

## building science + bullsh\*t seminar

### **H1 – It doesn't have to cost more**

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with Bernard Farrington & Peter Raimondo

## KEY DIFFERENCES IN R-VALUES

### OLD H1/AS1

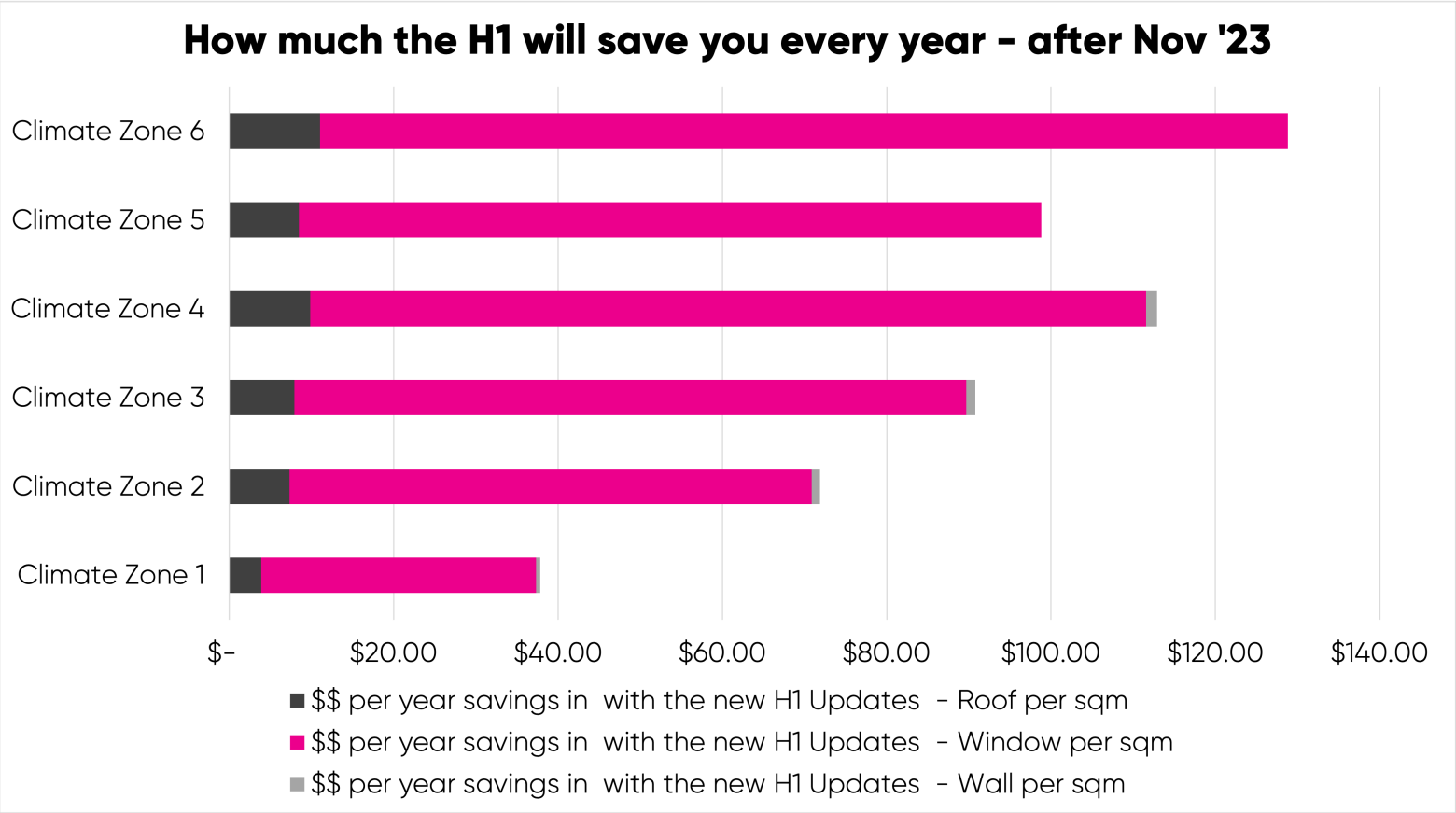
|                   | R-Value Required |      |
|-------------------|------------------|------|
| Climate Zone      | A                | B    |
| Roof              | 2.9              | 3.3  |
| Wall              | 1.9              | 2    |
| Floor (SOG)       | 1.3              | 1.3  |
|                   |                  |      |
| Windows and Doors | 0.37             | 0.37 |
| Skylights         | 0.37             | 0.37 |

