Report for CSR Hebel

Impact of wall and floor options on BASIX compliance

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1 Executive Summary

This report examined the thermal performance of three different wall and three different floor systems (including the Hebel PowerWall and the Hebel PowerFloor systems). Each wall system was simulated with each floor system in AccuRate within three climate zones: Sydney Inner West (Homebush Bay), Sydney Outer West (Penrith) and finally Canberra (Queanbeyan), Blue Mountains and Central Highlands. For each floor/wall scenario, and each climate zone, modifications were made to reach estimated BASIX thermal comfort thresholds (estimated as AccuRate star ratings). Differing amounts of double glazing or external louvres were added until all the scenarios had achieved the same AccuRate thermal rating.

The results of the thermal modelling showed unequivocally the thermal advantages of Hebel PowerFloor and Hebel PowerWall. The extra thermal resistance of the Hebel products tended to produce lower heating loads and usually lower cooling loads than the other construction systems. These reduced thermal loads will result in lower requirements for wall and/or floor insulation as well less other add-ons such as double glazing or external louvres.

For the wall systems simulated, PowerWall was shown to produce lower heating loads than both brick veneer and fibre cement in all three climate zones tested due to its superior thermal resistance. Overall, PowerWall outperformed the brick veneer and clearly outperformed the fibre cement. This was particularly noticeable for the two storey house where up to 10.9m2 of double glazing was required for the Brick Veneer to match the AccuRate rating of the PowerPanel. For the fibre cement, this was also more noticeable for the two storey house, where up to 46.5m2 of double glazing or 34.6m2 of external louvres were required to match the AccuRate rating of the PowerPanel.

For the floor systems analysed, it was evident that PowerFloor in the single storey house provides thermal performance midway between a timber floor and a slab. In a two storey house use of PowerFloor on the ground and upper floors provides comparable performance to slab floors. Overall, the PowerFloor outperformed the timber floor, particularly from a heating perspective. The overall difference was particularly evident for the case of the two storey house where up to 27.1m2 of double glazing or 12.2m2 of external louvres were required to match the AccuRate rating of the PowerFloor, depending on the climate zone. The slab on ground option is particularly well-suited to the Sydney climate, however, and hence it outperformed both the PowerFloor and the timber floor systems in this climate. For the cooler climate zones of Canberra, Blue Mountains and Southern Highlands, the performance of PowerFloor was comparable to slab on ground).

The BASIX DIY assessment, performed by the online BASIX tool, was also used to compare the thermal performance of the various wall and floor systems. Once again, these assessments highlighted the thermal benefits of both PowerWall and PowerFloor. For PowerWall, the DIY tool requests just R0.89 additional insulation, compared to R1.16 for brick veneer and R1.30 for fibre cement (for the zones analysed). Likewise, the PowerFloor is recognised as thermally superior to both the suspended slab and timber flooring systems (for both closed or open subfloors). In all climate zones, the PowerPanel required around R0.3 less insulation than the suspended slab and around R0.2 less insulation than the framed system.

In summary, therefore, regardless of whether the BASIX DIY tool is used or whether the BASIX simulation method is used, the thermal benefits of Hebel PowerFloor and Hebel PowerWall are clearly recognised by the BASIX tool. Even the slight thermal performance improvements achieved by the Hebel products can significantly reduce the compliance costs for insulation and glazing. It can also present more compliance options, such as the option of using just reflective foil, where bulk insulation may be required for other systems.

2 Introduction

This report examines the thermal benefits of PowerFloor and PowerWall for two houses: a single storey house of around 200 m^2 and a two storey house of around 260 m^2. It compares the thermal performance of three different wall and three different floor systems:

Floor systems examined:

- Concrete slab on ground
- Suspended timber floor over an enclosed subfloor space (actually 10mm of particleboard)
- Suspended Hebel 75 mm PowerFloor panels over an enclosed subfloor space

Wall systems examined:

- Brick Veneer Walls (subfloor walls are assumed to be a single layer of brickwork sheet when used with a suspended floor)
- Framed walls clad externally with fibre cement sheet (subfloor walls are assumed to be a single layer of FC sheet when used with a suspended floor)
- 75 mm Hebel PowerPanel used as a cladding on framed construction (Note that subfloor walls are assumed to be a single layer of PowerPanel when used with a suspended floor)

Each wall system was simulated with each floor system in AccuRate and the heating and cooling loads were recorded. Each scenario was modelled in three climate zones: Sydney Inner West (Homebush Bay), Sydney Outer West (Penrith) and finally Canberra (Queanbeyan), Blue Mountains and Central Highlands. It should be noted that these climate zones don't encompass the entire areas listed above. For example, the Queanbeyan district has three climate zones.

For each floor/wall scenario, and in each climate zone, modifications were made to reach estimated BASIX thermal comfort thresholds (estimated as AccuRate star ratings). Initially, the same generic modifications were made to all the scenarios and then differing amounts of double glazing or external louvres were added until all the scenarios had achieved the same AccuRate thermal rating.

