Kia Ora!

(Be Healthy)

Taking EnerPHit to Town

Multi-unit townhouse to Passive House in FIVE Simple Steps

Multi-Unit Townhouse to Passive House

Format for this presentation is…

- Introduction.
- What is Passive House? What is EnerPHit?
- The Townhouses.
- The Five Retrofit Steps to Passive House.
- The Economics of Energy Efficiency.
- Lots of Learnings.

About me

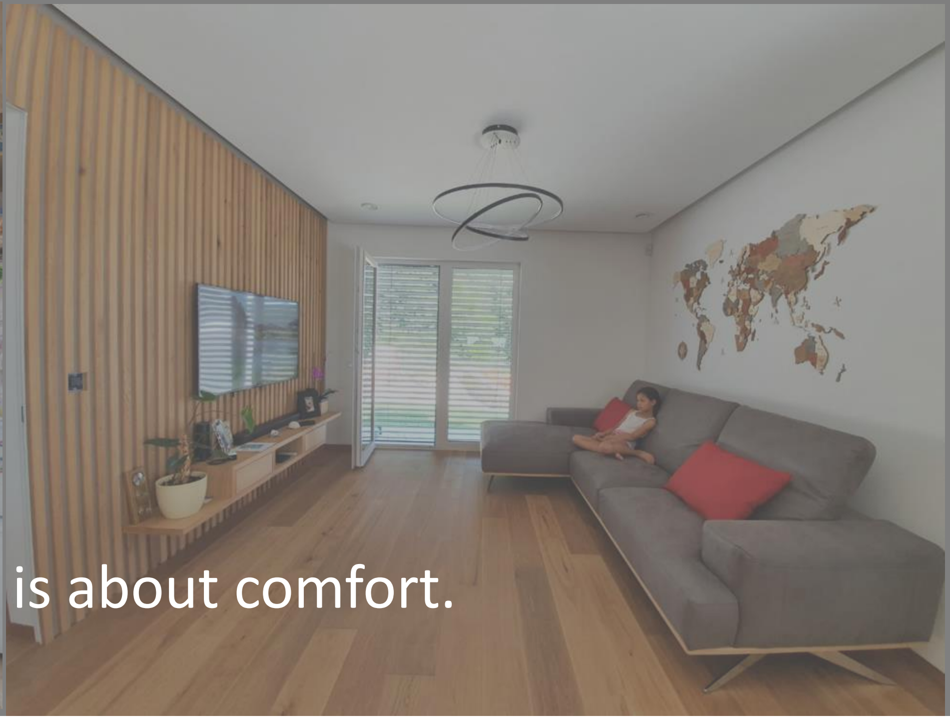
- I’m Damien McGill.
- Founded The Healthy Home Cooperation in October 2020.
- Certified Passive House Consultant and Civil Engineer.
- Canterbury Chapter Lead for Passive House Institute of NZ.
- Passionate about providing warm, dry, well ventilated, resilient homes to all Kiwi’s.
- Would dearly love to provide cost efficient passive homes for people and planet.

HEALTHY HOME COOPERATION

- Engineering happy healthy homes for people and planet.
- On a mission to change the way we design and build homes in Aotearoa.
- Access to warm, draught free, energy efficient, earthquake resilient housing should be the right of every New Zealander.
- Provide Energy Efficiency Advice, Energy Modelling, Geotechnical & Structural Engineering for high-performance homes.
- We’d love to celebrate the success of your deep retrofit project!
- www.healthyhome.kiwi

Passive House – Functional Definition

A Passive House is a building, for which thermal comfort can be achieved solely by heating or cooling of the fresh air volume required to provide good indoor air quality anyway.



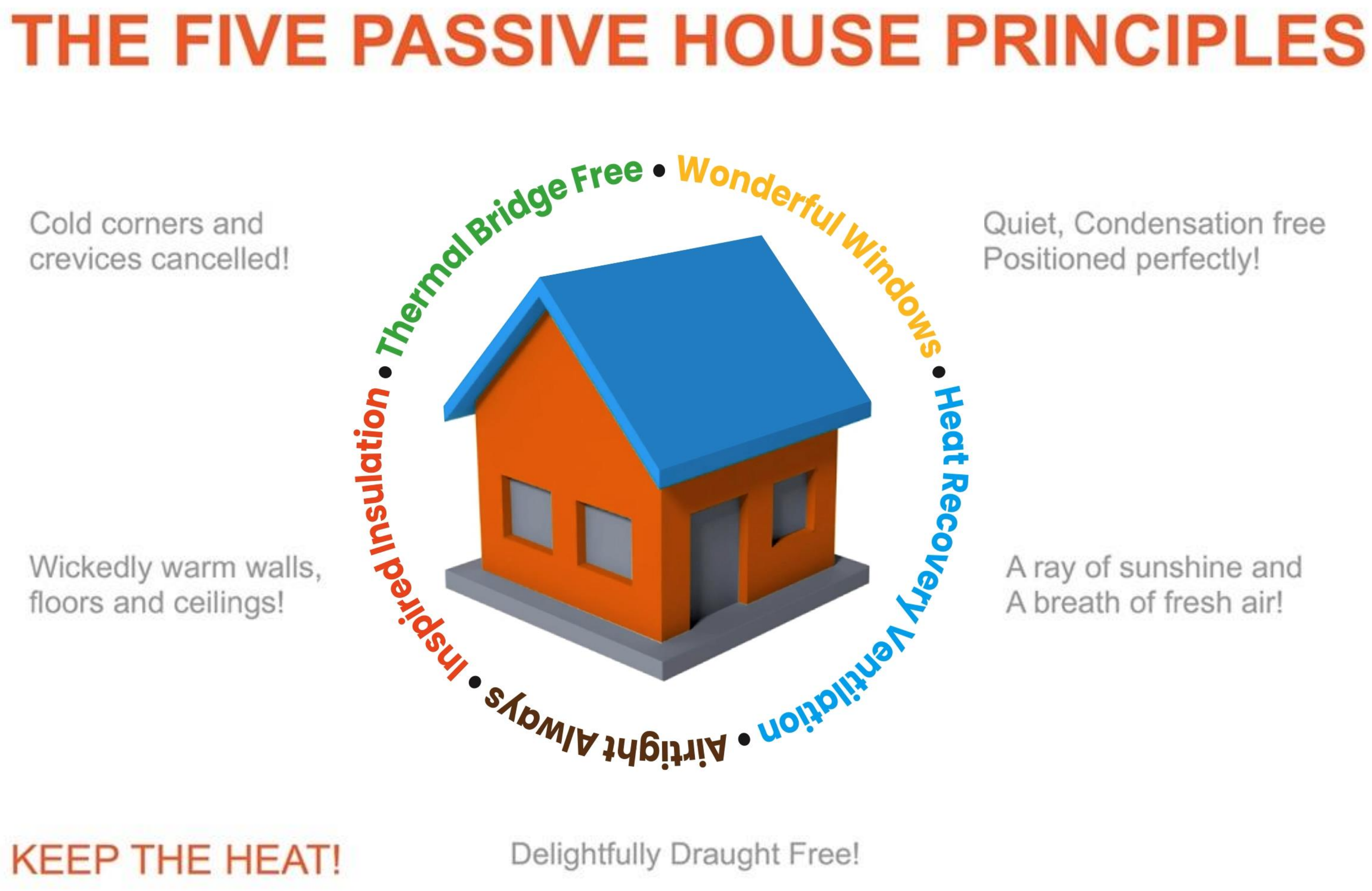
Fundamentally, Passive House is about comfort.