### NEW H1/AS1 – Table 2.1.2.2B

|                        | Minimum Construction R-Value Required |      |      |      |      |      |
|------------------------|---------------------------------------|------|------|------|------|------|
| Climate Zone           | 1                                     | 2    | 3    | 4    | 5    | 6    |
| Roof                   | 6.6                                   | 6.6  | 6.6  | 6.6  | 6.6  | 6.6  |
| Wall                   | 2                                     | 2    | 2    | 2    | 2    | 2    |
| Floor (SOG)            | 1.5                                   | 1.5  | 1.5  | 1.5  | 1.6  | 1.7  |
| Floor (Other than SOG) | 2.5                                   | 2.5  | 2.5  | 2.8  | 3    | 3    |
| Windows and Doors      | 0.46                                  | 0.46 | 0.46 | 0.46 | 0.5  | 0.5  |
| Skylights              | 0.46                                  | 0.46 | 0.54 | 0.54 | 0.62 | 0.62 |



## SAVING MONEY



This calculation allows for a better-quality products and saving a lot of money throughout the year!



## WALLS

**The good old, "this is the way we've always done it"**

Construction build-up from inside to outside

- 13mm gypsum plasterboard
- 90mm SG8 H1.2 timber frame (Assuming 21% timber/wall ratio)
- Wall cavity filled with glass wool insulation
- Underlay
- 20 – 40mm Vented cavity and cladding

**Construction R-Value 1.6 m<sup>2</sup>K/W**



# OCULUS

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## WALLS

**The good old, "this is the way we've always done it"**



## WALLS

**The good old, "this is the way we've always done it"**

COMPLIANCE TO THE CODE?  
Construction R-Value 1.6 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |



## WALLS

The good old, "this is the way we've always done it"

COMPLIANCE TO THE CODE?  
Construction R-Value 1.6 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |



## WALLS

**Let's brace it up and call it a SIP Panel**





## WALLS

### **Let's brace it up and call it a SIP Panel**

Construction build-up from inside to outside

- 13mm gypsum plasterboard
- 90mm SG8 H1.2 timber frame (Assuming 21% timber/wall ratio)
- Wall cavity filled with glass wool insulation
- 12mm OSB
- Vapour/Water/Air control layer
- 20 – 40mm Vented cavity and cladding

**Construction R-Value  $1.7 \text{ m}^2\text{K/W}$**



## WALLS

**Let's brace it up and call it a SIP Panel**

COMPLIANCE TO THE CODE?  
Construction R-Value 1.7 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |



## WALLS

Let's brace it up and call it a SIP Panel

COMPLIANCE TO THE CODE?  
Construction R-Value 1.7 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |



## WALLS

### Externally Insulated Wall



## WALLS

### Externally Insulated Wall

Construction build-up from inside to outside

- 13mm gypsum plasterboard
- 90mm SG8 H1.2 timber frame (Assuming 21% timber/wall ratio)
- Wall cavity with NO insulation
- 12mm OSB
- Vapour/Water/Air control layer
- 70mm Mineral wool insulation
- 20 – 40mm Vented cavity and cladding

**Construction R-Value  $2.4 \text{ m}^2\text{K/W}$**



## WALLS

### Externally Insulated Wall

COMPLIANCE TO THE CODE?  
Construction R-Value 2.4 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |



## WALLS

### Externally Insulated Wall

COMPLIANCE TO THE CODE?  
Construction R-Value 2.4 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.9    | 2.0 | 2.0          | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 |