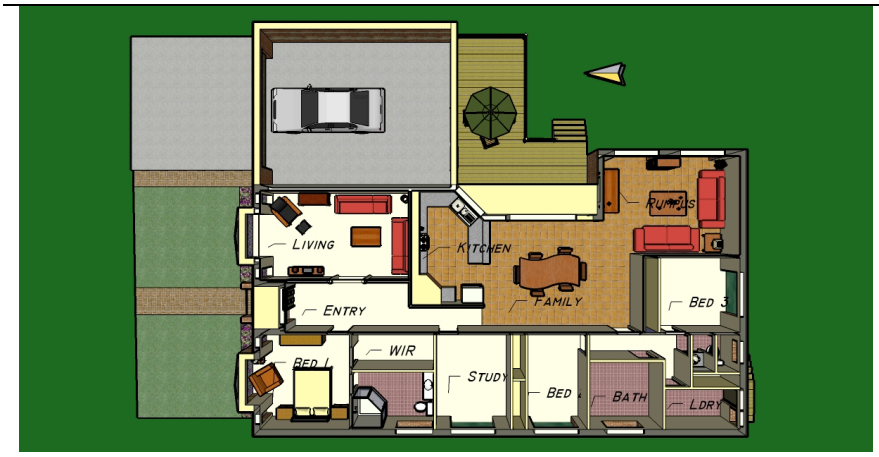
It must be noted that BASIX cannot currently accommodate AccuRate results, but will do shortly. The thermal targets, for each climate zone, are therefore approximate but still provide a good comparison between the nine options. An AccuRate star rating was adopted for each climate zone/house combination, and these were generally between 4 and 5 stars. These ratings were chosen to approximate the potential thermal target marks to be adopted by BASIX, when AccuRate marks are accommodated. Heating and cooling loads have been compared in this study and the AccuRate target marks were estimated by taking into account the possible BASIX heating and cooling thresholds, for each climate zone.

It should also be noted that for all simulations of the two storey house, the floor construction of the ground floor was also used for the upper floor. In all cases, the underside of these upper floors was modelled as plasterboard lined. Furthermore, brick veneer walls often create a cavity joining the subfloor and attic and reducing performance however for all simulations this was assumed to be blocked.

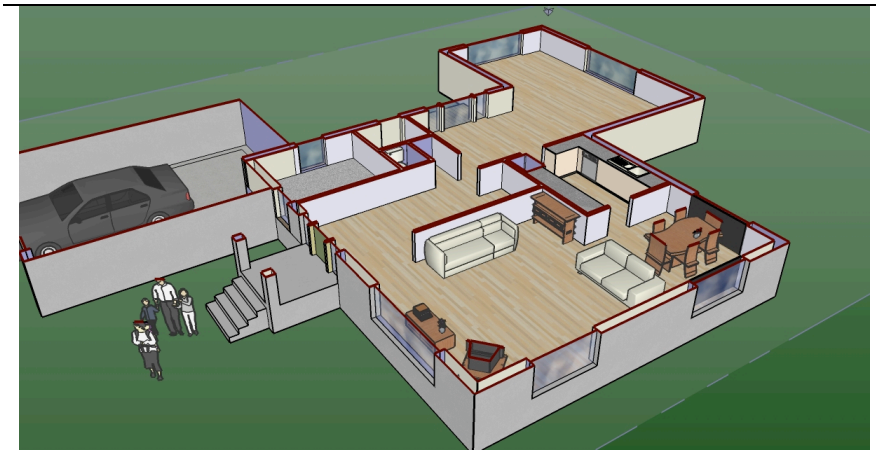
Thermal models were run using the AccuRate software by CSIRO version 1.0.0.

3 House Plans

Plan: Single Storey House



Ground Floor Plan: Two Storey House



First Floor Plan: Two Storey House

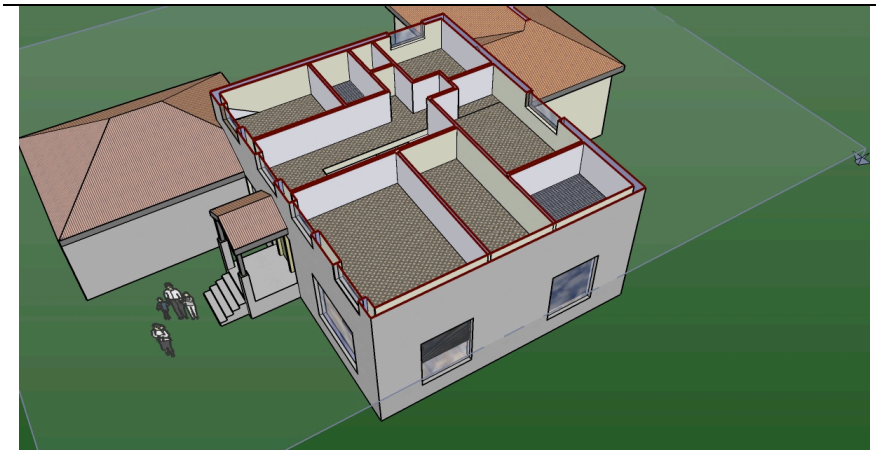


Figure 1 Single and Two storey houses

The base cases for both houses were simulated with no wall insulation and R2.5 ceiling insulation. No weather stripping or other air leakage control measures were assumed. Glazing was assumed to be generic aluminium framed with clear single glazing. It should be noted that most manufacturer's products will have significantly better performance than this generic product.

