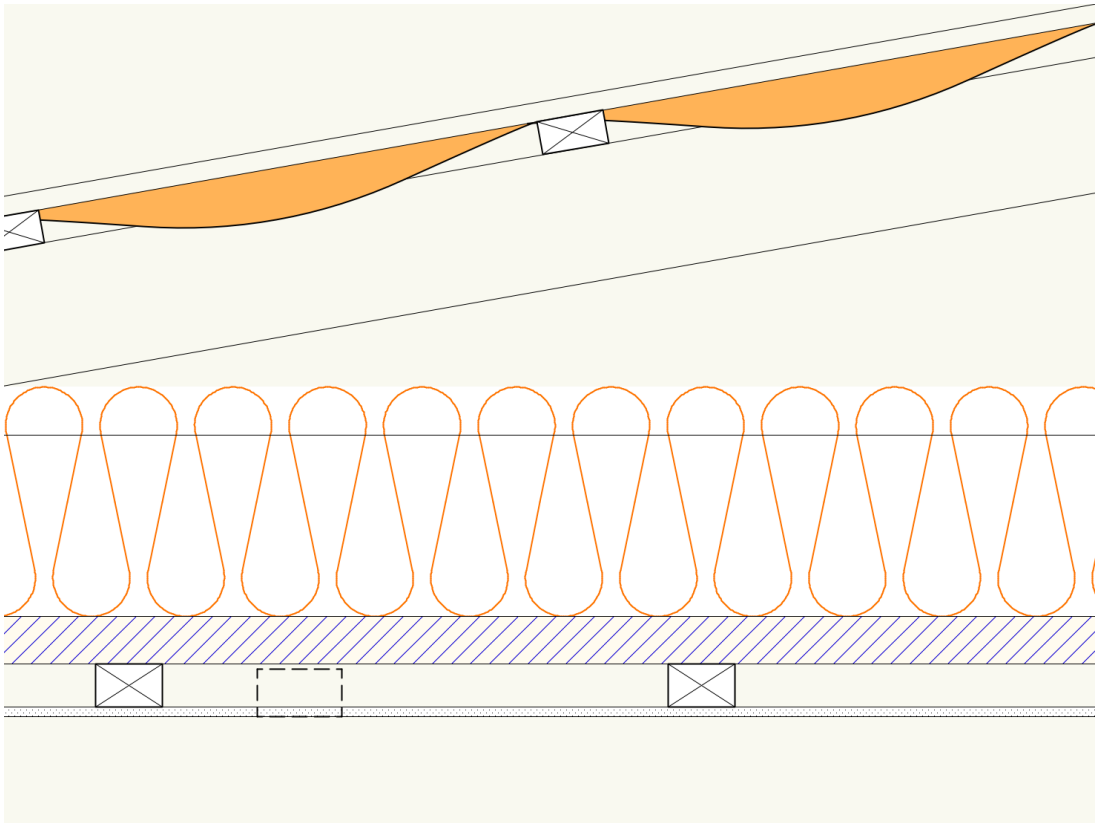
frame

- slab edge insulation
- render for air tightness

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

The Addition



- anticon
- R4.5 polyester
- 50mm K10
- air gap (lights)
- lining

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

The Addition

	Select the active variant here >>>>>>>	3-REAR RENOVATION	EXISTING BUILDING	ATTIC CONVERSION
	Units	3	1	2
Heating demand	kWh/(m²a)	10.0	52.4	39.3
Heating load	W/m²	24.3	68.5	55.1
Cooling & dehum. demand	kWh/(m²a)	9.2	14.0	12.4
Cooling load	W/m²	25.6	44.0	37.6
Frequency of overheating (> 25 °C)	%			
PER demand	kWh/(m²a)	45.9	61.0	53.6
EnerPHit Classic?	yes / no	no	no	no
		-	-	-
		-	-	-
Frequency of overheating:		12.2%	18.1%	16.5%
Frequency of exceeded humidity:		14.5%	13.7%	14.3%
Building element towards neighbour		373.9	625.1	488.0