PASS



## **BENEFITS OF EXTERNALLY INSULATED WALL ASSEMBLY**

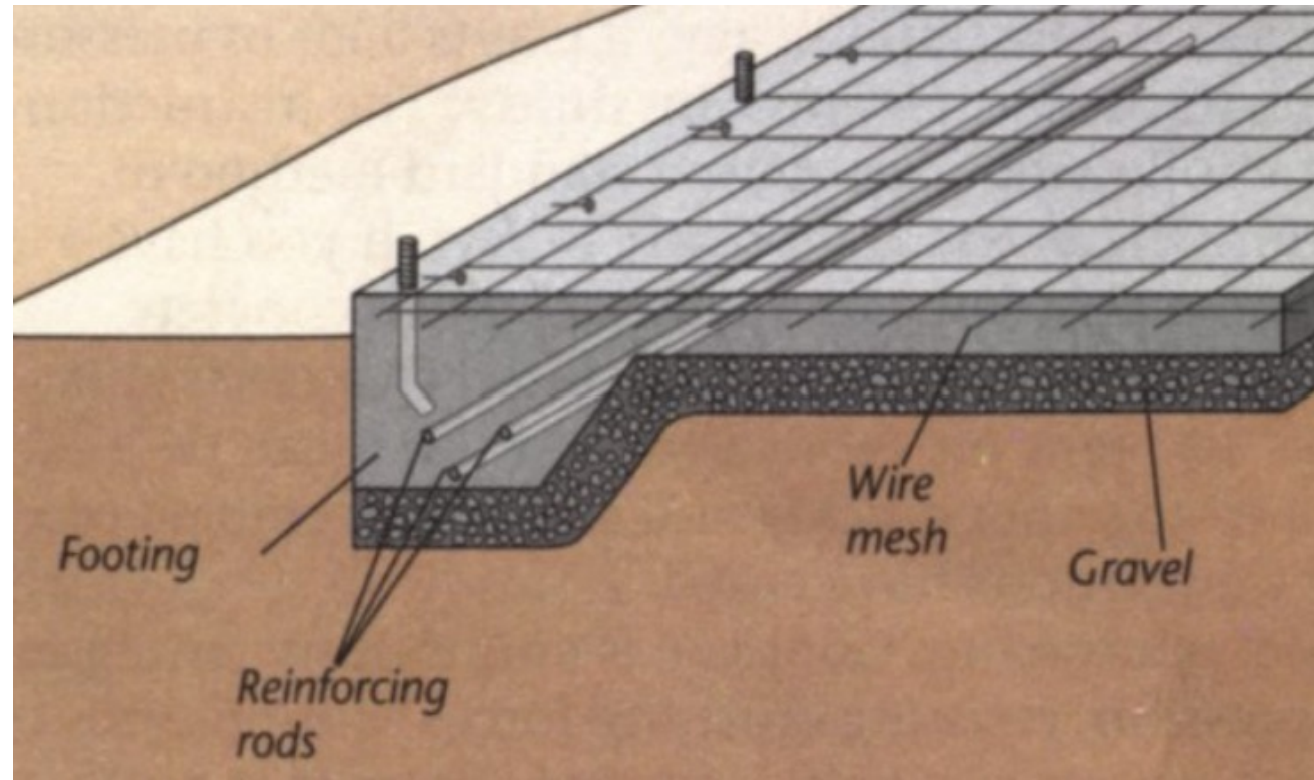
- Closes thermal bridges (slab edges)
- Can be easier to install on site
- Makes one uniform insulation layer around the whole building
- No risk for interstitial condensation
- Improves acoustics and fire rating





## FLOOR – SLAB ON GROUND

**Raft Slab – with a  
300mm deep  
perimeter ring beam**



## FLOOR – SLAB ON GROUND

**Raft Slab – with a 300mm deep perimeter ring beam**

Construction R-Value 0.14 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.3    | 1.3 | 1.5          | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 |