Passive House seal

EnerPHit seal

EnerPHit^{+i} seal (for buildings with mostly interior insulation)

PHI Low Energy Building seal


THE FIVE PASSIVE HOUSE PRINCIPLES
Cold corners and crevices cancelled!
Quiet, Condensation free Positioned perfectly!
Thermal Bridge Free • Wonderful Windows • Heat Recovery Ventilation • Airtight Always • Inspired Insulation
Wickedly warm walls, floors and ceilings!
A ray of sunshine and A breath of fresh air!
KEEP THE HEAT!
Delightfully Draught Free!

Passive House Planning Package (PHPP)

- In 1996, Dr. Wolfgang Feist founded the Passivhaus Institut in Darmstadt, Germany, to develop and promote the Passive House Standard using the tool developed to enable these buildings to be consistently replicated: the Passive House Planning Package (PHPP) was born!
- PHPP is an easy to use planning tool for energy efficiency for the use of designers and building experts. The reliability of the calculation results and ease of use of this planning tool has already been experienced by several thousand users.
- PHPP can be used to make any new or renovated building more energy efficient.

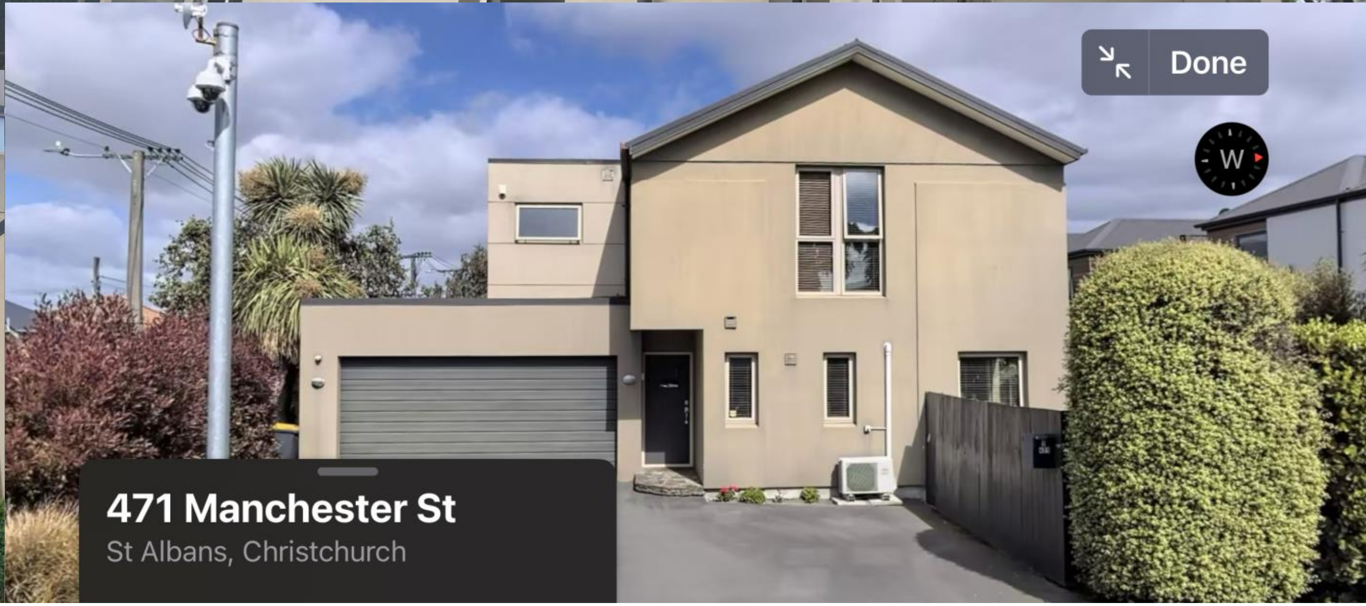
Passive House – EnerPHit Requirements*

- 1. Window Insulation Uw-1.05 (R-0.95). H1 = R-0.50 for new builds.
- 2. Mechanical Ventilation with heat recovery (MVHR) 75% efficient.
- 3. Airtightness below 1.0 ACH @ 50pa.
- 4. Heating demand less than 20kWh/(m^2a).
- 5. Primary Energy Renewable (PER) demand 60kWh/(m^2a).