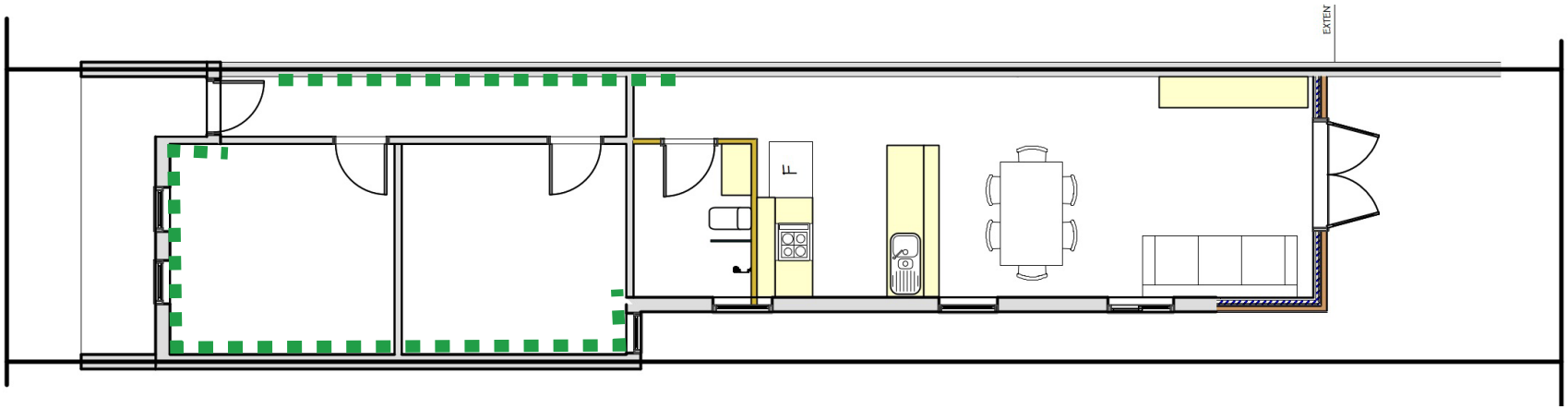
- new concrete slab
- new roof build up w K10 to ceiling
- Hempcrete walls
- internal insulation to existing walls (25mm)
- assumed 4 ACH
- MHRV

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Fixing the Old

- 25mm internal insulation
- services cavity
- new lining
- windows



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Fixing the Old

Select the active variant here >>>>>>>		4-INT INSULATION TO FRONT OF HOUSE	EXISTING BUILDING	ATTIC CONVERSION	REAR RENOVATION
	Units	4	1	2	3
Heating demand	kWh/(m²a)	3.7	52.4	39.3	10.0
Heating load	W/m²	14.6	68.5	55.1	24.3
Cooling & dehum. demand	kWh/(m²a)	7.9	14.0	12.4	9.2
Cooling load	W/m²	19.4	44.0	37.6	25.6
Frequency of overheating (> 25 °C)	%				
PER demand	kWh/(m²a)	43.5	61.0	53.6	45.9
EnerPHit Classic?	yes / no	yes	no	no	no
		-	-	-	-
		-	-	-	-
Frequency of overheating:		10.5%	18.1%	16.5%	12.2%
Frequency of exceeded humidity:		14.7%	13.7%	14.3%	14.5%
Building element towards neighbour		164.4	625.1	488.0	373.9

- 25mm internal insulation
- services cavity
- new lining
- windows

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Love thy neighbours

EnerPHit with PHPP Version 9.6a

Cooling load

#

Building type:	TERRACE							Treated floor area A_{TFA}:	76.4	m²		Spec. capacity:	60	Wh/(m²K)
								Building volume:	218	m³		Nominal humidity:	12.0	g/kg
								Interior temperature:	25	°C		Internal humidity sources:	2.6	g/(m²h)

Temperature:	Outdoor air		Dew point		Sky		Radiation:	North	East	South	West	Horizontal	
Weather 1:	30.1	°C	20.7	°C		°C		70	180	225	195	305	W/m²
Weather 2:	28.3	°C	22.0	°C		°C		110	215	150	225	375	W/m²
Ground design temp.	24.2	°C		SHX	19.3	°C							