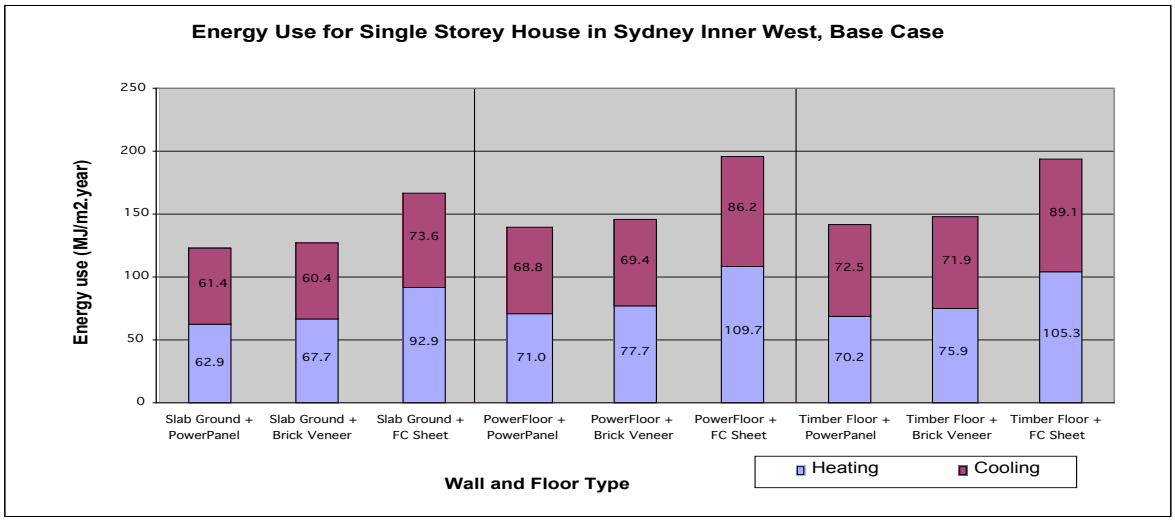
To simplify the task of calculating potential BASIX compliance, a suite of measures was applied to both houses and then a consistent AccuRate star rating was achieved by adding either double glazing or adjustable vertical louvres. Standard measures applied to all scenarios, before the addition of double glazing or louvres, included:

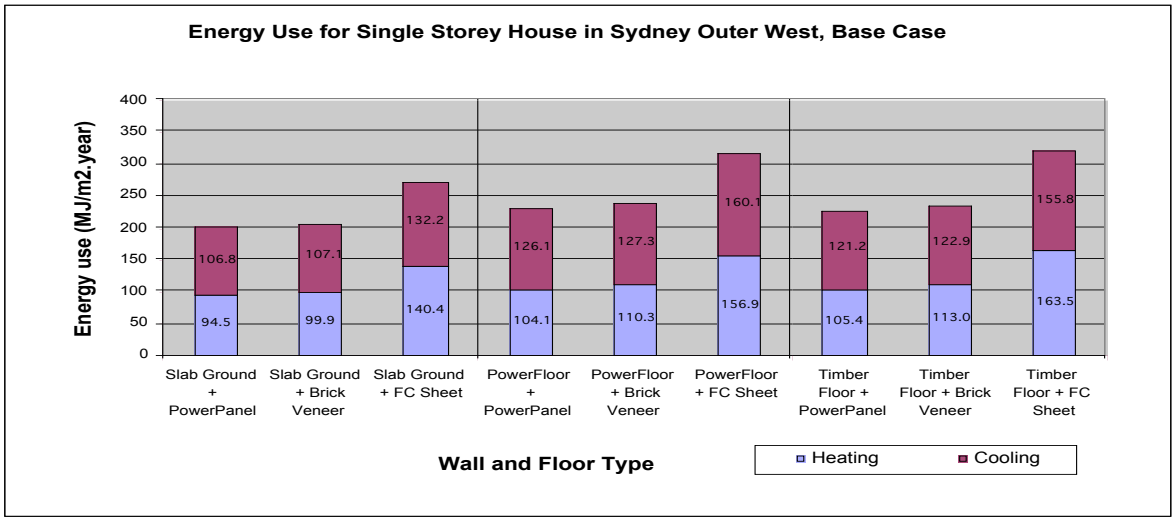
- R1.0 + sarking roof insulation
- R1.5 wall insulation
- Weather stripping to all windows and doors
- Thermally improved frames to all windows (a generic aluminium awning window was used with a U-value of 6.17 compared to standard glazing, with a U-value of 7.12)
- Sunhoods to all north windows (35% of window height)
- Ceiling fans to all bedrooms and living/dining/lounge areas

If these measures were not sufficient to obtain the estimated BASIX thermal thresholds, then either external adjustable vertical louvres or double glazing was added (the latter also with thermally improved frames, U value of 3.49).

4 Results for the single Storey AccuRate Base Cases

In their base case conditions AccuRate showed the following results, for the single storey house:





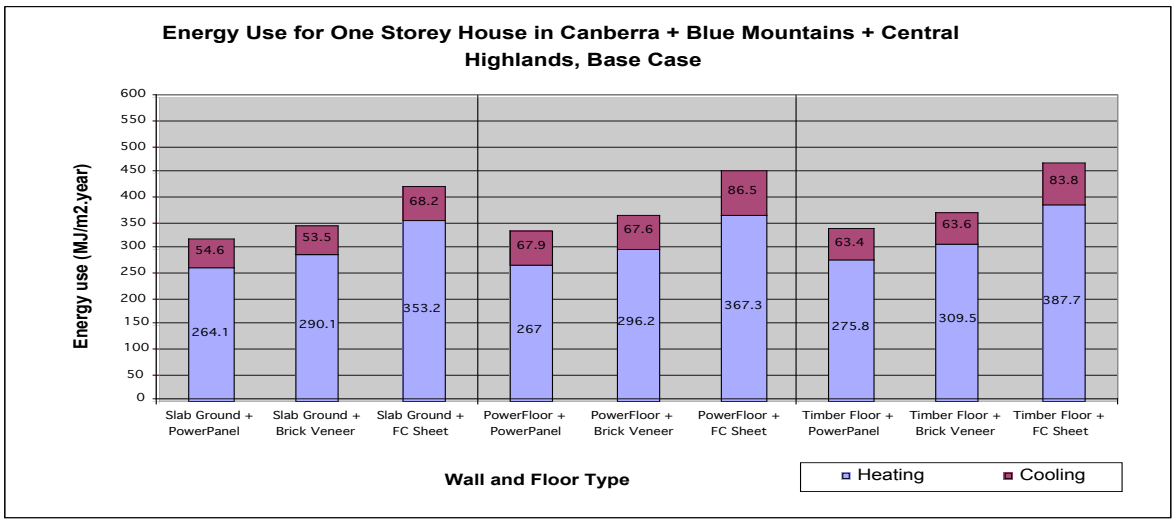


Figure 2 Base Cases for the Single Storey House with various wall and floor constructions