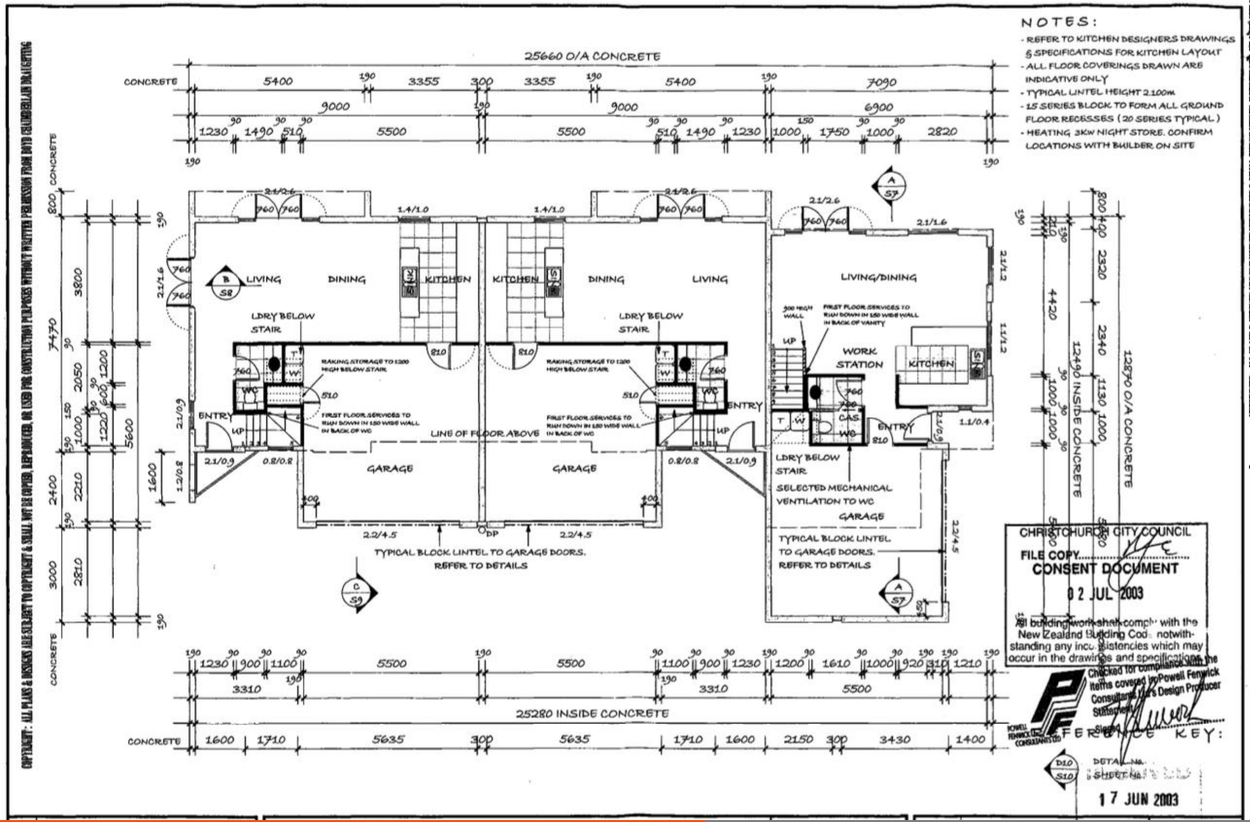
Multi-Unit Townhouses

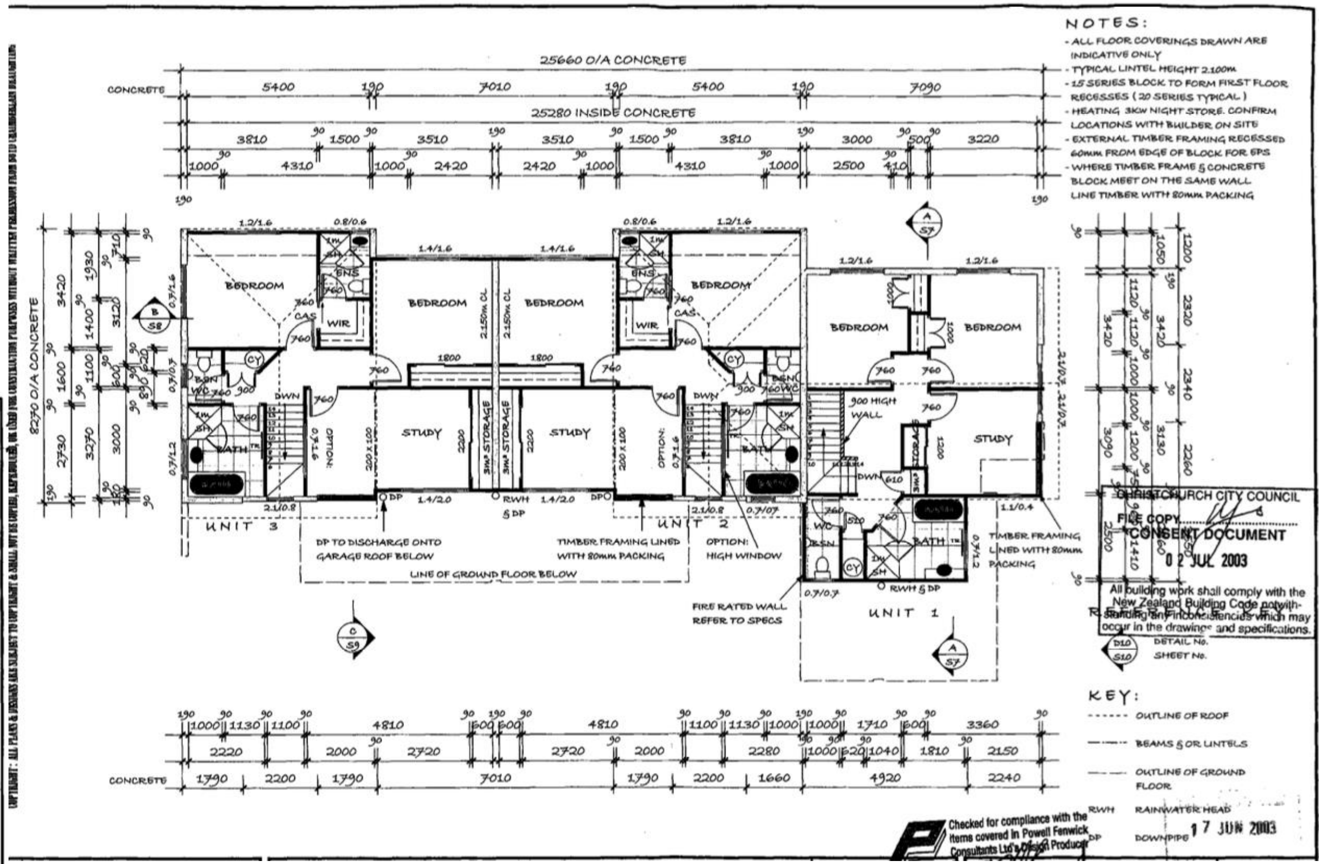
- A three unit townhouse development built in 2003. Located in central Christchurch.
- Uninsulated, concrete slab floor, piled to solid ground with 95x95mm concrete piles.
- Ground floor 20 series masonry with 60mm EPS insulation (Rockcote). (U-value 0.344, R-value 2.3).
- First floor a mixture of masonry and 90mm timber frame with 60mm direct fixed EPS. (U-value 0.237, R-value 4.22).
- Trussed roof insulated with 100mm of Pink Batts R3.2 insulation. (U-value 0.364, R-value 2.74).
- Skillion roof area insulated with 100mm of Pink Batts R3.2 insulation. (U-value 0.344, R-value 2.91).
- Thermaseal aluminium double glazed windows (U-value 3.85, R-value 0.26).
- Standard ventilation; bathroom and kitchen extraction and opening windows.