Building assembly	Temperature zone	Area m²		U-Value W/(m²K)		Factor always 1 (except "X")		TempDiff 1 K		TempDiff 2 K		P_T 1 W		P_T 2 W
External wall - Ambient	A	53.0	*	1.035	*	1.00	*	5.1	or	3.3	=	280	or	181
External wall - Ground	B		*		*	1.00	*	-0.8	or	-0.8	=		or	
Roof/Ceiling - Ambient	A	96.8	*	0.133	*	1.00	*	5.1	or	3.3	=	65	or	42
Floor slab / Basement ceiling	B	82.7	*	3.293	*	1.00	*	-0.8	or	-0.8	=	-208	or	-208
	A		*		*	1.00	*	5.1	or	3.3	=		or	
	A		*		*	1.00	*	5.1	or	3.3	=		or	
	X		*		*	0.75	*	5.1	or	3.3	=		or	
Windows	A	15.9	*	3.287	*	1.00	*	5.1	or	3.3	=	267	or	173
Exterior door	A		*		*	1.00	*	5.1	or	3.3	=		or	
Exterior TB (length/m)	A		*		*	1.00	*	5.1	or	3.3	=		or	
Perimeter TB (length/m)	P		*		*	1.00	*	-0.8	or	-0.8	=		or	
Ground TB (length/m)	B		*		*	1.00	*	-0.8	or	-0.8	=		or	
Building element towards neighbour	I	102.9	*	1.211	*	1.00	*	3.0	or	3.0	=	374	or	374
Radiation correction outdoor air				$L_{ambient}$ W/K		-4.3	*	5.1	or	3.3	=	-22	or	-14
Radiation correction sky				L_{Sky} W/K		3.1	*		or		=		or	
Transmission heat load P_T										Total	=	**756**	or	**548**