## FLOOR – SLAB ON GROUND

**Raft Slab – with a 300mm deep perimeter ring beam**

Construction R-Value 0.14 m<sup>2</sup>K/W

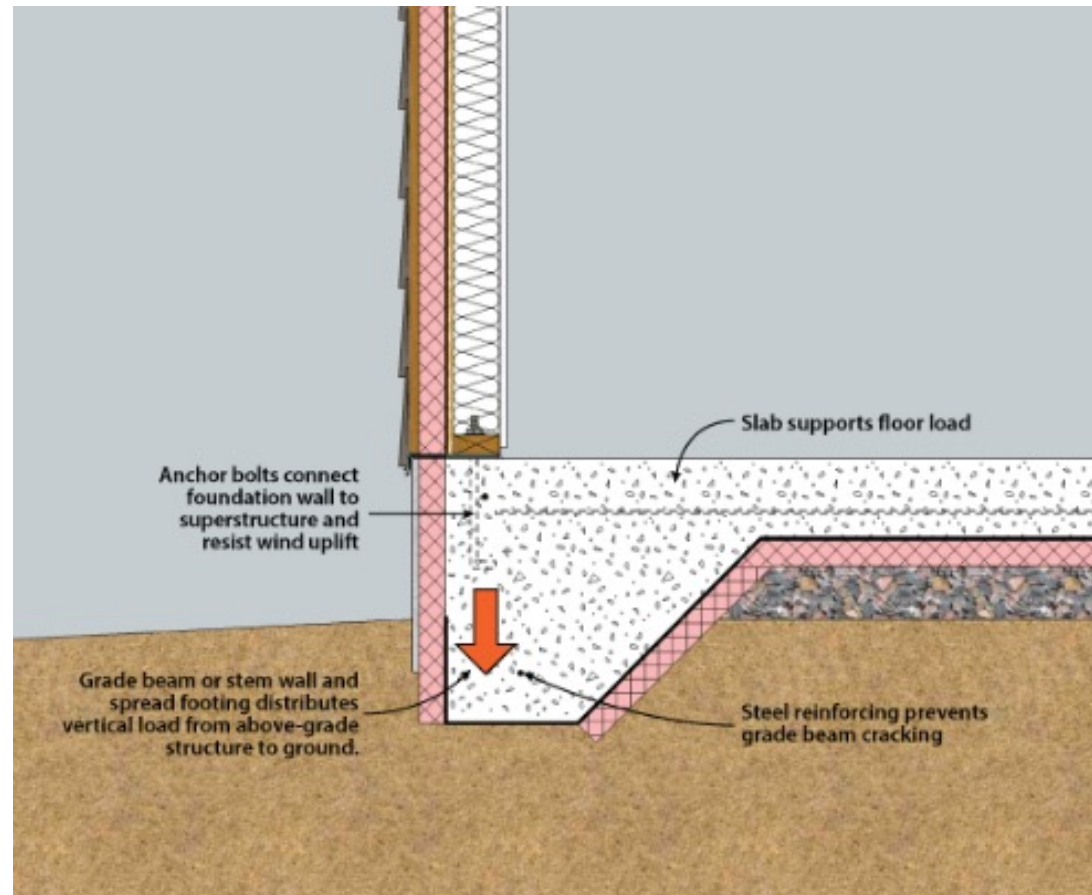
| OLD H1 |     | NEW H1       |   |     |     |     |  |
|--------|-----|--------------|---|-----|-----|-----|--|
| REGION |     | CLIMATE ZONE |   |     |     |     |  |
| A      | B   | 1            | 2 | 4   | 5   | 6   |  |
| 1.3    | 1.3 | 1.5          |   | 1.5 | 1.6 | 1.7 |  |

FAIL



## FLOOR – SLAB ON GROUND

**Raft Slab – with a  
300mm deep perimeter  
ring beam**



## FLOOR – SLAB ON GROUND

**Raft Slab – with a 300mm deep perimeter ring beam**

50mm Rigid Polyurethane Foam around perimeter

Construction R-Value 1.7 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 1.3    | 1.3 | 1.5          | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 |