Multi Unit - Photos



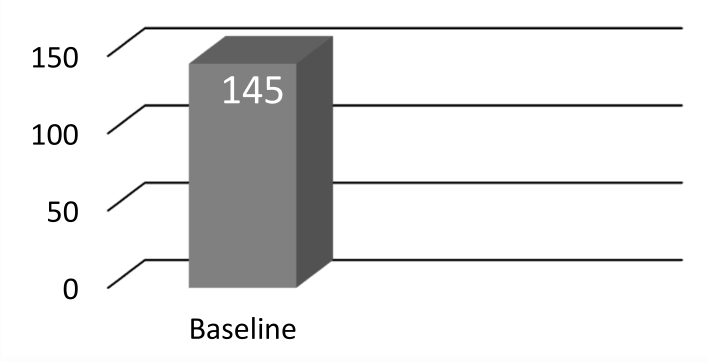
Multi Unit - Plans

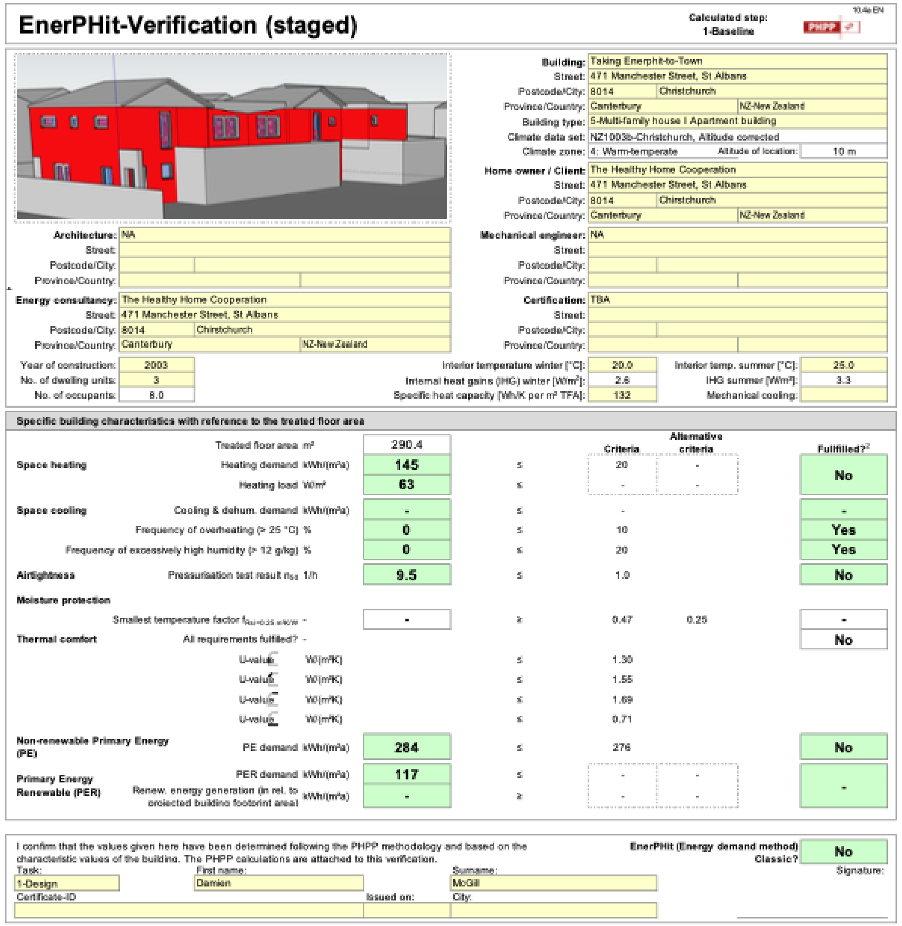




Multi Unit – Modelled in PHPP

- Treated Floor Area (TFA) – 290.4m^2
- Occupancy – 8 persons.
- Airtightness tested 9.51ACH@50pa.
- Heating demand – 145 kWh/(m^{2}a).
- Heating load – 63 W/m^2





EnerPHit-Verification (staged)

10.4a EN

Calculated step: 1-Baseline

Building:	Taking Enerphit-to-Town
Street:	471 Manchester Street, St Albans
Postcode/City:	8014 Christchurch
Province/Country:	Canterbury NZ-New Zealand
Building type:	5-Multi-family house I Apartment building
Climate data set:	NZ1003b-Christchurch, Altitude corrected
Climate zone:	4: Warm-temperate; Altitude of location: 10 m
Home owner / Client:	The Healthy Home Cooperation
Street:	471 Manchester Street, St Albans
Postcode/City:	8014 Chirstchurch
Province/Country:	Canterbury NZ-New Zealand
Architecture:	NA
Street:	
Postcode/City:	
Province/Country:	
Mechanical engineer:	NA
Street:	
Postcode/City:	
Province/Country:	
Energy consultancy:	The Healthy Home Cooperation
Street:	471 Manchester Street, St Albans
Postcode/City:	8014 Chirstchurch
Province/Country:	Canterbury NZ-New Zealand
Certification:	TBA
Street:	
Postcode/City:	
Province/Country:	

Year of construction:	2003	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	3	Internal heat gains (IHG) winter [W/m^2]:	2.6	IHG summer [W/m^2]:	3.3
No. of occupants:	8.0	Specific heat capacity [Wh/K per m^2 TFA]:	132	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

						Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area	m^2	290.4					
Space heating	Heating demand	kWh/(m^{2}a)	145	≤		20	-	No
	Heating load	W/m^2	63	≤		-	-	
Space cooling	Cooling & dehum. demand	kWh/(m^{2}a)	-	≤		-		-
	Frequency of overheating (> 25 °C)	%	0	≤		10		Yes
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤		20		Yes
Airtightness	Pressurisation test result n_{50}	1/h	9.5	≤		1.0		No
Moisture protection								
	Smallest temperature factor $f_{Rsi=0.25\ m^2K/W}$	-	-	≥		0.47	0.25	-
Thermal comfort	All requirements fulfilled?	-						No
	U-value	W/(m^{2}K)		≤		1.30		
	U-value	W/(m^{2}K)		≤		1.55		
	U-value	W/(m^{2}K)		≤		1.69		
	U-value	W/(m^{2}K)		≤		0.71		
Non-renewable Primary Energy (PE)	PE demand	kWh/(m^{2}a)	284	≤		276		No
Primary Energy Renewable (PER)	PER demand	kWh/(m^{2}a)	117	≤		-	-	-
	Renew. energy generation (in rel. to projected building footprint area)	kWh/(m^{2}a)	-	≥		-	-	

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

EnerPHit (Energy demand method) Classic? No

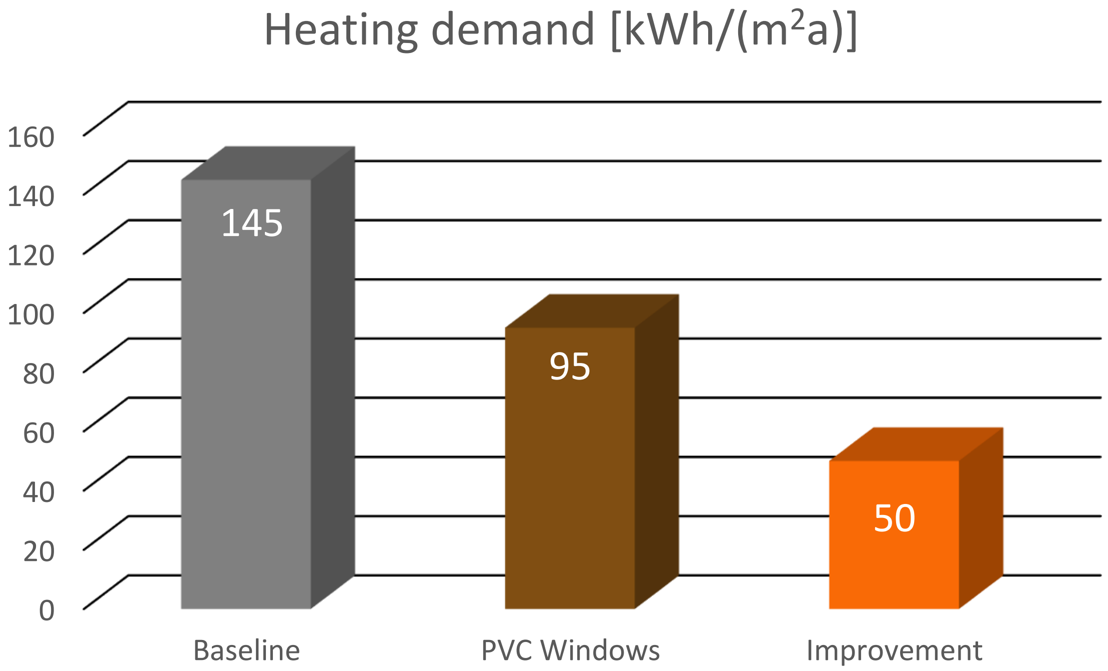
Task:	First name:	Surname:	Signature:
1-Design	Damien	McGill	
Certificate-ID	Issued on:	City:	

The Five Steps to EnerPHit

- 1. Improve Windows by replacing aluminium for triple glazed PVC.
- 2. Improve Insulation by adding ceiling, roof and overhang insulation.
- 3. Improve Ventilation by adding MVHR.
- 4. Improve Thermal Bridging by insulating on top of the slab.
- 5. Improve Airtightness to less than 1.0ACH by adding an airtightness layer.

