

Rochelle Payne

Building Excellence Engineer **BXG**



**THE IMPACT OF THE PASSIVE HOUSE STANDARD ON THE CONSTRUCTION COST OF
SOCIAL HOUSING PROJECTS IN NEW ZEALAND**

NZ Energy Use

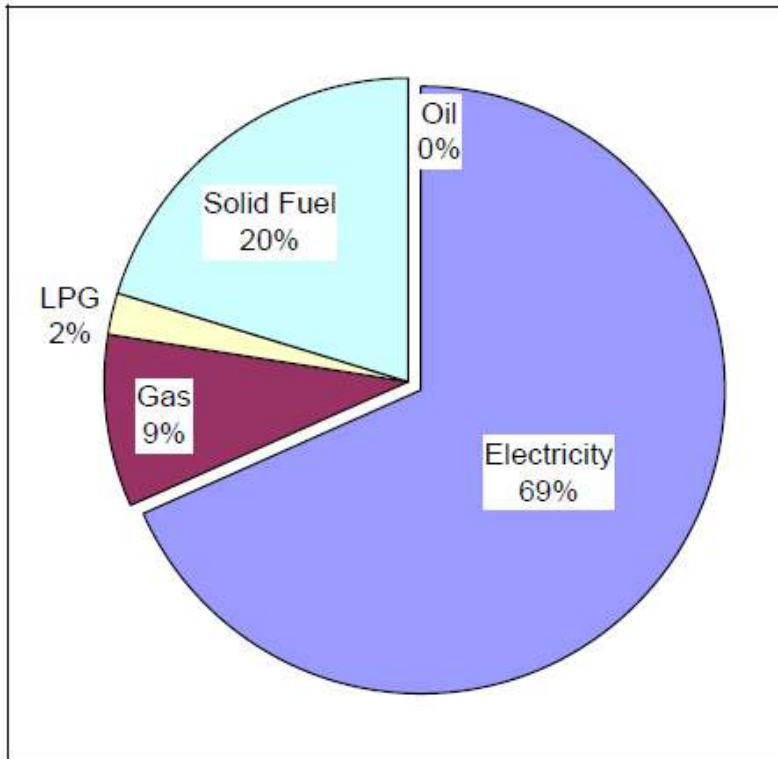


Figure 13: Total energy use by fuel type

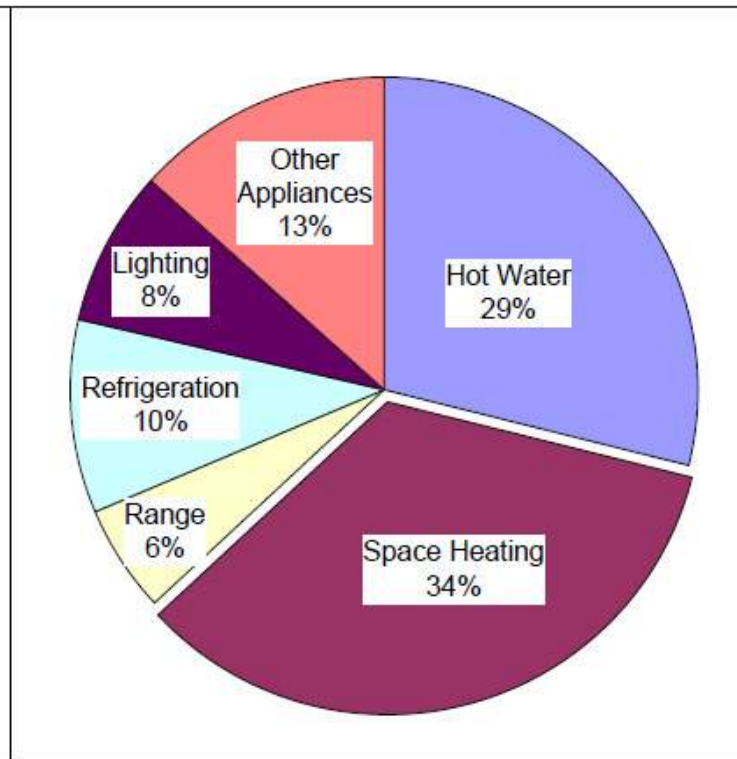


Figure 14: Total energy use by end-use

Source: Isaacs (2010) HEEP Energy Use in NZ Households BRANZ Study Report 221, Page 15