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	124.2	3.0		-18.5
Slab Ground	Brick Veneer	128.1	2.9	3.9	-19.8
Slab Ground	FC	166.5	2.3	42.3	-28.0
PowerFloor	PowerPanel	142.7	2.7		
PowerFloor	Brick Veneer	147.9	2.6	5.2	
PowerFloor	FC	194.5	1.9	51.8	
Timber	PowerPanel	139.8	2.7		-2.9
Timber	Brick Veneer	147.1	2.6	7.3	-0.8
Timber	FC	195.9	1.9	56.1	1.4

*+ve means Hebel Product uses less energy

Table 1: Base Case Results for the Single Storey House in Sydney Inner West

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	201.3	3.0		-29.0
Slab Ground	Brick Veneer	206.9	2.9	5.6	-30.7
Slab Ground	FC	272.6	2.2	71.3	-44.4
PowerFloor	PowerPanel	230.3	2.7		
PowerFloor	Brick Veneer	237.6	2.6	7.3	
PowerFloor	FC	317	1.9	86.7	
Timber	PowerPanel	226.6	2.7		-3.7
Timber	Brick Veneer	235.9	2.6	9.3	-1.7
Timber	FC	319.3	1.8	92.7	2.3

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Table 2: Base Case Results for the Single Storey House in Sydney Outer West

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	318.7	3.6		-16.2
Slab Ground	Brick Veneer	343.6	3.4	24.9	-20.2
Slab Ground	FC	421.4	2.8	102.7	-32.4
PowerFloor	PowerPanel	334.9	3.5		
PowerFloor	Brick Veneer	363.8	3.2	28.9	
PowerFloor	FC	453.8	2.5	118.9	
Timber	PowerPanel	339.2	3.4		4.3
Timber	Brick Veneer	373.1	3.1	33.9	9.3
Timber	FC	471.5	2.4	132.3	17.7

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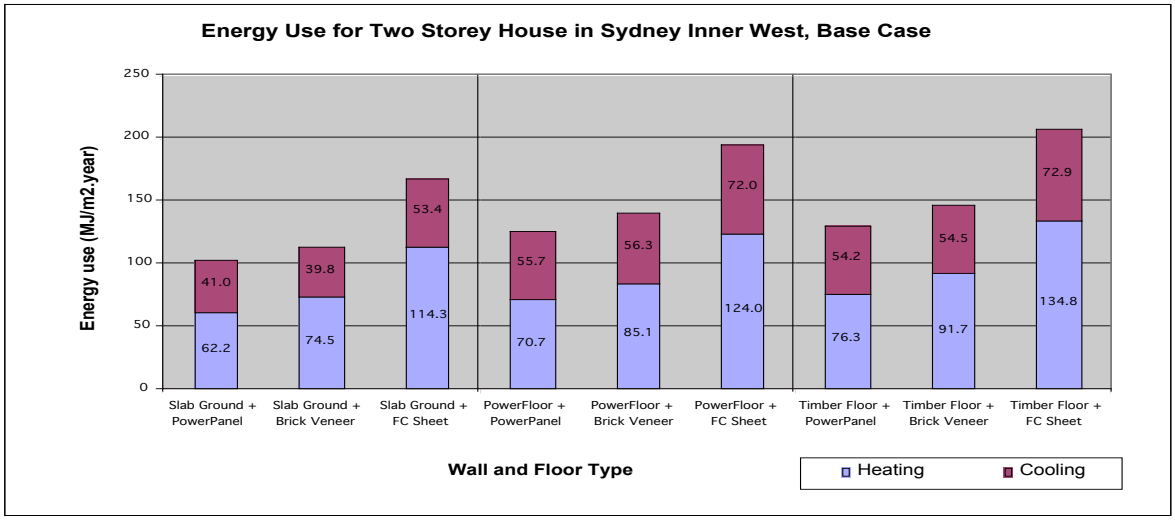
Table 3: Base Case Results for the Single Storey House in Canberra, Blue Mountains & Central Highlands

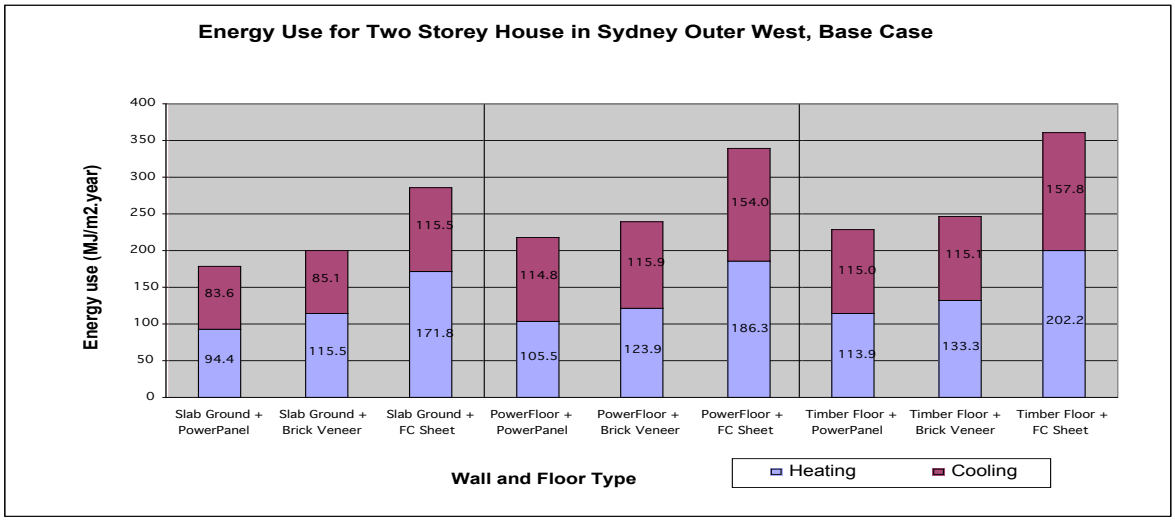
As seen from the table and graphs above, the additional R-value of the PowerPanel walls means that they perform better than the Brick Veneer and clearly better than the Fibre Cement when uninsulated. In particular, the superior heating performance of the PowerPanel is evident over both of the other systems (as shown by the purple components of the graphs). The cooling performance of the PowerPanel is comparable to the Brick Veneer and clearly superior to the Fibre Cement.