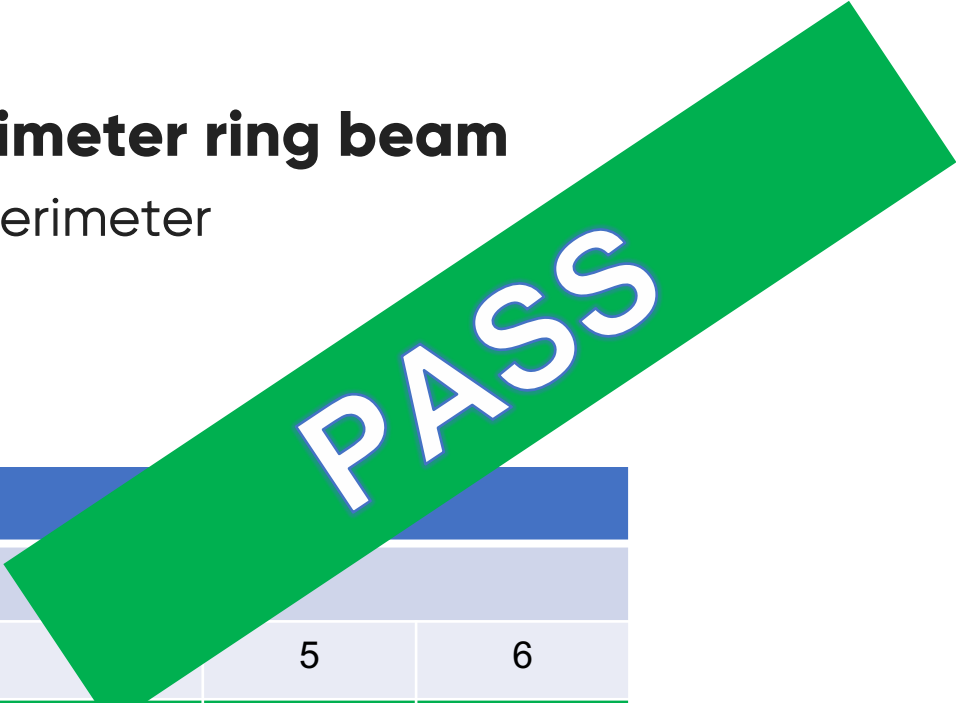


## FLOOR – SLAB ON GROUND

**Raft Slab – with a 300mm deep perimeter ring beam**

50mm Rigid Polyurethane Foam around perimeter

Construction R-Value 1.7 m<sup>2</sup>K/W



| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   |     | 5   | 6   |
| 1.3    | 1.3 | 1.5          | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 |



## ROOF

### **The traditional – “Cold roof with a bit of insulation thrown in”**

Construction build-up from inside to outside

- 13mm gypsum plasterboard
- 90mm SG8 H1.2 timber truss frame (Assuming 16% timber/ceiling ratio)
- 120mm Glass wool insulation (This is impractical by the way)
- Sheet metal roof on underlay

**Construction R-Value 3.3 m<sup>2</sup>K/W**



## ROOF

**The traditional – “Cold roof with a bit of insulation thrown in”**





## ROOF

**The traditional – “Cold roof with a bit of insulation thrown in”**

Construction R-Value 3.3 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 2.9    | 3.3 | 6.6          | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |



## ROOF

The traditional – “old” roof with a bit of insulation thrown in”

Construction  $U = 0.18 \text{ m}^2\text{K/W}$

PASS

|     |     | NEW H1       |     |     |     |     |     |
|-----|-----|--------------|-----|-----|-----|-----|-----|
|     |     | CLIMATE ZONE |     |     |     |     |     |
| A   | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 2.9 | 3.3 | 6.6          | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |



## ROOF

The traditional – “old” roof with a bit of insulation through the roof

Construction: 100 mm EPS m<sup>2</sup>K/W

PASS

FAIL

|     |     | NEW H1       |     |     |     |     |     |
|-----|-----|--------------|-----|-----|-----|-----|-----|
|     |     | CLIMATE ZONE |     |     |     |     |     |
| A   | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 2.9 | 3.3 | 6.6          | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |



## ROOF

**The traditional – “Cold roof with a bit more insulation thrown in”**

**We don't recommend this by the way!**

Construction build-up from inside to outside

- 13mm gypsum plasterboard
- 90mm SG8 H1.2 timber truss frame (Assuming 16% timber/ceiling ratio)
- 285mm Glass wool insulation (Which is reasonably practical)
- Sheet metal roof

**Construction R-Value 6.9 m<sup>2</sup>K/W**



## ROOF

**The traditional – “Cold roof with a bit more insulation thrown in”**



## ROOF

**The traditional – “Cold roof with a bit more insulation thrown in”**

Construction R-Value 6.9 m<sup>2</sup>K/W

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 2.9    | 3.3 | 6.6          | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |



## ROOF

The traditional – “Cold roof with a bit more insulation thrown in”

Construction R-Value 6.9 m<sup>2</sup>K/W

PASS

| OLD H1 |     | NEW H1       |     |     |     |     |     |
|--------|-----|--------------|-----|-----|-----|-----|-----|
| REGION |     | CLIMATE ZONE |     |     |     |     |     |
| A      | B   | 1            | 2   | 3   | 4   | 5   | 6   |
| 2.9    | 3.3 | 6.6          | 6.6 | 6.6 | 6.6 | 6.6 | 6.6 |