NZ Energy Use



Total annual energy consumption on average is 11,410 kWh per year*

34% of that is 3,879 kWh per year

Using a cost of \$0.297 per kWh** that is **\$3,388** per year for the average household with **\$1,152** spent on space heating.

**: Isaacs (2010) HEEP Energy Use in NZ Households BRANZ Study Report 221, Page 13*
***<https://www.mbie.govt.nz/assets/398198b193/quarterly-survey-of-domestic-electricity-prices.pdf>*

Fuel Poverty



A household is in **fuel poverty** if it would need to spend more than 10% of the total household income on all household fuels to achieve a satisfactory indoor environment

(21°C in the living areas and 18°C in other parts of the house).

Source: <https://www.msd.govt.nz/about-msd-and-our-work/publications-resources/journals-and-magazines/social-policy-journal/spj27/fuel-poverty-on-new-zealand-27-pages142-155.html>

NZ incomes



To access social housing in NZ you must have income under:

- **\$601.31** a week (after tax) for people who have no partner and no dependent children
- **\$925.08** a week (after tax) for people who have a partner and/or dependent children

Source:
<http://housing.msd.govt.nz/forms/factsheets/who-can-get-social-housing.html>

NZ incomes



		\$3,388	\$1,152
Income per week	Income per year	% of income	% of income
\$601/week	\$31,252/year	10%	3%
\$925/week	\$48,100/year	7%	2%

Source:
<http://housing.msd.govt.nz/forms/factsheets/who-can-get-social-housing.html>



THE GRIM REALITY OF ENERGY POVERTY IN NEW ZEALAND

“Over the past decade, electricity prices have soared by 42%.”

NEW ZEALAND

Power poverty: 'We don't even have a heater'

10:22 am on 12 September 2018

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Matthew Theunissen, Reporter
matthew.theunissen@radioz.co.nz

Pensioners sit in cold houses wrapped in sleeping bags for fear of a big power bill, a budgeting services trust says, as a new report reveals energy hardship in NZ.

Nearly a third of all households struggle to pay their electricity bills with many incurring fines or having their power cut entirely.



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PRIM REAL ENERGY POVERTY ZEALAND



Energy poverty is a reality for at least a fifth of New Zealanders

Eleanor Wenman · 20:17, Dec 16 2017



MONIQUE FORD/STUFF

Wellington resident Kelly McLeod said energy poverty has a ripple effect, as people struggle to cover the cost of electricity along with rent, food and education.

Reduced summer power bills used to be a welcome reprieve for struggling families: the sun's out, the heaters are off, and everyone's outside saving on power use.

But, that's not the case anymore. High power bills are becoming a year-round phenomenon, and it's crippling some families.

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Q APPS

THE SPINOFF

Home TV Politics Music Society Food Business Atea Parents Books Gaming Science

NOVEMBER 24, 2017



EMILY AND EDDIE FIVE YEARS AGO

Energy poverty is real in New Zealand. I've been there.



Emily Whites | Parents Editor
Pastor content

One in five New Zealanders live in energy poverty, forced to choose between adequately heating their homes and other life essentials. Emily Whites looks back at her own experience raising a family in a drafty, cold, damp Kiwi home.

stuff

business

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Eleanor Wenman · 20:17, Dec 16 2017

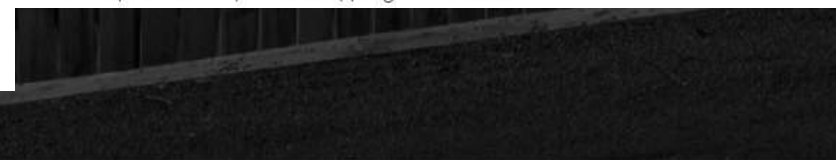


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NOTED | LISTENER | NORTH/SOUTH | Metro | @RNZ

Fuel poverty in the land of plenty

by Ruth Laugesen / 01 October, 2011

Soaring electricity prices are causing more New Zealanders to struggle to cold, damp, unhealthy houses.