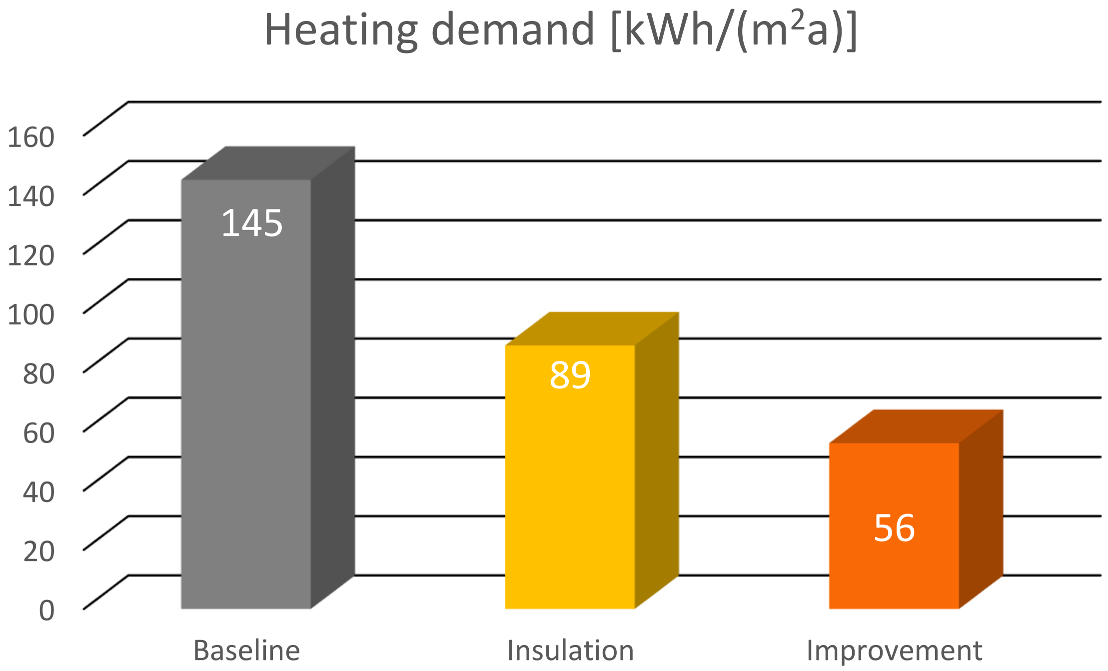
Step 1 to Passive House

- Improve Windows by replacing aluminium for triple glazed PVC.



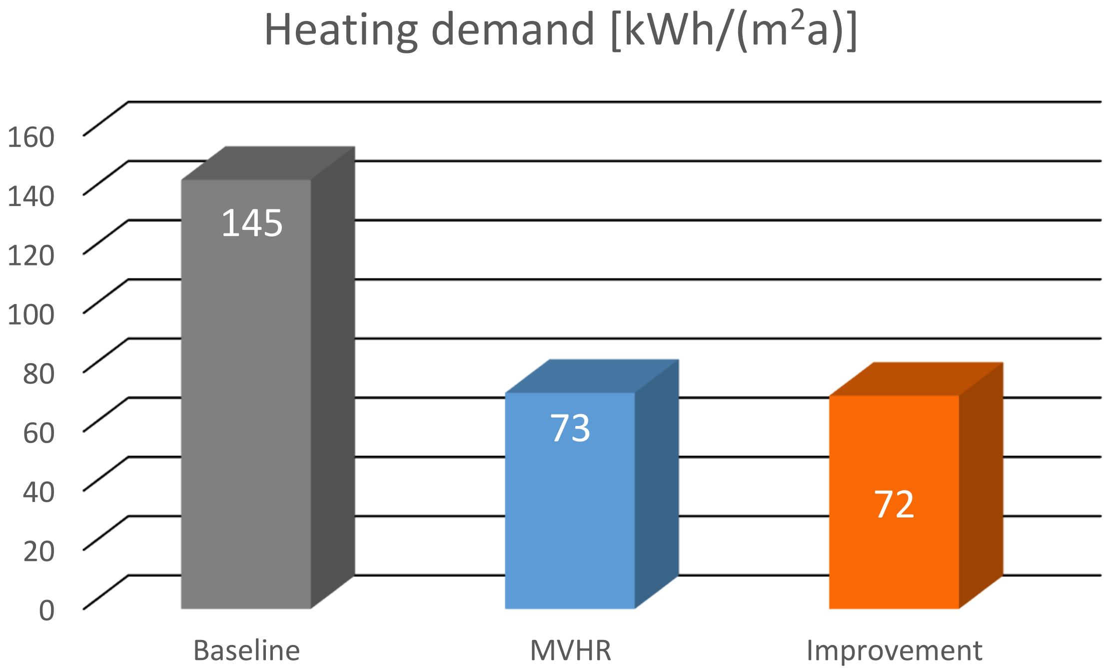
Step 2 to Passive House

- Improve Insulation by adding ceiling, roof and overhang insulation.



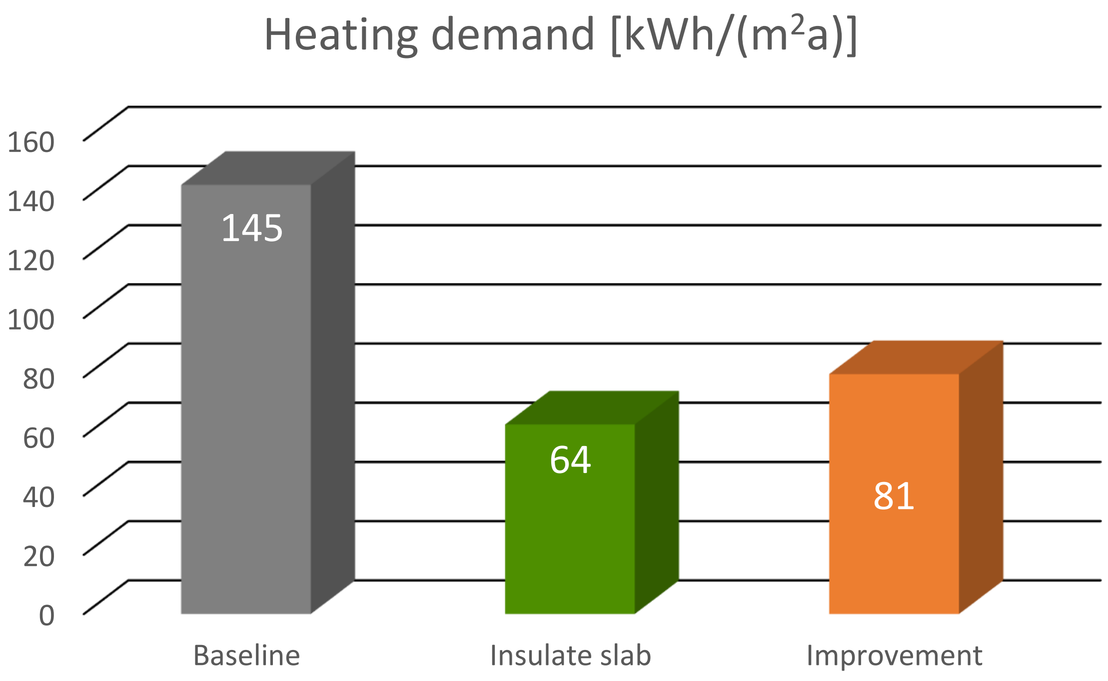
Step 3 to Passive House

- Improve Ventilation by adding MVHR.