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

Opening the Windows

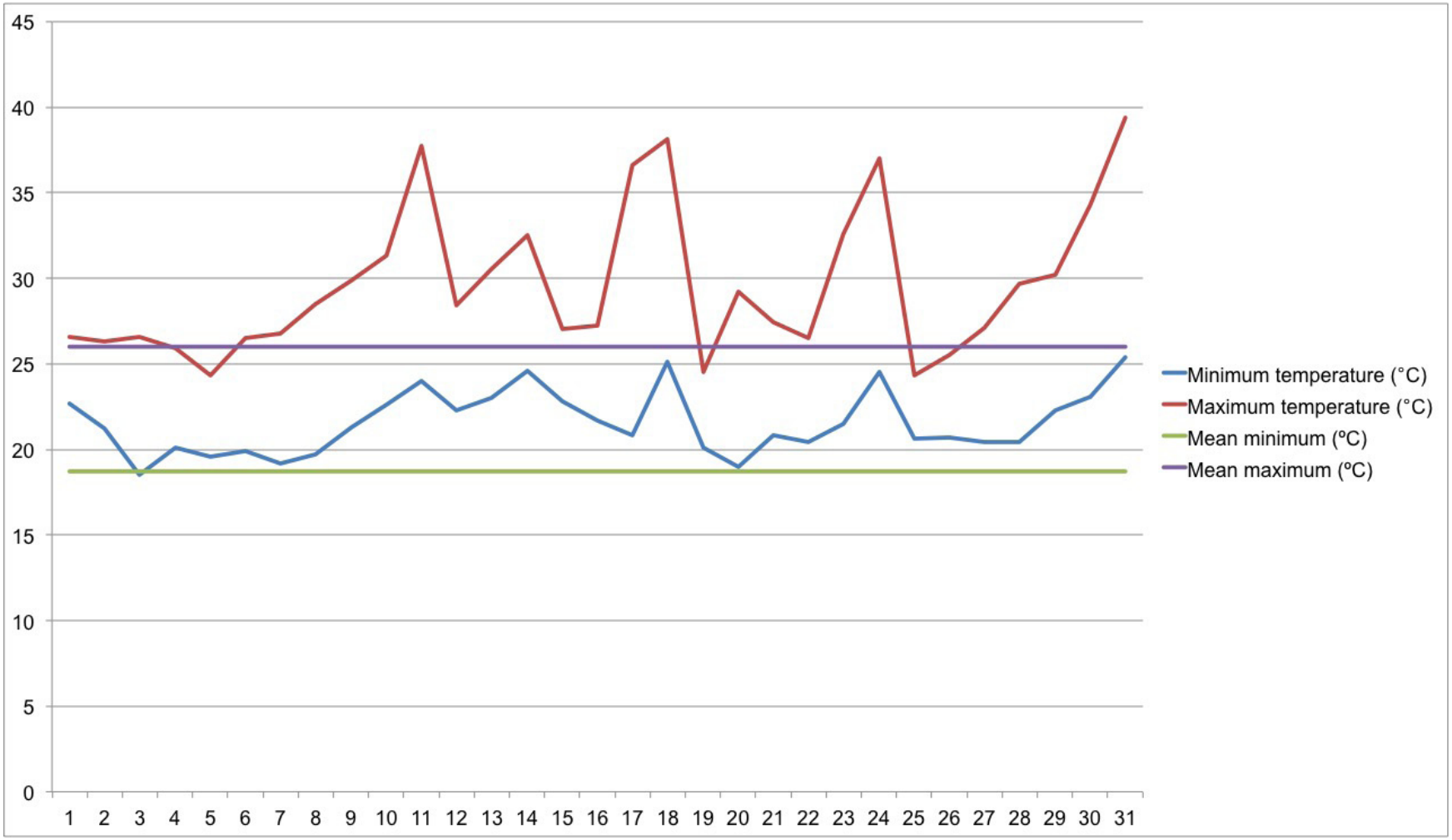
	Select the active variant here >>>>>>>	5-IMPROVE NIGHT VENT	EXISTING BUILDING	ATTIC CONVERSION	REAR RENOVATION	INT INSULATION TO FRONT OF HOUSE
	Units	5	1	2	3	4
Heating demand	kWh/(m²a)	3.7	52.4	39.3	10.0	3.7
Heating load	W/m²	14.6	68.5	55.1	24.3	14.6
Cooling & dehum. demand	kWh/(m²a)	6.8	14.0	12.4	9.2	7.9
Cooling load	W/m²	19.4	44.0	37.6	25.6	19.4
Frequency of overheating (> 25 °C)	%					
PER demand	kWh/(m²a)	43.3	61.0	53.6	45.9	43.5
EnerPHit Classic?	yes / no	yes	no	no	no	yes
		-	-	-	-	-
		-	-	-	-	-
Frequency of overheating:		9.6%	18.1%	16.5%	12.2%	10.5%
Frequency of exceeded humidity:		12.2%	13.7%	14.3%	14.5%	14.7%
Building element towards neighbour		164.4	625.1	488.0	373.9	164.4