## ROOF

**But hang on a minute, the extra insulation cost more right?**

The difference in compliance to the new H1 is an extra 195mm of Glass Wool Insulation (about \$11/m<sup>2</sup>)





## TRADITIONAL ROOF – COST NOW VS LATER

|  |                    |
|--|--------------------|
| Nominal material cost per m <sup>2</sup> =   | \$ 10.74           |
| Differential in Thermal Loss w/m <sup>2</sup> K                                    |                    |
| R Value  | 3.3                |
| U value  | 0.303              |
| Qt = A x U-Value x Temperature Factor x Climate Factor /<br>m <sup>2</sup> x K x a |                    |
| Climate Factor for Queenstown kKh/a  | 74                 |
| Reduction in Heat loss kWh/a/m <sup>2</sup>  | 22.42              |
| Cost of electricity kWh  | \$ 0.30            |
| Savings per year per m <sup>2</sup>  | \$ 6.73            |
| Payback Period for Extra Insulation (Years)  | 1.6                |
| Nominal House Roof Area – Single Storey (m <sup>2</sup> )                          | 150                |
| <b>Electricity Bill Savings pa</b>   | <b>\$ 1,009.09</b> |



## COMMENTARY ON ADDING MORE INSULATION

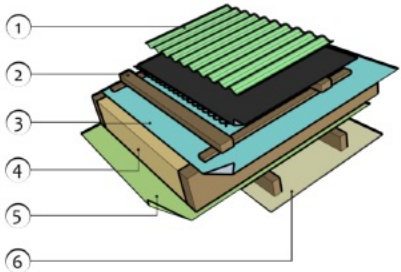
- Yes, there is an initial increase in cost of insulation of \$10.74m<sup>2</sup>
- (Note, this is a retail price from Bunnings.)
- But you save \$6.73m<sup>2</sup> per year on your power bill
- This doesn't account for the trend of electricity prices doubling every 10 years.
- It doesn't fix condensation risk



## ROOF

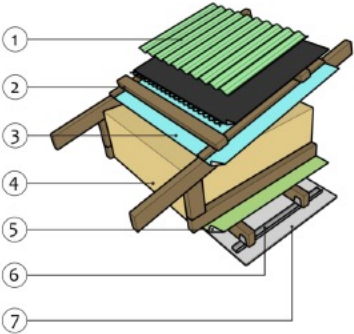
## PROPER ROOFS

### Condensation controlled cold roof



Skillion roof timber rafters:

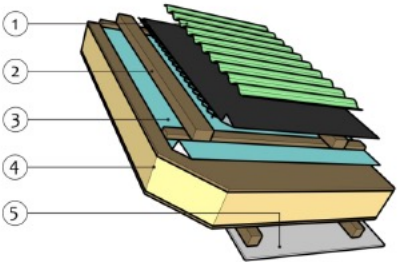
1. Roofing, underlay and safety mesh
2. Counter batten and purlin (ventilated)
3. Roof underlay vapour open membrane
4. Timber rafters and fibre insulation fully filling the rafters
5. Air/Vapour control membrane
6. Interior finish plasterboard with optional service cavity.



Timber truss roof:

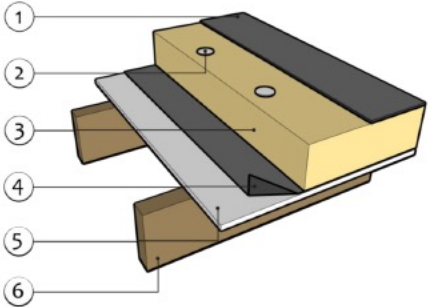
1. Roofing, underlay and safety mesh
2. Counter batten and purlin (ventilated)
3. Roof underlay vapour open membrane
4. Timber truss and fibre insulation ventilated
5. Air/vapour control layer membrane
6. Service cavity timber blocking with steel batten system shown
7. Interior finish plasterboard

### Warm roof



Skillion SIP roof

1. Roofing, underlay and safety mesh
2. Counter batten and purlin (ventilated)
3. Roof underlay vapour open membrane
4. SIP interior junctions taped for air/vapour control
5. Interior finish plasterboard with optional service cavity.