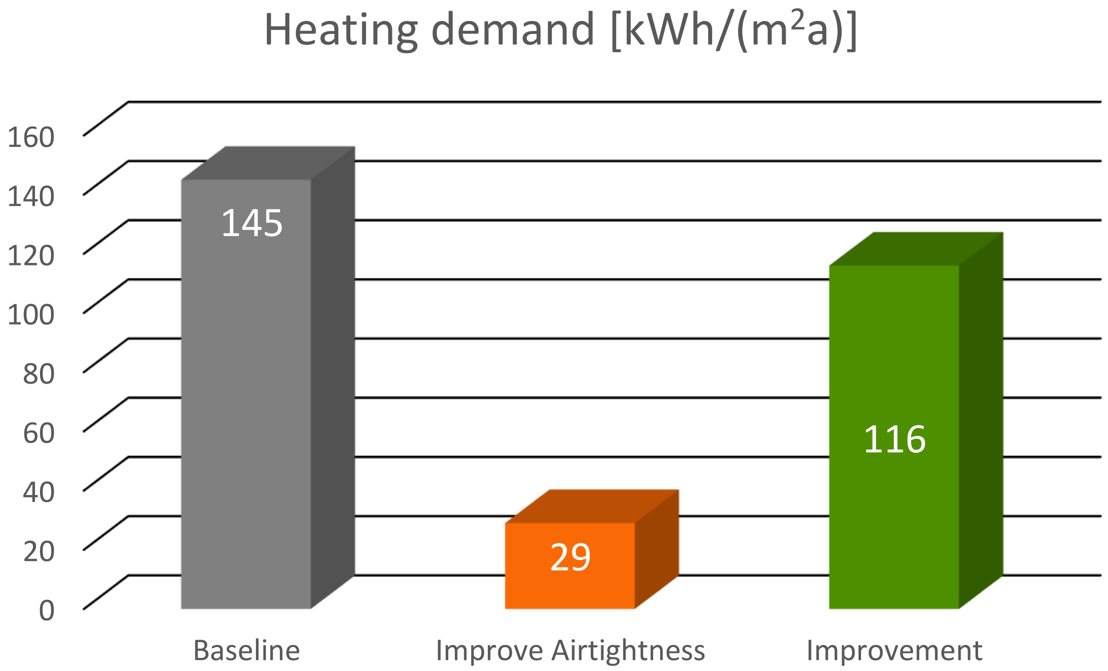
Step 4 to Passive House

- Improve Thermal Bridging by insulating on top of the slab.



Step 5 to Passive House

- Improve Airtightness to less than 1.0ACH by adding an airtightness layer.

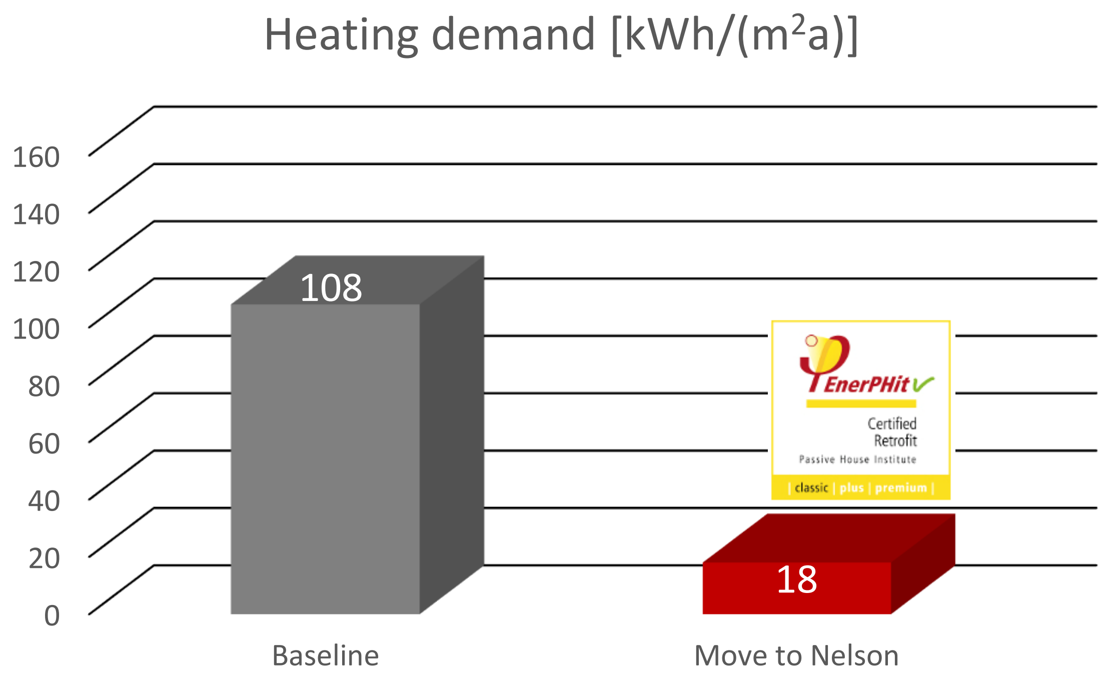


Have we achieved Passive House?

- Well Yeahsss… and No.
- The exercise has failed to reach the lofty goals of EnerPHit, but we have met the Passive House Institute Low Energy Building Standard.
- This is a valid option too.
- **Achieving the PHI-Low Energy standard enables this house to meet MBIE's proposed Building for Climate Change Intermediate Cap for thermal performance of 30kWh/(m²a).**

Step 5a to Passive House

- Move units to Nelson.



Summary

- The Passive House EnerPHit standard is achievable for many ordinary multi-unit developments across New Zealand in just five reasonably simple steps.

- **Passive House is Practically Possible!**

Part 2

The Economics of Energy Efficiency

Health checks

- PHPP assumes that homes are heated to 20 degrees every room, all the time.
- Kiwi's chronically underheat their houses.
- This shows up in doctor's bills, prescriptions & productivity.
- This exercise is for this particular development in this particular setting. The numbers following may not relate to your or other builds.
- This exercise shows what can be achieved when energy modelling in PHPP and using the variants tab, then extrapolating further using economic principles.
- My purpose in this is to provide detailed data to drive determined defined decisions.