For this house, the PowerFloor produces a better heating performance than the timber floor, but the timber floor provides a better cooling performance. In overall performance they are quite similar (except in the cooler climate zones where the PowerFloor performs better overall). The slab on ground outperforms both systems for this house, from both a heating and cooling perspective.

5 Results for the two Storey AccuRate Base Cases

In their base case conditions AccuRate showed the following results, for the two storey house:





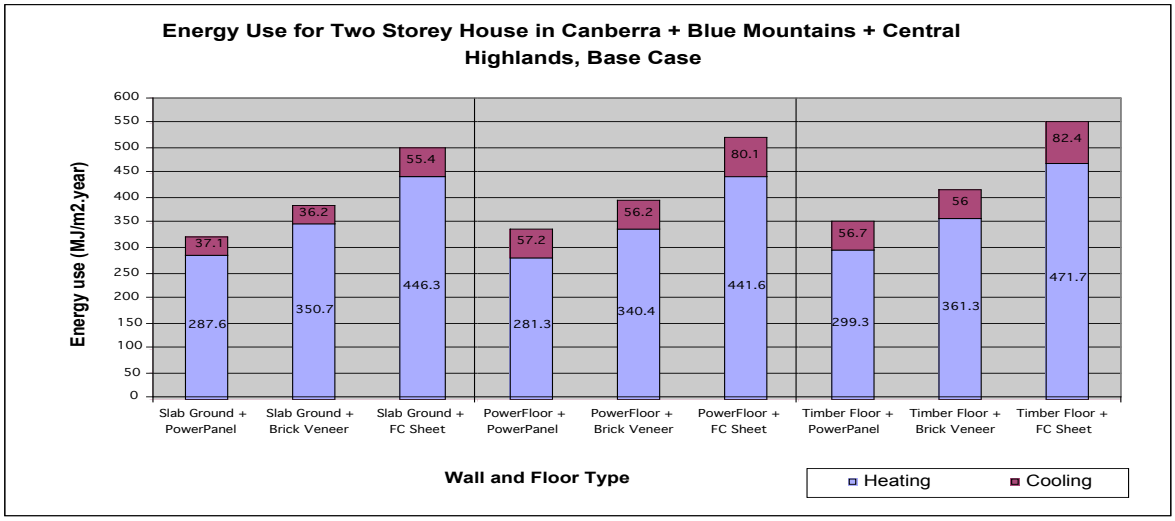


Figure 3: Base Cases for the two Storey House with various wall and floor constructions

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	103.2	3.5		-23.2
Slab Ground	Brick Veneer	114.2	3.1	11	-27.2
Slab Ground	FC	167.7	2.3	64.5	-28.2
PowerFloor	PowerPanel	126.4	2.9		
PowerFloor	Brick Veneer	141.4	2.7	15	
PowerFloor	FC	195.9	1.9	69.5	
Timber	PowerPanel	130.5	2.9		4.1
Timber	Brick Veneer	146	2.6	15.5	4.6
Timber	FC	207.7	1.8	77.2	11.8

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Table 4: Base Case Results for the two Storey House in Sydney Inner West

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	178	3.4		-42.3
Slab Ground	Brick Veneer	200.7	3	22.7	-39.2
Slab Ground	FC	287.3	2.1	109.3	-53.0
PowerFloor	PowerPanel	220.3	2.8		
PowerFloor	Brick Veneer	239.9	2.6	19.6	
PowerFloor	FC	340.3	1.7	120	
Timber	PowerPanel	228.9	2.7		8.6
Timber	Brick Veneer	248.4	2.5	19.5	8.5
Timber	FC	360.1	1.5	131.2	19.8

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Table 5: Base Case Results for the two Storey House in Sydney Outer West

Floor	Wall	Total Energy Use	Star	Compared to PowerPanel*	Compared to PowerFloor*
Slab Ground	PowerPanel	324.7	3.6	0	-13.8
Slab Ground	Brick Veneer	386.9	3	62.2	-9.7
Slab Ground	FC	501.7	2.3	177	-20.0
PowerFloor	PowerPanel	338.5	3.4	0	
PowerFloor	Brick Veneer	396.6	2.9	58.1	
PowerFloor	FC	521.7	2.2	183.2	
Timber	PowerPanel	356	3.3	0	17.5
Timber	Brick Veneer	417.3	2.8	61.3	20.7
Timber	FC	554.1	1.9	198.1	32.4

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Table 6: Base Case Results for the two Storey House in Canberra, Blue Mountains & Central Highlands

Once again, as seen from the table and graphs above, the additional R-value of the PowerPanel walls means that they perform better than Brick Veneer and clearly better than the Fibre Cement when uninsulated. In particular, the superior heating performance of the PowerPanel is evident over both of the other systems (as shown by the purple components of the graphs). Again, the cooling performance of the PowerPanel is comparable to the Brick Veneer and clearly superior to the Fibre Cement.