Membrane on rigid insulation warm roof:

1. Roof membrane (watertightness layer)
2. Mechanical fasteners (optional)
3. Rigid insulation
4. Air/vapour control membrane layer
5. Structural roof deck plywood shown (steel option)
6. Roof structure timber rafters shown (steel option)



## BENEFITS OF A WARM ROOF

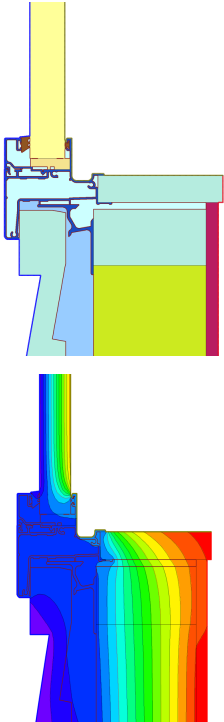
- Closes thermal bridges (slab edges)
- Can be easier to install on site
- Makes one uniform insulation layer around the whole building
- No risk for interstitial condensation
- Improves acoustics and fire rating (maybe)



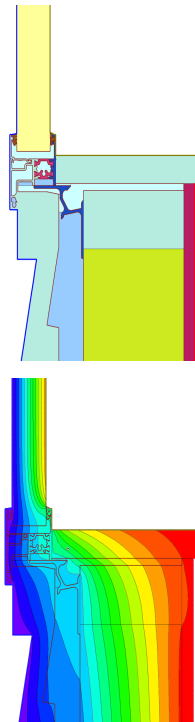
## WINDOWS

### Comparison of different types of windows

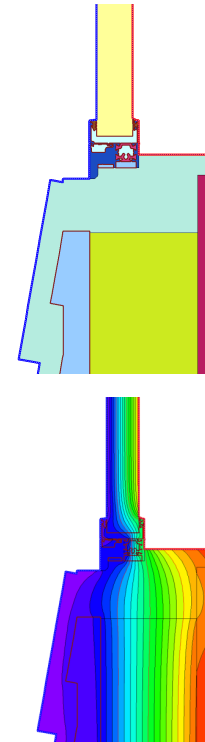
Non -  
thermally  
broken  
frame  
installed  
outside



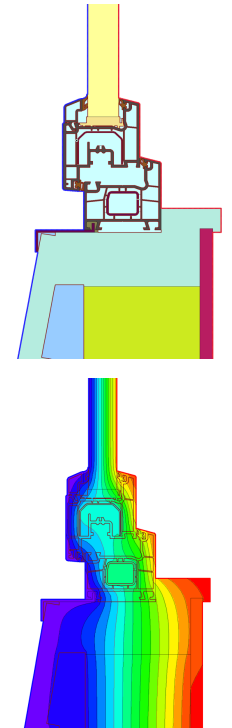
Thermally  
broken  
frame  
installed  
outside