Just Quickly

- Our last years power bill in Unit 3 was \$2,290 for the year. (including the \$250 off deal we got.)
- We maintained a minimum of 18-20 degrees in every room at all times. But not the full 20 degrees all the time.
- Our Treated Floor Area is 124.8m^2
- We have a deal where we pay \$0.23/kWh, as we are low users.
- So \$2,290 / 124.8 / 0.23 = 80kWh/(m^2a)
- Pretty close to where we are at, right now, circa 85-88kWh/(m^2a) for all power use according to PHPP.

The Numbers for this house

- Treated Floor Area: 290.4m^2
- Work done / Work to do
- Interest Rate: 3% / 5%
- Inflation Rate: 4% / 3%

- Time Period; 30 years

Step 1 to PHI Low Energy Building

- Improve Windows by replacing aluminium for triple glazed PVC.

- Energy Saving 49.9kWh/(m^2a)
- Heating bill reduction = $3,330 /year
- Price of Improvement; $76,184
- Payback period; 23 years
- Triple glazing is oh so quiet!

Step 2 to PHI Low Energy Building

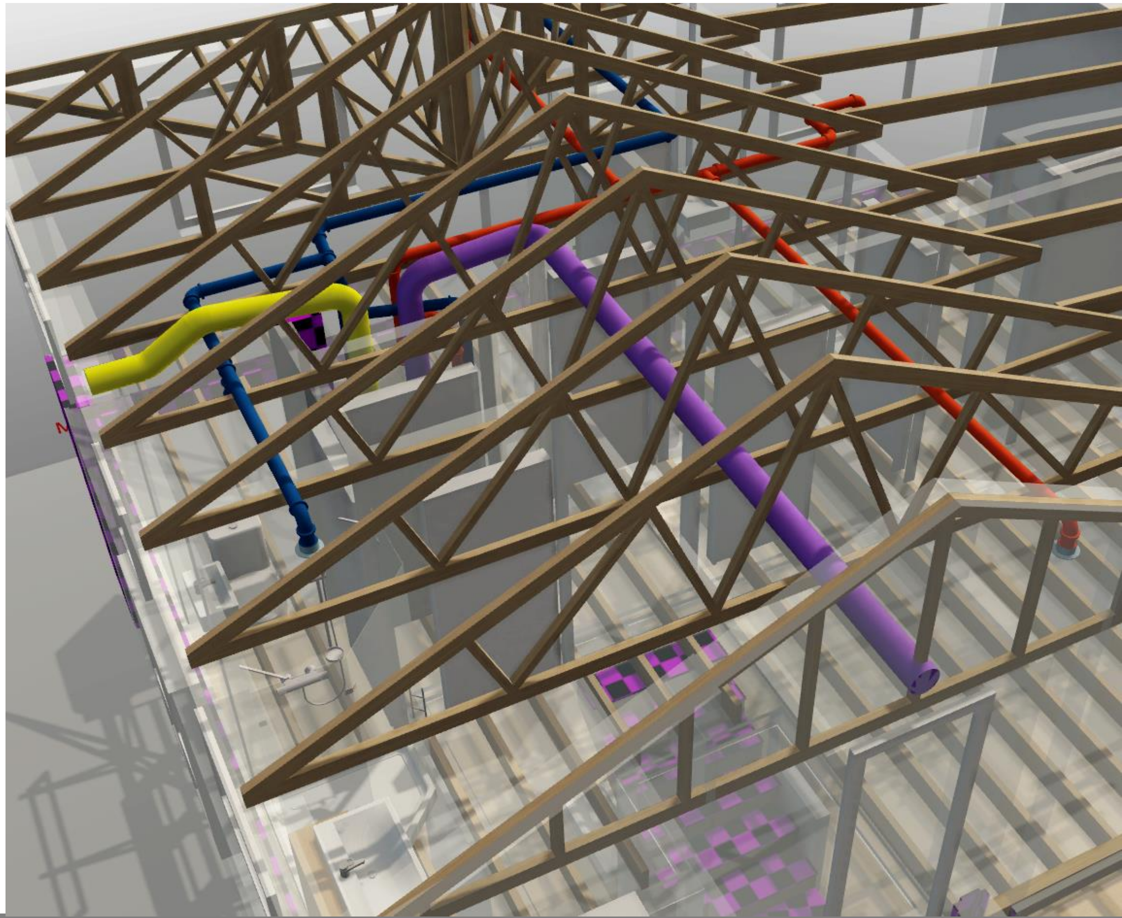
- Improve Insulation by adding ceiling, roof and overhang insulation.

- Energy Saving 6.3kWh/(m^2a)
- Heating bill reduction = $422 /year
- Price of Improvement; $2,864
- Payback period; 7 years.
- No brainer!

Step 3 to PHI Low Energy Building

- Improve Ventilation by adding MVHR.

- Energy Saving 16kWh/(m^{2}a)
- Heating bill reduction = $1,060 /year
- Price of Improvement; $45,000
- Payback period; Greater than 30 years.
- JUST DO IT!
- Nothing beats a breathe of fresh air!



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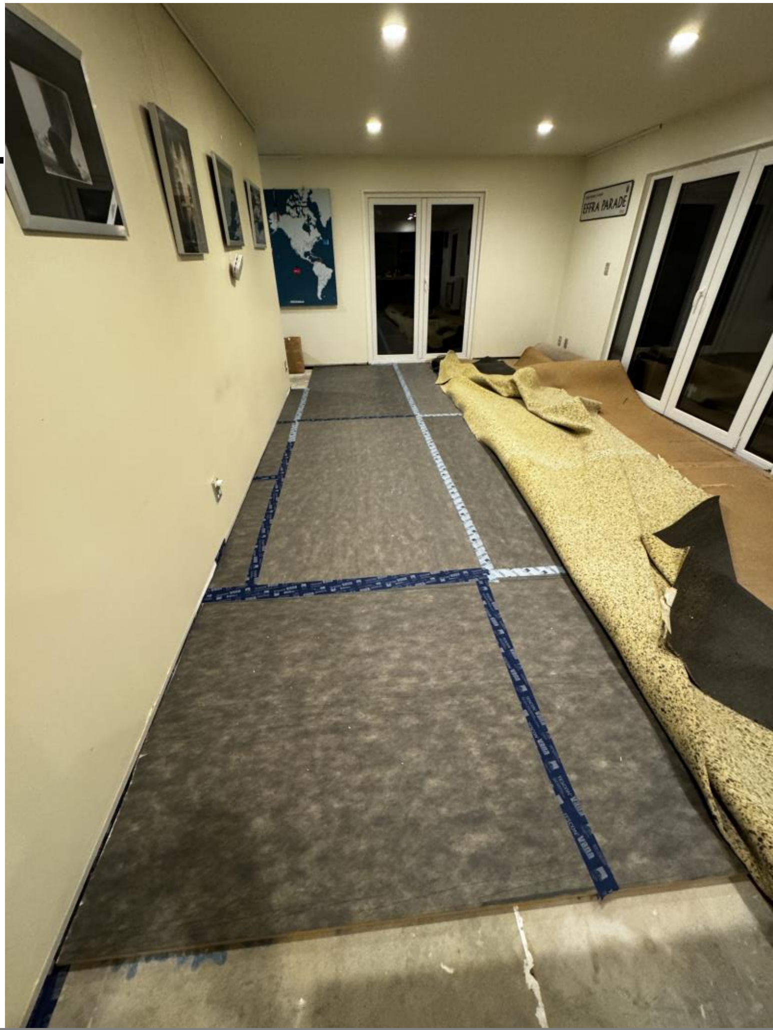
Step 4 to PHI Low Energy Building

- Improve Thermal Bridging by insulating on top of the slab.