For this house, the PowerFloor produces a better heating performance than the timber floor, and comparable cooling performance. In overall performance, the PowerFloor clearly outperforms the timber floor. Once again, the slab on ground outperforms both systems, from both a heating and cooling perspective. It should be noted that in the cooler climate zones, the PowerFloor has heating loads very close to those of the concrete slab.

6 Achieving BASIX compliance with the Single Storey House in Sydney Inner West

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. It should be noted that due to the thermal benefits of the slab on ground, all simulations with this floor type were manipulated until they achieved 4.4 stars (highlighted blue), while the simulations with framed floors were manipulated to reach 3.9 stars. Hence the six simulations with framed floors should be compared with each other and not with the three combinations with the slab on ground.

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceil Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.4
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	4.4
Slab Ground	FC	R1.5	R2.5	R1+foil	None	7.6	0	4.4
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	3.9
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	3.9
PowerFloor	FC	R1.5	R2.5	R1+foil	None	17.0	0	3.9
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	3.9
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	3.9
Timber	FC	R1.5	R2.5	R1+foil	None	20.8	0	3.9

Table 7: Modifications required to achieve an estimated BASIX compliance for the single storey House in Sydney inner west

6.1 Floor type

Due to the comparable performances of the PowerFloor and the timber floor, similar measures were adopted to reach the same AccuRate rating.

6.2 Wall type

Due to the comparable performances of the PowerPanel and Brick Veneer walls (after the addition of R1.5 wall insulation), similar measures were adopted to reach the same AccuRate rating. Both of these systems clearly outperform the fibre cement system, as shown by the areas of double glazing required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 20.8m2 more double glazing will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel.

7 Achieving BASIX compliance with the Single Storey House in Sydney Outer West

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. It should be noted that due to the thermal benefits of the slab on ground, all simulations with this floor type were manipulated until they achieved 4.5 stars (highlighted blue), while the simulations with framed floors were manipulated to reach 3.9 stars. Hence the six simulations with framed floors should be compared with each other and not with the three combinations with the slab on ground.

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceiling Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.5
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	4.5
Slab Ground	FC	R1.5	R2.5	R1+foil	None	0	13.2	4.5
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	3.9
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	3.9
PowerFloor	FC	R1.5	R2.5	R1+foil	None	0	24.4	3.9
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	3.9
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	3.9
Timber	FC	R1.5	R2.5	R1+foil	None	0	30.4	3.9

Table 8: Modifications required to achieve an estimated BASIX compliance for the single storey House in Sydney outer west

7.1 Floor type

Once again, due to the comparable performances of the PowerFloor and the timber floor, similar measures were adopted to reach the same AccuRate rating.

7.2 Wall type

Again, due to the comparable performances of the PowerPanel and Brick Veneer walls (after the addition of R1.5 wall insulation), similar measures were adopted to reach the same AccuRate rating. Both of these systems clearly outperform the fibre cement system, as shown by the areas of external louvres required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 30.4m2 more external louvres will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel.

8 Achieving BASIX compliance with the Single Storey House in Canberra, Blue Mountains & Central Highlands

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. It should be noted that due to the thermal benefits of the slab on ground, all simulations with this floor type were manipulated until they achieved 4.9 stars (highlighted blue), while the simulations with framed floors were manipulated to reach 4.7 stars. Hence the six simulations with framed floors should be compared with each other and not with the three combinations with the slab on ground.

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceiling Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.9
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	4.0	0	4.9
Slab Ground	FC	R1.5	R2.5	R1+foil	None	12.2	0	4.9
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.7
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	6.5	0	4.7
PowerFloor	FC	R1.5	R2.5	R1+foil	None	26.0	0	4.7
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	5.2	0	4.7
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	14.2	0	4.7
Timber	FC	R1.5	R2.5	R1+foil	None	43.1	0	4.7

Table 9 Modifications required to achieve an estimated BASIX compliance for the single storey house in Canberra, Blue Mountains & Central Highlands

8.1 Floor type

Unlike the last two climate zones, this zone highlights the superior performance of the PowerFloor over the timber floor. Depending on the wall type chosen, up to 17.1m2 more double glazing will be required for the timber floor to reach the same AccuRate rating as the Power Floor.

8.2 Wall type

This climate zone also highlights the superior performance of the PowerPanel over the Brick Veneer walls (even after the addition of R1.5 wall insulation). Depending on the floor type chosen, up to 9.0m2 more double glazing will be required for the Brick Veneer to reach the same AccuRate rating as the PowerPanel.

Both of these systems clearly outperform the fibre cement system, as shown by the areas of double glazing required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 37.9m2 more double glazing will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel.

9 Achieving BASIX compliance with the Two Storey House in Sydney Inner West

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. It should be noted that due to the thermal benefits of the slab on ground, all simulations with this floor type were manipulated until they achieved 4.9 stars (highlighted blue), while the simulations with framed floors were manipulated to reach 4.5 stars. Hence the six simulations with framed floors should be compared with each other and not with the three combinations with the slab on ground.

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceiling Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.9
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	4.9
Slab Ground	FC	R1.5	R2.5	R1+foil	None	22.3	0	4.9
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.5
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	3.8	0	4.5
PowerFloor	FC	R1.5	R2.5	R1+foil	None	35.4	0	4.5
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	11.6	0	4.5
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	19.3	0	4.5
Timber	FC	R1.5	R2.5	R1+foil	None	58.1	0	4.5

Table 10 Modifications required to achieve an estimated BASIX compliance for the two storey House in Sydney inner west

9.1 Floor type

Unlike the single storey house, this two storey houses highlights the superior performance of the PowerFloor over the timber floor. Depending on the wall type chosen, up to 22.7m2 more double glazing will be required for the timber floor to reach the same AccuRate rating as the Power Floor.