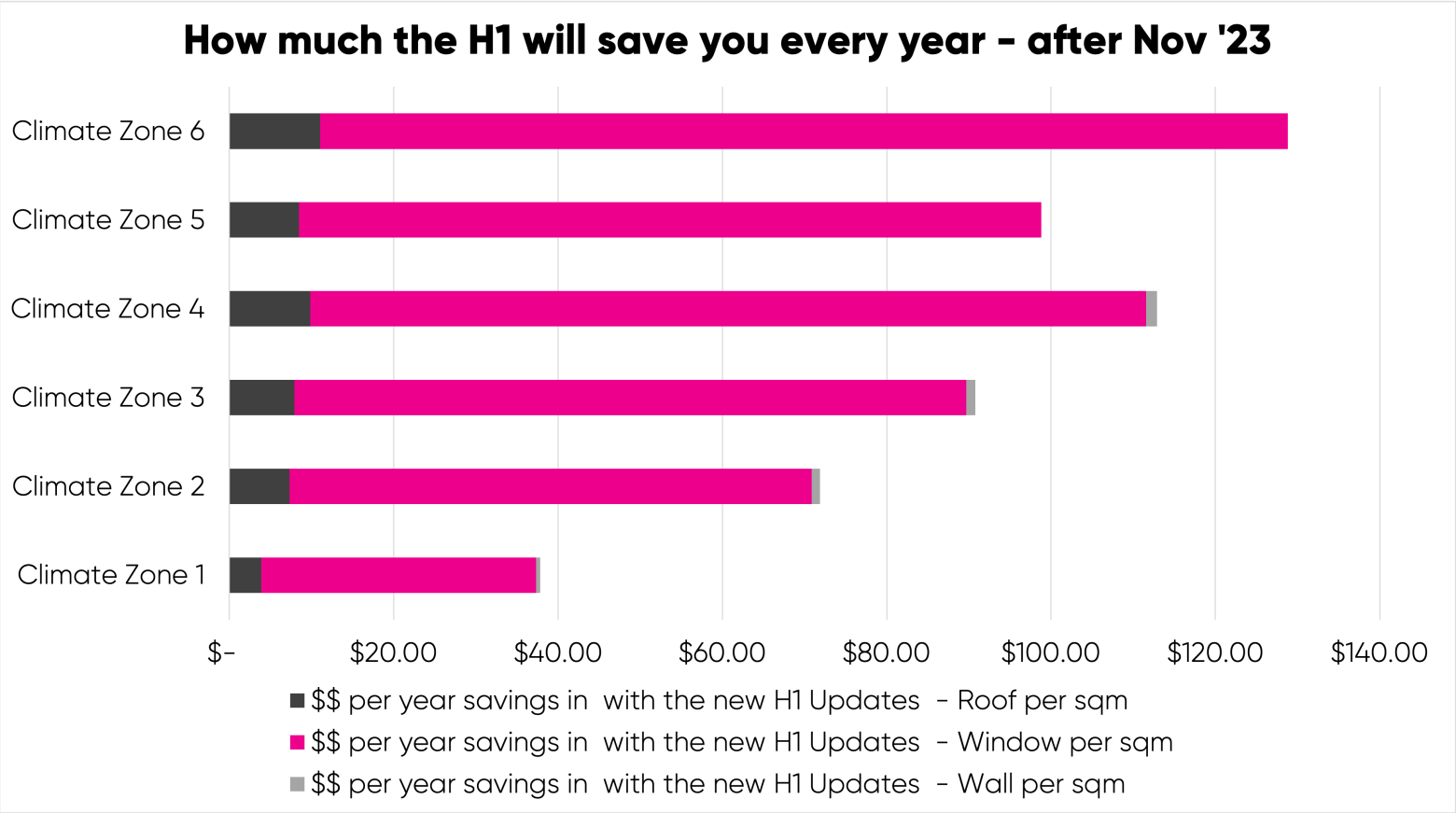
Thermally  
broken  
frame  
installed  
tucked in



uPVC  
frame  
installed  
inside



## SAVING MONEY



This calculation allows for a better-quality products and saving a lot of money throughout the year!



## WINDOWS: OTHER WAYS TO SAVE COST

- Delete wanz bar
- Taped air seals
- Airtightness
- Align window with thermal layer
- Fewer large windows rather than more small windows



## Q&A

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H1 – IT DOESN'T HAVE TO COST MORE



## WHAT OTHER ALTERNATIVE WAYS OF BUILDING OUTSIDE OF TIMBER FRAMING THAT ARE COST EFFECTIVE?

- Externally insulated steel frame
- SIPs
- Thermal mass concrete panels
- Steel deck under warm roof
- Panelisation



## QUESTIONS

1. Understanding the “breathability” of a building versus airtight.
2. H1 for commercial and education buildings – updates and compliance generally



REGISTER NOW!



### MARCH

30/03/23

NZBC H1 – Examples of compliant assemblies



### APRIL

27/04/23

NZBC H1 – Costing – No, it doesn't cost more

### MAY

25/05/23

Blower door testing & implementation on a multi-unit state-housing Passive House development

### JULY

27/07/23

Tanking Fundamentals

### AUGUST

31/08/23

Building improvements and their energy use impact

### SEPTEMBER

28/09/23

The difference between code compliant and actually good

### OCTOBER

26/10/23

Best practice for upgrading existing roofs

### NOVEMBER

30/11/23

How to keep your house cool

## MORE INFORMATION?



**@pink.moose**



**Oculus Architectural Engineering Ltd**



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**Next Building Science + Bullsh\*t Seminar: 27/04/2023 – H1 – Costing – No, it doesn't cost more!**