- Energy Saving 10kWh/(m^2a)
- Heating bill reduction = $695 /year
- Price of Improvement; $2,790
- Payback period; 4 years
- Mad not to!

Step 5 to PHI Low Energy Building

- Improve Airtightness to less than 1.0ACH by adding an airtightness layer.

- Energy Saving 34kWh/(m^{2}a)
- Heating bill reduction = $2,266 /year
- Price of Improvement; $33,104
- Payback period; 23 years.
- What’s tighter, the house or the wallet?

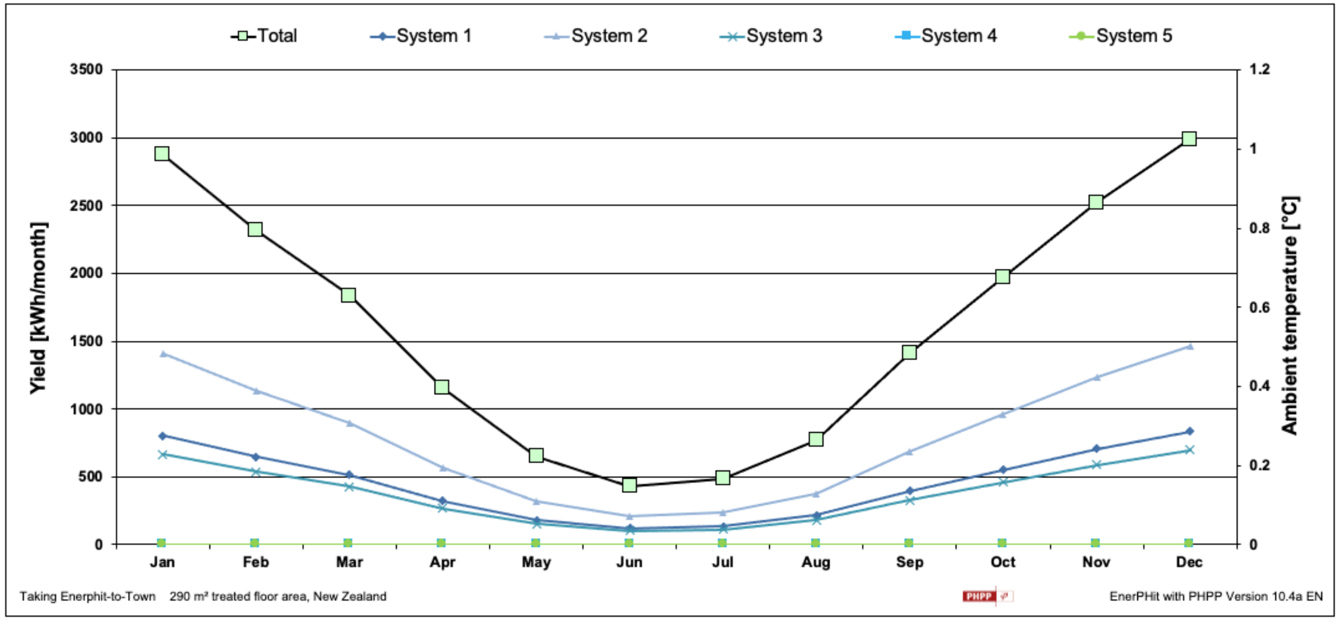
Step 1-5 to PHI Low Energy Building

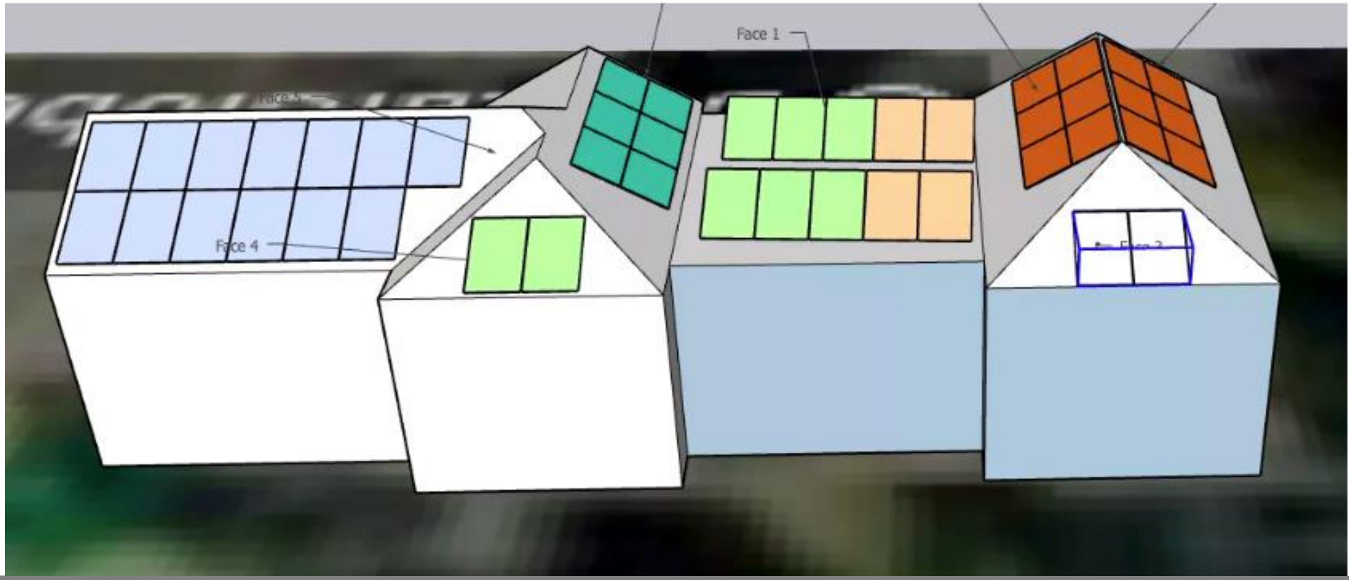
- Combining Steps 1-5.

- Energy Saving 116.4kWh/(m^2a)
- Heating bill reduction = $7,773 /year
- Price of Improvement; $160,000
- Payback period; 29 years.
- Good for another 50 years!

Adding Solar Panels

- Just for Mike Casey ☺
- 19.7kW Solar Array
- Power generated 19,427 kWh
- 50% used @$0.23 = $2,234
- 50% to grid @$0.15 = $1,457
- Saving = $3,691
- Payback period; 13.6 years.





Lots of Learnings

- The cost of money has a massive impact on payback periods.
- What was good value in 2021 isn't now.
- It's never cheaper than now to make improvements.
- **You can't put a price on comfort!**
- Do ventilation earlier.
- All models are wrong, some are useful. PHPP is very useful
- You need to break eggs to make an omelet.
- I'm very happy being warm and comfortable in a salubrious home.
- I'm very happy I can provide warm and comfortable homes for others!
- **You can't put a price on comfort!**

Kia Ora!

(Be Healthy)

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Eco Design Advisor