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In July 2010, five-and-a-half-month-old Roretana Holland was found dead in the bed he was sharing with his four-year-old sister, at his parents' home in Warspite Ave, Porirua. The coroner for the case, Ian Smith, warned once more about the dangers of cot death when sleeping arrangements are shared. Social deprivation, smoking in the household and excessive alcohol consumption were all there. But one part of



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Flick Electric Co

@FlickElectricCo

Follow

Energy poverty is a real problem in NZ, with 1 in 5 Kiwis not able to afford their power bill. Find out why Kiwis like @MatildaRice are backing our call for change 💡 ❤️ → bit.ly/GiveAFlick

Benefits of Passive House for Social Housing

Preaching to the choir, but:

- Passive House (PH) is a proven performance standard for building extremely low energy buildings.
- A Code standard house could consume over 100kWhr/m²/annum for heating but as a PH the building would consume less than 15KWhr/m²/annum.
- The PH system is most beneficial to those in our community who are struggling to pay for heating.
- The up-front costs can be absorbed over the life time of the building.
- PH buildings are very comfortable and quiet with good air quality and high occupant satisfaction





International Context



Many parts of the world already do this, for example.....



Fulmondeston,
Norfolk



Rochestown House

Dún Laoghaire, Ireland



14 new sustainable duplexes
for low income families
Brussels, Belgium

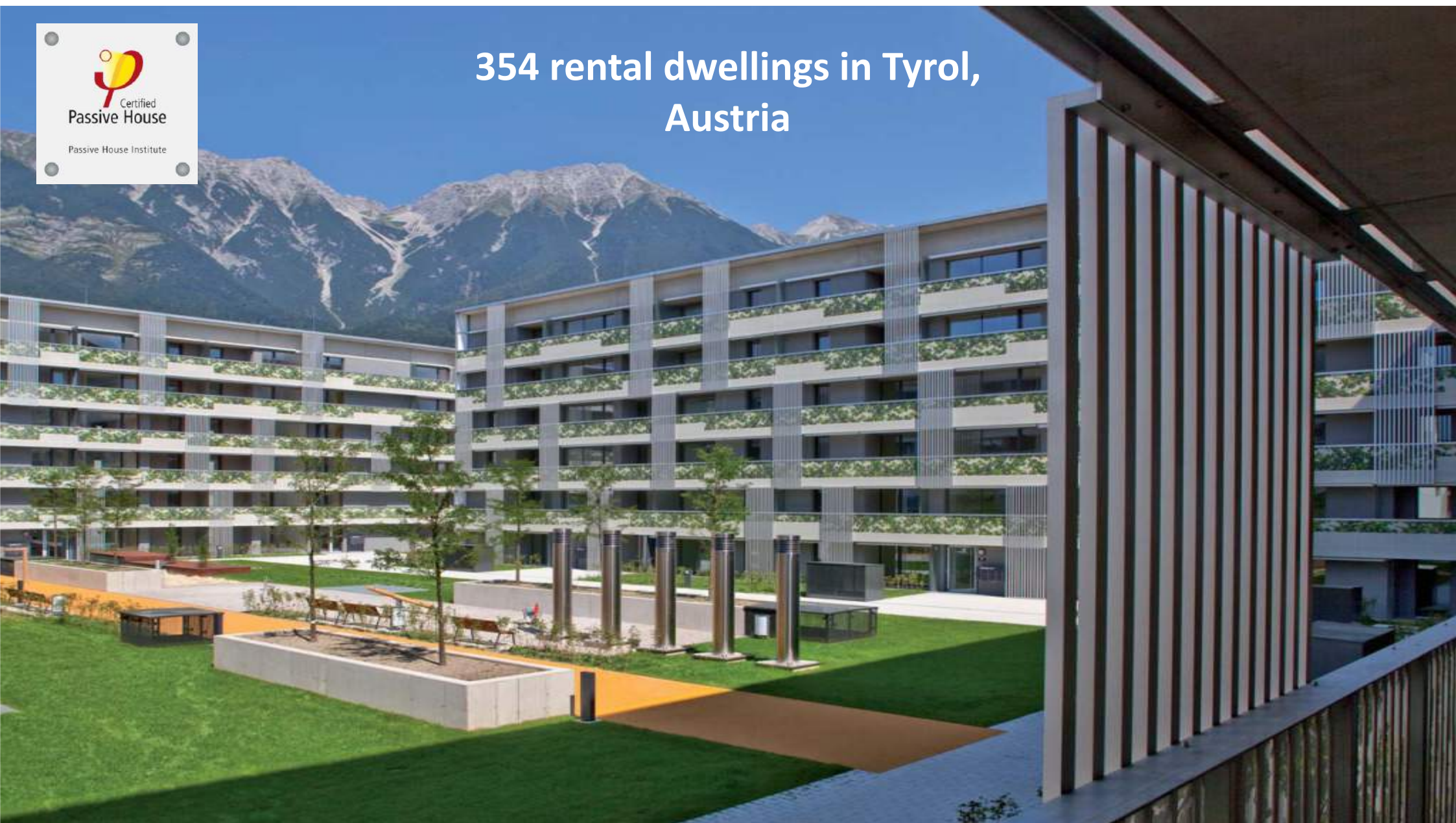


30 Apartments and eco- neighbourhood in Harenberg, Belgium





354 rental dwellings in Tyrol, Austria



Casa Light, Italy





**Belfield Homes,
Philadelphia, USA**



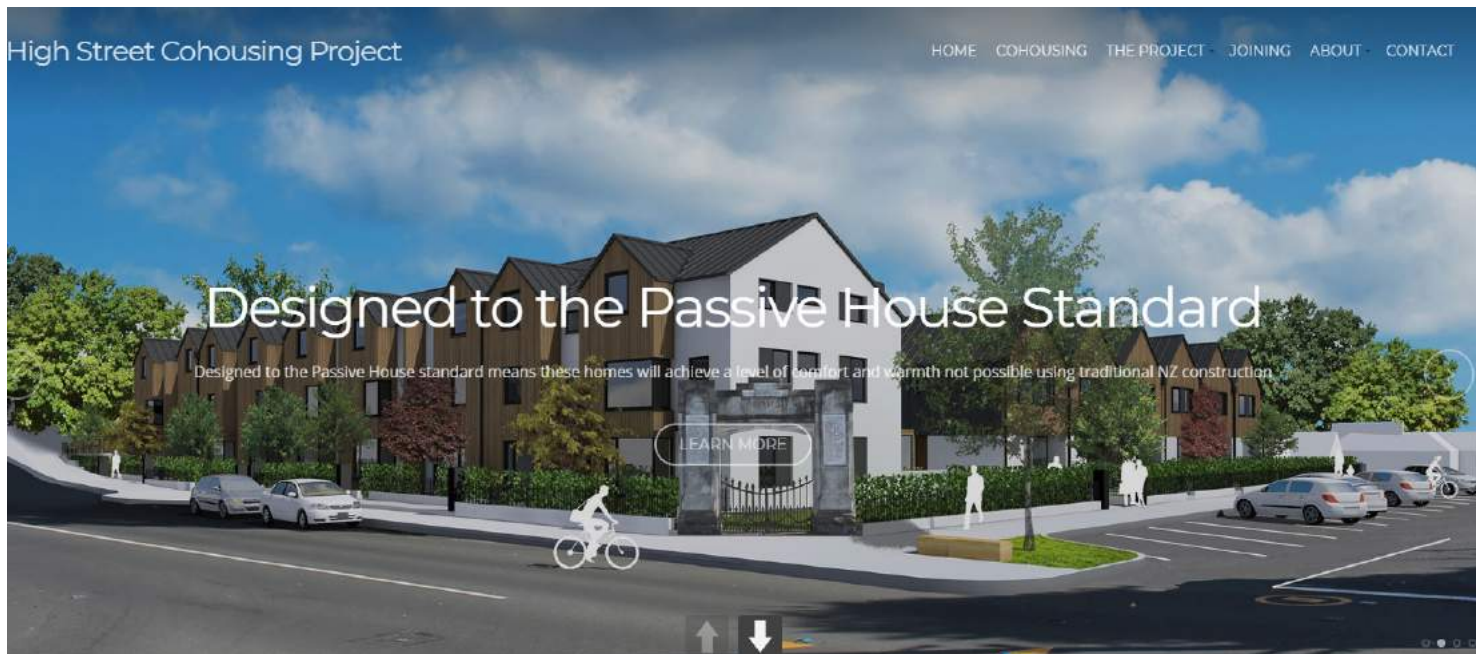


Heidelberg West, Melbourne, Australia



The New Zealand Context

At this time New Zealand does not have any certified Passive House social housing projects.



Why Not?



Build Cost!





Passive House Institute of New Zealand low cost awards

Five bespoke Passive House delivered in 2016/2017 for between \$2,097 and \$2,860 per square meter of gross floor area.