9.2 Wall type

This two storey houses also highlights the superior performance of the PowerPanel over Brick Veneer walls (even after the addition of R1.5 wall insulation). Depending on the floor type chosen, up to 7.7m2 more double glazing will be required for the Brick Veneer to reach the same AccuRate rating as the PowerPanel.

Both of these systems clearly outperform the fibre cement system, as shown by the areas of double glazing required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 46.5m2 more double glazing will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel.

10 Achieving BASIX compliance with the Two Storey House in Sydney Outer West

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. It should be noted that due to the thermal benefits of the slab on ground, all simulations with this floor type were manipulated until they achieved 4.4 stars (highlighted blue), while the simulations with framed floors were manipulated to reach 4.1 stars. Hence the six simulations with framed floors should be compared with each other and not with the three combinations with the slab on ground.

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceiling Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.4
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	0	0	4.4
Slab Ground	FC	R1.5	R2.5	R1+foil	None	0	25.1	4.4
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.1
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	0	2.7	4.1
PowerFloor	FC	R1.5	R2.5	R1+foil	None	0	34.6	4.1
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	0	11.4	4.1
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	0	14.9	4.1
Timber	FC	R1.5	R2.5	R1+foil	None	24.0	34.6	4.1

Table 11 Modifications required to achieve an estimated BASIX compliance for the two storey House in Sydney outer west

10.1 Floor type

Once again, this two storey houses highlights the superior performance of the PowerFloor over the timber floor. Depending on the wall type chosen, up to 24.0 m2 more double glazing will be required (or 12.2 m2 more external louvres) for the timber floor to reach the same AccuRate rating as the Power Floor.

10.2 Wall type

This two storey houses also highlights the superior performance of the PowerPanel over Brick Veneer walls (even after the addition of R1.5 wall insulation). Depending on the floor type chosen, up to 3.5 m2 more external louvres will be required for the Brick Veneer to reach the same AccuRate rating as the PowerPanel.

Both of these systems clearly outperform the fibre cement system, as shown by the areas of external louvres required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 34.6m2 more external louvers will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel (or 23.2m2 more external louvers accompanied by 24.0m2 of extra double glazing).

11 Achieving BASIX compliance with the Two Storey House in Canberra, Blue Mountains & Central Highlands

The table below shows the modifications required to achieve an estimated BASIX compliance for the various wall and floor constructions. In this case all simulations were manipulated until they achieved 4.9 stars (including those with slab on ground). Hence all nine simulations should be compared with each other regardless of floor type (unlike the last 5 house/climate zone combinations).

It should be noted that other changes were also implemented to all nine simulations, including: weather stripping to all windows and doors; thermally improved frames to all windows; sunhoods to all north windows (35% of window height) and ceiling fans to all bedrooms and living/dining/lounge areas.

Floor	Wall	Wall Ins.	Ceiling Ins.	Roof Ins.	Floor Ins.	Area of Double Glazing	Area of External Louvres	AccuRate Rating
Slab Ground	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.9
Slab Ground	Brick Veneer	R1.5	R2.5	R1+foil	None	6.7	0	4.9
Slab Ground	FC	R1.5	R2.5	R1+foil	None	23.2	0	4.9
PowerFloor	PowerPanel	R1.5	R2.5	R1+foil	None	0	0	4.9
PowerFloor	Brick Veneer	R1.5	R2.5	R1+foil	None	8.4	0	4.9
PowerFloor	FC	R1.5	R2.5	R1+foil	None	30.9	0	4.9
Timber	PowerPanel	R1.5	R2.5	R1+foil	None	15.9	0	4.9
Timber	Brick Veneer	R1.5	R2.5	R1+foil	None	26.8	0	4.9
Timber	FC	R1.5	R2.5	R1+foil	None	58.0	0	4.9

Table 12 Modifications required to achieve an estimated BASIX compliance for the two storey house in Canberra, Blue Mountains & Central Highlands

11.1 Floor type

Once again, this two storey houses highlights the superior performance of the PowerFloor over the timber floor. Depending on the wall type chosen, up to 27.1m2 more double glazing will be required for the timber floor to reach the same AccuRate rating as the Power Floor. The PowerFloor also performs comparably to the slab in all cases, highlighting the thermal benefits of the PowerFloor in cooler climates.

11.2 Wall type

This two storey houses also highlights the superior performance of the PowerPanel over Brick Veneer walls (even after the addition of R1.5 wall insulation). Depending on the floor type chosen, up to 10.9m2 more double glazing will be required for the Brick Veneer to reach the same AccuRate rating as the PowerPanel.

Both of these systems clearly outperform the fibre cement system, as shown by the areas of double glazing required to obtain the same AccuRate rating (for all three floor type). Depending on the floor type chosen, up to 42.1m2 more double glazing will be required for the fibre cement to reach the same AccuRate rating as the PowerPanel.

12 BASIX DIY for Houses 1 and 2

The tables below show the requirements for floor, wall and roof insulation, as generated by the BASIX DIY function. It should be noted that both houses gave the same results as each other (regardless of climate zone). Hence the results below apply to both the single storey and two storey houses, for all three climate zones.