- night time cooling increased to 3 ACH

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

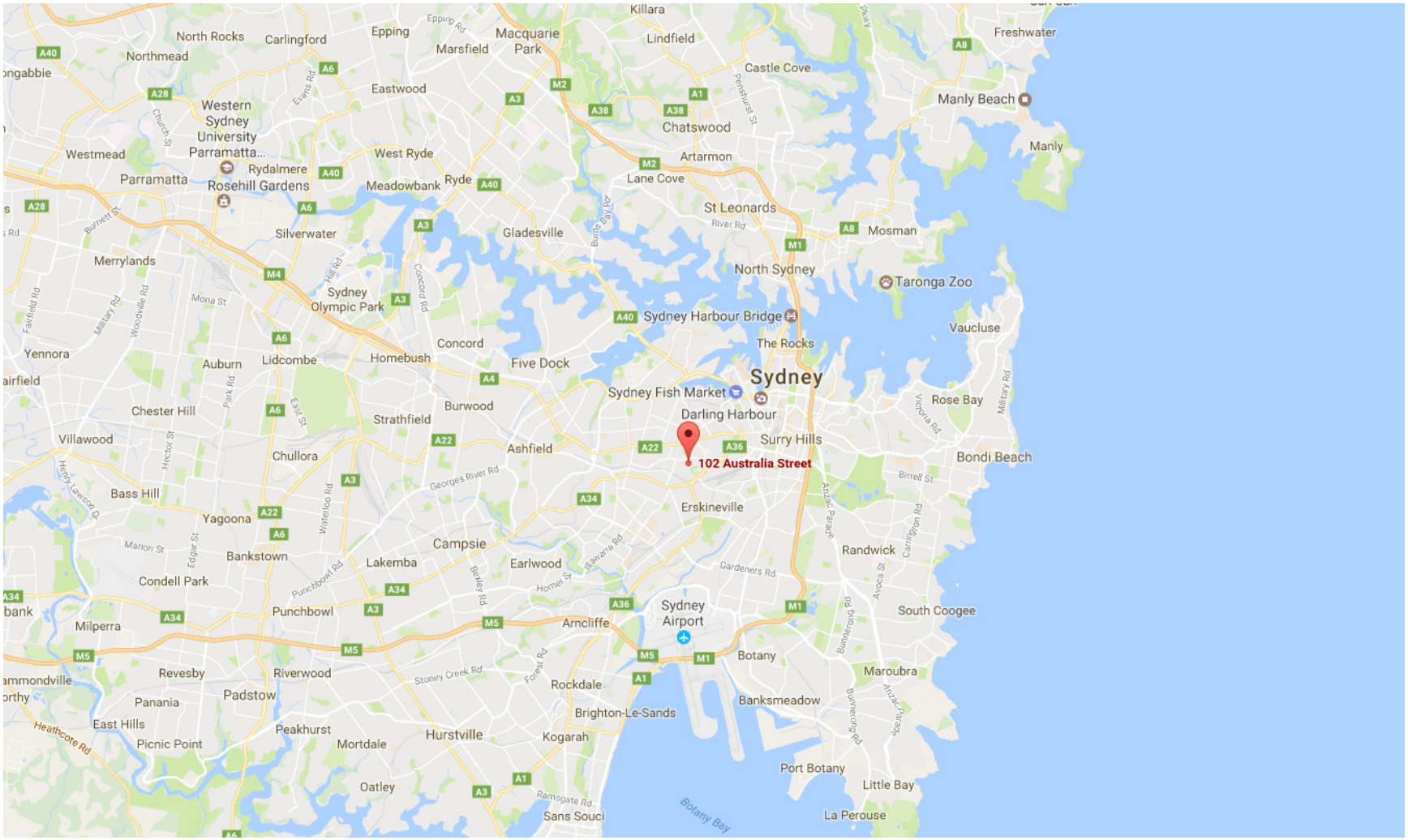
January 2017



Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Location, location, location