\$1500m² is very cheap, \$2-2500m² is more usual and then anything from \$3000m² and up is more consistent with bespoke houses*



*

<http://www.buildingguide.co.nz/planning/building-costs/>



Social Housing Construction Costs*

225 social houses

10 different builders

Median construction cost psm = \$3,150

Min = \$2,125

Max = \$5,000

** Upcoming publication*



The Research



Qualitative and Quantitative study

Qualitative: Perception study via short survey of industry participants

Quantitative: formal pricing of a social housing project



Qualitative Survey



Qu 1. What do you think the cost impact of Passive House certification would be on a project?

- Cost decrease
- No difference
- Cost increase
- Other

Qu 2. If you answered increase or decrease above please advise the percentage impact that you think Passive House certification would have.

Qu 3. Where do you think a cost impact will occur (please rank in order of impact)?

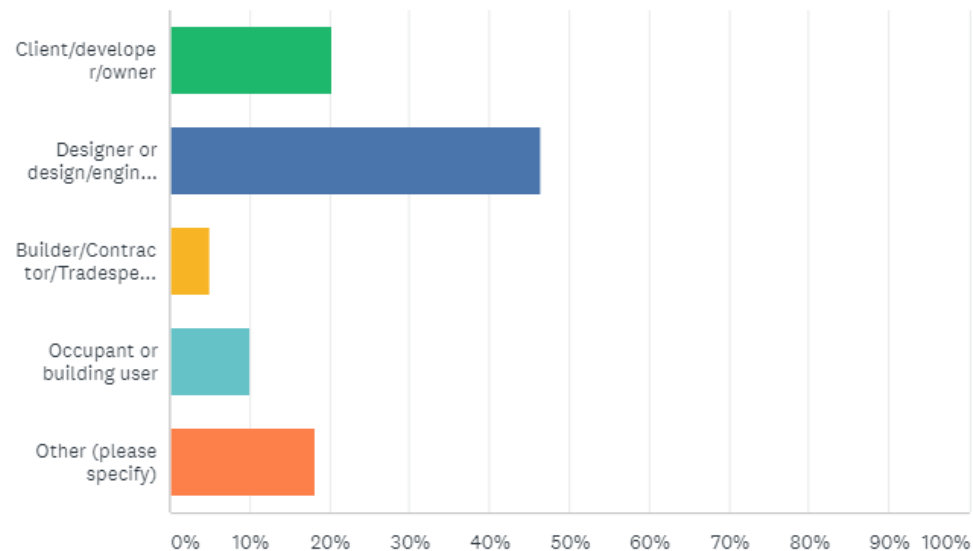
- Window
- Insulation
- Mechanical systems
- Certification and consultant fees
- Other



99 responses were received

Qu 4. What is your typical role on a project?