Walls	Floor Type	Subfloor Type	Floor Insulation	Wall Insulation	Ceiling Insulation	Roof Insulation
Hebel 75	Hebel 75	Open	1.12	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Hebel 150-200	Open	0.66	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Hebel 200	Open	0.4	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Hebel 75	Closed	0.82	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Hebel 150-200	Closed	0.36	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Hebel 200	Closed	0.1	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Slab on Ground	NA	NIL	0.89	0.95 (UP)	Foil + 100mm blanket
Hebel 75	Slab Suspended	Open	1.4	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Slab Suspended	Closed	1.1	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Framed Floor	Open	1.3	0.89	1.45 (UP)	Foil + 100mm blanket
Hebel 75	Framed Floor	Closed	1	0.89	1.45 (UP)	Foil + 100mm blanket

Table 13: BASIX DIY requirements for PowerPanel walls, for both houses and all three climate zones

Walls	Floor Type	Subfloor Type	Floor Insulation	Wall Insulation	Ceiling Insulation	Roof Insulation
Brick Veneer	Hebel 75	Open	1.12	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Hebel 150-200	Open	0.66	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Hebel 200	Open	0.4	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Hebel 75	Closed	0.82	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Hebel 150-200	Closed	0.36	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Hebel 200	Closed	0.1	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Slab on Ground	NA	NIL	1.16	0.95 (UP)	Foil + 100mm blanket
Brick Veneer	Slab Suspended	Open	1.4	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Slab Suspended	Closed	1.1	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Framed Floor	Open	1.3	1.16	1.45 (UP)	Foil + 100mm blanket
Brick Veneer	Framed Floor	Closed	1	1.16	1.45 (UP)	Foil + 100mm blanket

Table 14: BASIX DIY requirements for Brick Veneer walls, for both houses and all three climate zones

Walls	Floor Type	Subfloor Type	Floor Insulation	Wall Insulation	Ceiling Insulation	Roof Insulation
Fibre Cement	Hebel 75	Open	1.12	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Hebel 150-200	Open	0.66	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Hebel 200	Open	0.4	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Hebel 75	Closed	0.82	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Hebel 150-200	Closed	0.36	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Hebel 200	Closed	0.1	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Slab on Ground	NA	NIL	1.3	0.95 (UP)	Foil + 100mm blanket
Fibre Cement	Slab Suspended	Open	1.4	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Slab Suspended	Closed	1.1	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Framed Floor	Open	1.3	1.3	1.45 (UP)	Foil + 100mm blanket
Fibre Cement	Framed Floor	Closed	1	1.3	1.45 (UP)	Foil + 100mm blanket

Table 15: BASIX DIY requirements for Fibre Cement walls, for both houses and all three climate zones

The results from the BASIX DIY analyses show how the recommendations are based on several simple calculations by the BASIX tool. For both houses (and in all three climate zones) the BASIX tool recommended a total floor R-value of R2.0 (if the floor had an open subfloor), or R1.7 (if the floor had a closed subfloor). There was no extra insulation if a slab on ground was selected.

Similarly for walls, the BASIX DIY tool recommended a total system R-value of R1.7 for both houses, in all climate zones. This led to the visible consistency in additional wall insulation (as seen in the tables on the previous the page). For all cases with PowerPanel walls (assumed R-value of 0.81) the additional insulation was R0.89. Likewise, for all cases with Brick veneer walls (assumed R-value of 0.54) the additional insulation was R1.16, while for all cases with fibre cement walls (assumed R-value of 0.40) the additional insulation was R1.30.

The results from the BASIX DIY analysis clearly show the advantage of using Hebel PowerPanel walls over either Brick veneer or Fibre Cement. Both of the latter systems require over R1 additional insulation (as mentioned above) while the PowerWalls required just R0.89. Since wall insulation often comes in increments of 0.5, this means that an extra thickness of bulk insulation would be required for both brick veneer and fibre cement systems. Alternatively, if reflective foil was to be used to achieve the required R-values, there would be many products capable of achieving the R0.89 (for the PowerWalls), but only a few to achieve the R1.16 (for the brick veneer) and even less to achieve the R1.30 (for the fibre cement).

Likewise, BASIX recognises the superior performance of the PowerFloor over both the suspended concrete slab and the timber floor (for both closed or open subfloors). In all climate zones, the PowerFloors required around R0.3 less insulation than the slab and R0.2 less insulation than the framed system.

13 Conclusion

Overall, this report highlights the considerable thermal benefits of both PowerWall and PowerFloor. In particular, PowerWall was shown to produce lower heating loads than both brick veneer and fibre cement, in all three climate zones tested. Overall, the PowerWall also outperformed the brick veneer. This was particularly noticeable for the two storey house where up to 10.9m2 of double glazing was required to match the AccuRate rating of the PowerPanel (depending on the climate zone). The PowerWall also clearly outperformed the fibre cement. This was also more noticeable for the two storey house, where up to 46.5m2 of double glazing or 34.6m2 of external louvres were required to match the AccuRate rating of the PowerPanel.

Similarly, the PowerFloor outperformed the timber floor, particularly from a heating perspective. The overall difference was particularly evident for the case of the two storey house where up to 27.1m2 of double glazing or 12.2m2 of external louvres were required to match the AccuRate rating of the PowerFloor, depending on the requirements of the climate zone. The slab on ground option was shown to be particularly well-suited to the Sydney climate, and hence it outperformed both the PowerFloor and the timber floor systems (except for the cooler climate zones of Canberra, Blue Mountains and Southern Highlands, where the PowerFloor was comparable to the slab on ground system).

The BASIX DIY assessment is founded on basic thermal calculations, conducted by the BASIX online tool. These calculations also highlighted the thermal benefits of both PowerWall and PowerFloor. For PowerWall, the DIY tool requests just R0.89 additional insulation, compared to R1.16 for brick veneer and R1.30 for fibre cement. Likewise, the PowerFloor is recognised as thermally superior to both the suspended slab and timber flooring systems (for both closed or open subfloors). In all climate zones, the PowerPanel required around R0.3 less insulation than the suspended slab and around R0.2 less insulation than the framed system.