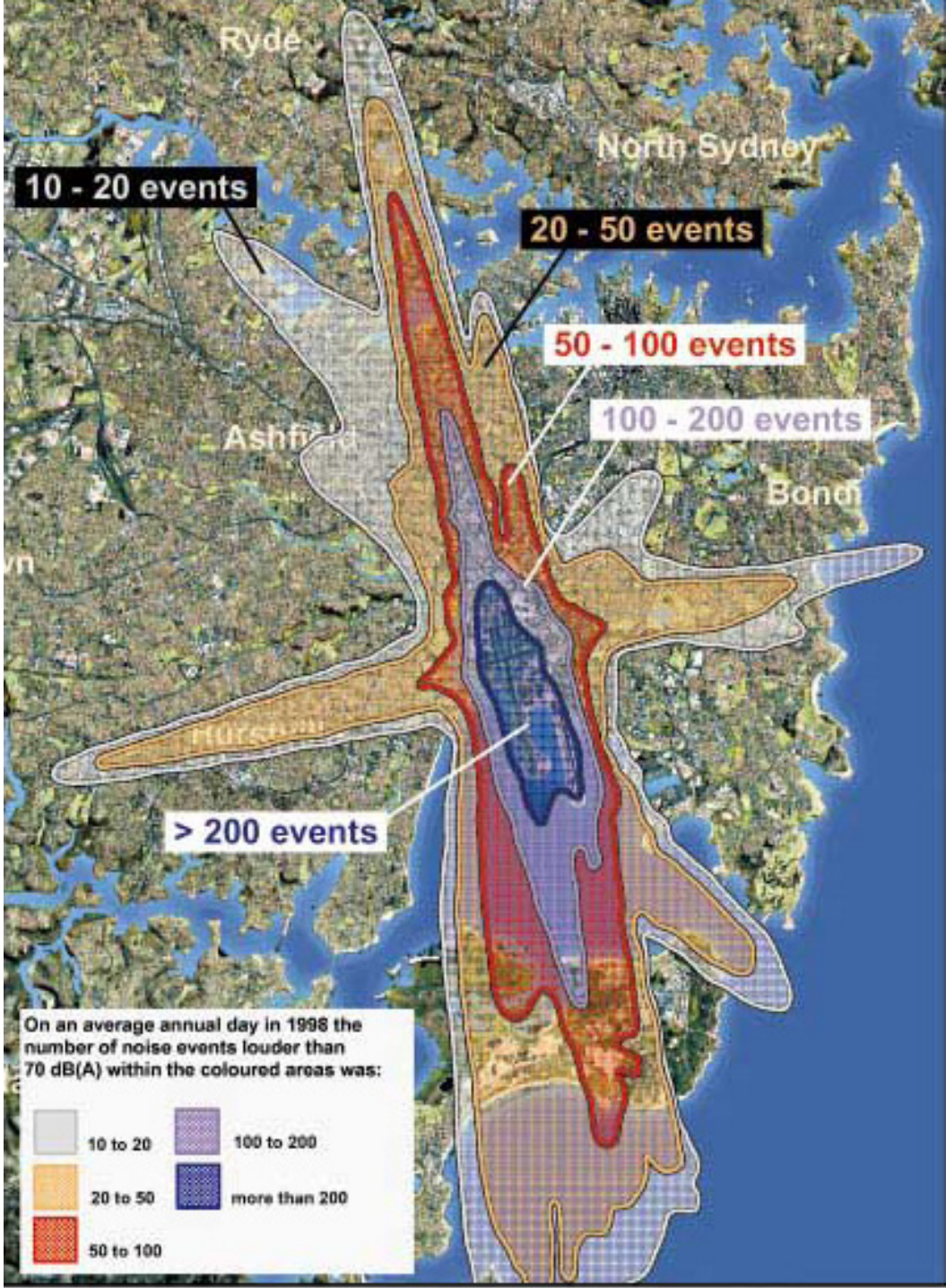


Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017

Acoustics

Noise Level dB(A)	Description
120	Threshold of pain
95	Pneumatic drill (un-silenced at 7m distance)
83	Heavy diesel lorry (40 km/h at 7m distance)
81	Modern twin-engine jet (at take-off at 152m distance)
70	Passenger car (60 km/h at 7m distance)
60	Office environment
50	Ordinary conversation
40	Library reading room
35	Quiet bedroom
0	Threshold of hearing



Envirotecture

AS2021

F3.3.6 *Ventilation*

An acoustically insulated building must be kept virtually air tight to exclude external noise. Therefore mechanical ventilation or airconditioning is needed to provide fresh air and to control odours. Requirements for acceptable indoor-air quality are given in AS 1668.2. Recommended design sound levels for different areas of occupancy in buildings are given in AS/NZS 2107.

NOTES:

1 The requirements of AS 1668 should be viewed as applying also to Class 1 buildings as defined by the National Construction Code.

From the predicted aircraft noise levels and recommended indoor design objectives (*Table 5*), *Table 7* presents the aircraft noise reduction (ANR) required with windows/doors in the closed position. If windows/doors are open, the ANR provided by the building would be significantly reduced.

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION MEMBER | 2017

Passive House & Sydney

- climate means minimal increases in insulation over current code
- current homes low energy - low comfort
- well suited to dense environments with poor solar access
- windows still a useful cooling strategy
- makes the Inner West liveable
- additional benefit en masse for terrace housing & units

Envirotecture

AUSTRALIAN PASSIVE HOUSE ASSOCIATION
MEMBER | 2017