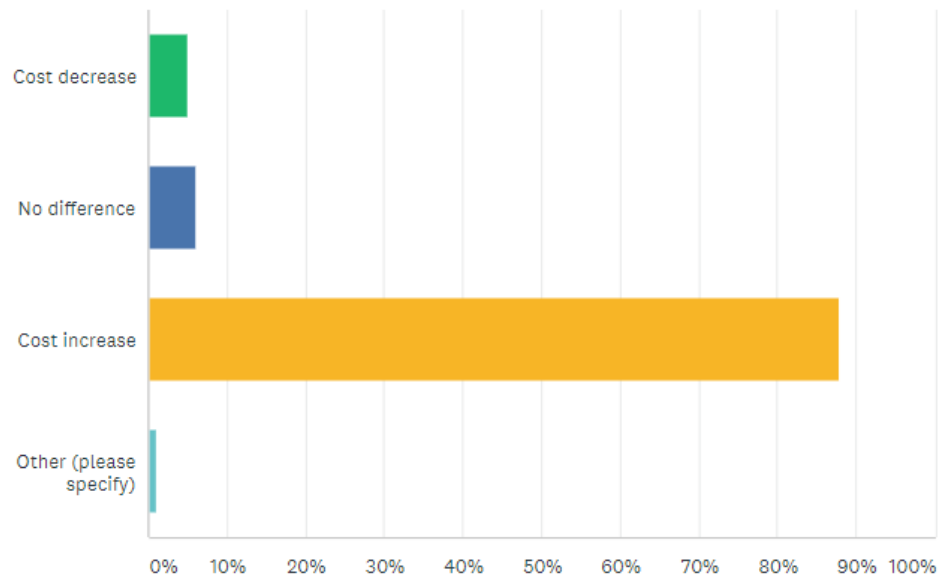
Answered: 99 Skipped: 0





Qu 1. What do you think the cost impact of Passive House certification would be on a project?

Answered: 99 Skipped: 0





Qu 2: Percentage impact that you think Passive House certification would have?

Average: 17-18%

Builder: 9%

Client: 13%

Consultant: 16%

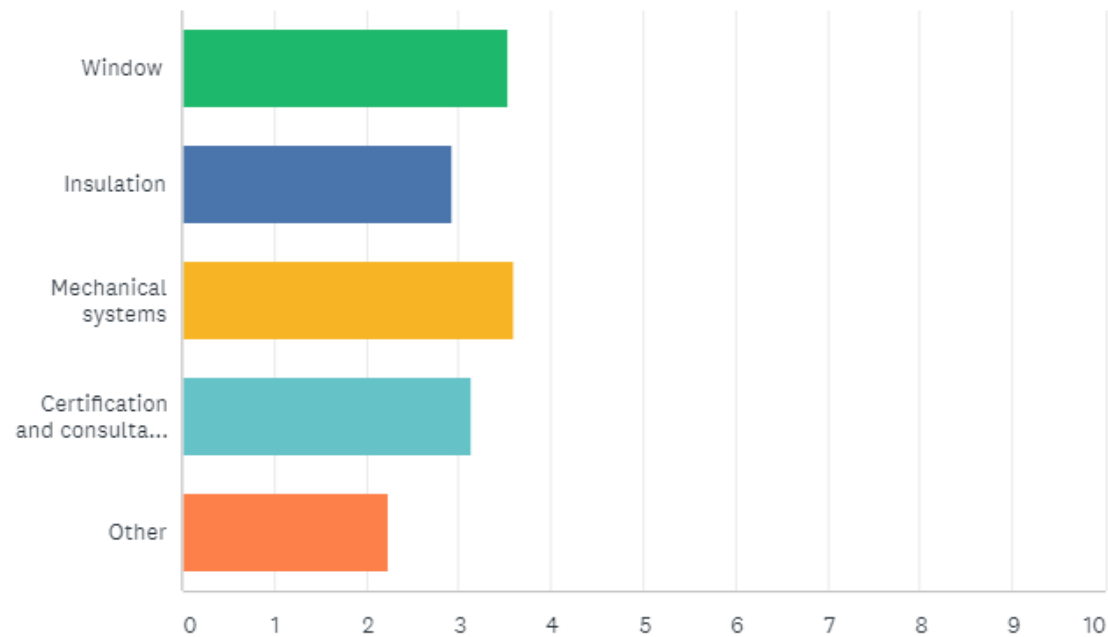
Other: 19%

Occupant: 27%



Qu 3. Where do you think a cost impact will occur?

Answered: 97 Skipped: 2

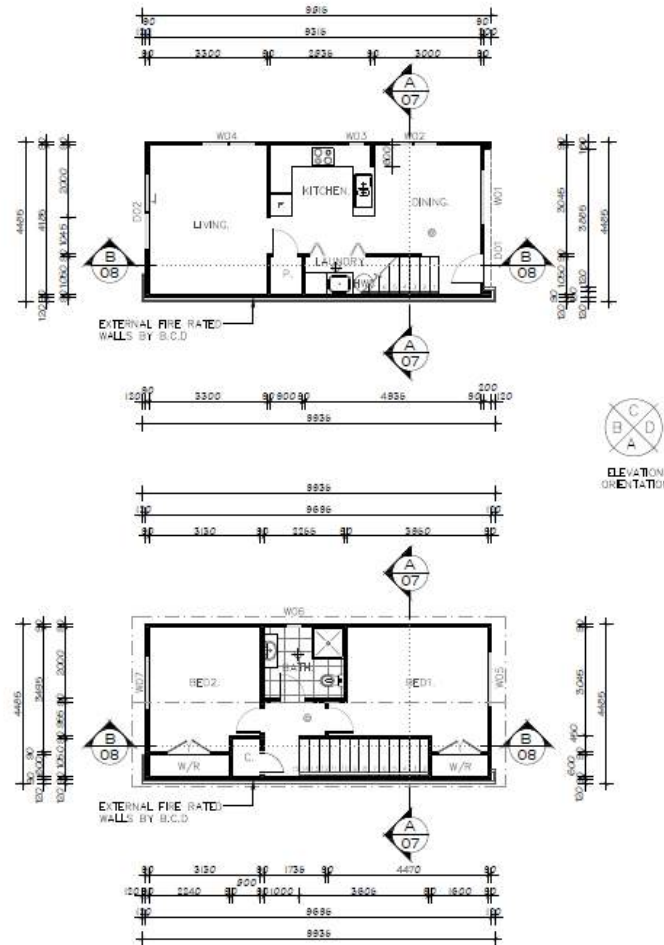




Quantitative Research

The process:

- A real social house design
- Modelled in PHPP
- Required changes listed
- QS developed a formal pricing document
- Development manager issued to the market for pricing
- QS priced both options as well



The pricing document was issued to:

- **five** traditional on site building companies
- **five** partial prefabrication (SIPs) builders
-
- **four** off site full pre-fabrication manufacturers



Pricing document

Further to our recent correspondence we would be pleased to receive your tender price to undertake the construction work (included related trades) as described in the attached pricing schedule and building consent plans.

Please do not hesitate to contact our office on 09 368 5570 should you have any questions.

Tender Summary

		Price
1 SITE PREPARATION		0.00
2 SUBSTRUCTURE		0.00
3 FRAME		0.00
5 UPPER FLOORS		0.00
6 ROOF		0.00
7 EXTERNAL WALLS AND EXTERNAL FINISHES		0.00
8 WINDOWS AND EXTERIOR DOORS		0.00
9 STAIRS AND BALUSTRADES		0.00
10 INTERIOR WALLS		0.00
11 INTERIOR DOORS		0.00
12 FLOOR FINISHES		0.00
13 WALL FINISHES		0.00
14 CEILING FINISHES		0.00
15 FITTINGS AND FIXTURES		0.00
16 SANITARY PLUMBING		0.00
17 HEATING AND VENTILATION SERVICES		0.00
19 ELECTRICAL SERVICES		0.00
22 DRAINAGE		0.00
23 EXTERNAL WORKS		0.00
25 PRELIMINARIES		0.00
Subtotal		0.00
Margins (Offsite overhead and Profit)	[insert %]	0.00
Total contract price excluding GST		0.00



KWANTO™
construction cost consultants





Results

Cost Uplift from NZBC

Industry Perception

17-18%



Cost Uplift from NZBC

Industry Perception
QS

17-18%
10%



Cost Uplift from NZBC

Industry Perception

17-18%

QS

10%

On site

11-12%



Cost Uplift from NZBC

Industry Perception

17-18%

QS

10%

On site

11-12%

Partial prefab

19%



Cost Uplift from NZBC

Industry Perception

17-18%

QS

10%

On site

11-12%

Partial prefab

19%

Full prefab (offsite)

No responses



Payback

QS

Cost uplift

10%

Payback (yrs)

9.4



Payback

QS
On site

Cost uplift

10%

11-12%

Payback (yrs)

9.4

9.3



Payback

	Cost uplift	Payback (yrs)
QS	10%	9.4
On site	11-12%	9.3
Partial prefab	19%	10.1



Comparison to other tools

	Cost uplift	Payback (yrs)
QS	10%	9.4
On site	11-12%	9.3
Partial prefab	19%	10.1
6-Homestar	3-5%*	62**



- *At what cost? An analysis of the green cost premium to achieve 6-Homestar (Ade & Rehm forthcoming 2020 Journal of Green Building)*

***Buying limes but getting lemons: Cost-benefit analysis of residential green buildings -A New Zealand case study (Ade & Rehm, 2019) Energy and Buildings*

<https://doi.org/10.1016/j.enbuild.2019.01.040>



My Conclusions

1) The perceived cost of Passive House certification is higher than reality

Industry Perception	17-18%
QS	10%
On site	11-12%
Partial prefab	19%
Full prefab (offsite)	No responses



2) SIPS was significantly more expensive when compared to a traditional on site build

Industry Perception	17-18%
QS	10%
On site	11-12%
Partial prefab	19%
Full prefab (offsite)	No responses

3) The payback period was **much** shorter than anticipated

	Cost uplift	Payback (yrs)
QS	10%	9.4
On site	11-12%	9.3
Partial prefab	19%	10.1
6-Homestar	3-5%*	62**

4) Social housing is expensive to build!

	Standard*	Passive House	%
Median	\$3,150	\$3,432	109%
Min	\$2,125	\$2,693	127%
Max	\$5,000	\$4,382	88%

\$1500m² is very cheap, \$2-2500m² is more usual and then anything from \$3000m² and up is more consistent with bespoke houses**

**Upcoming publication*

***<http://www.buildingguide.co.nz/planning/building-costs/>*



Study Limitations



- No off site manufacturers returned tenders
- Only 1 partial off site (SIPS) compliant tender was returned
- Only one design was reviewed
- Only the Auckland climate zone was reviewed



Future Research



- More detailed qualitative research
- A mix of designs (up to ten) and climate zones (up to 4)
- A longer tender timeframe to allow more tender returns



A segway as we have time



Targeting:





Design Features (the green bling!)



Green roof



Solar array



Composting toilets



Rammed Earth



Grey water gardens



50,000 L rainwater tanks



MHVR





The living

HOUSE





Fun stuff : Wall workshop





Right now





**Thanks for
listening**

**You can
follow us on**

www.livinghouse.org.nz

<https://www.facebook.com/TheLivingHouseNZ/>

