

Codebreakers

Constructing KiwiBuild
homes to a standard above
the New Zealand Building
Code

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SENSE PARTNERS

DATA LOGIC ACTION



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Sense Partners are experienced economists with backgrounds in modelling, public policy, regulatory affairs and economic assessments. An independent consultancy, their strengths are data analysis, logic and frameworks, and their experience includes modelling specific projects, statistical evaluation of policies and regulations, and forecasting of social, economic and demographic trends.

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1. Executive summary

This report, commissioned by the New Zealand Green Building Council, is an economic analysis of the possible benefits and costs if the New Zealand Government's KiwiBuild programme adopts a building standard higher than the current New Zealand Building Code.

For this analysis, we used the independent and industry recognised Homestar 6 standard, which has been used by the sector since 2011 and is administered and overseen by the not-for-profit organisation the New Zealand Green Building Council.

We find that while there is an upfront cost of building at Homestar 6, compared to the current Building Code, the private benefits outweigh the costs, and there are also substantial social benefits.

We estimate \$331m of total net benefits if KiwiBuild adopts Homestar 6, compared to the current code across the 100,000 homes. \$191m of that will be in private benefits and \$139m in social benefits.

If the cost premium closes after five years and adoption of the standard increases by a modest 10,000 homes outside KiwiBuild, the total benefit could increase to \$682m.

There is compelling evidence to move towards higher quality homes and KiwiBuild is an excellent opportunity to test this, build capacity and collect evidence at scale.

2. The New Zealand Building Code

The New Zealand Building Code is recognised as being behind international standards. The poor state of New Zealand homes has been linked to negatively impacting on the health of New Zealanders. The following excerpts neatly capture the lagging state of New Zealand regulation:

"The New Zealand Building Code is below the standards required in most other IEA countries with comparable climates, and it would be absurd to have to retrofit newly built homes in the future." International Energy Agency, Energy Policies of IEA Countries, 2017 Review

"To avoid retrofitting new houses, the government should consider modernising the Building Code; its building standards are less stringent than those of many other OECD member Countries." OECD, Environmental Performance Review of New Zealand 2017

"NZ R values, the measure of the heat lost through walls, floors and ceiling, are twice as poor as Australia and three times worse than the UK and Ireland." NZ's Building Performance, 2017, Berndatte Muir, Ara Institute of Canterbury, and Rory Greenan, School of Engineering, Trinity College, Dublin



3. Homestar ratings and how they work

Plenty of studies have shown the net benefits of building homes with higher energy and water efficiency ratings, and using eco-friendly materials, designs and processes.

In practical terms, these benefits show up in savings on electricity and water bills for residents. It makes it cheaper to heat and ventilate homes to healthy levels. The upfront cost to build a higher efficiency home, for example a Homestar 6, is a little higher (2.0% - 2.6% higher than at current code level, including certification and assessment), but the lifetime savings in utilities and social gains more than offsets it.

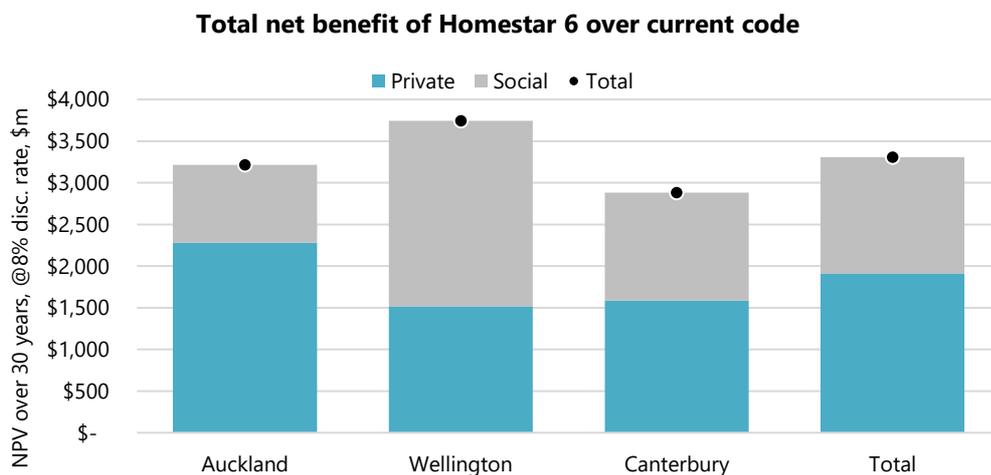
We estimate that an Auckland homeowner will be \$2,300 personally better off over a 30-year analysis period on a net present value basis, around \$1,500 better off in Wellington and \$1,600 better off in Christchurch. Auckland homeowners reap more benefit because of volumetric charging on water; in other regions water savings will be captured as a wider social benefit.

A higher quality home is a no brainer when looked through a whole of life lens.

The value people place also shows up in the premium people are willing to pay for accredited houses.

When we include social benefits, by looking at reduced carbon emissions, reduced waste and potential water runoff¹ from sites, the total benefits of Homestar 6 over current building code stack up even better. We estimate the total private and social benefits of \$3,200 in Auckland, \$3,700 in Wellington and \$2,900 in Christchurch, for an averaged sized home.

FIGURE 1: OVER A 30 YEAR PERIOD, A HOMESTAR 6 HOME IS BETTER FOR THE OWNER AND SOCIETY



¹ Not all Homestar 6 homes have water runoff implemented.



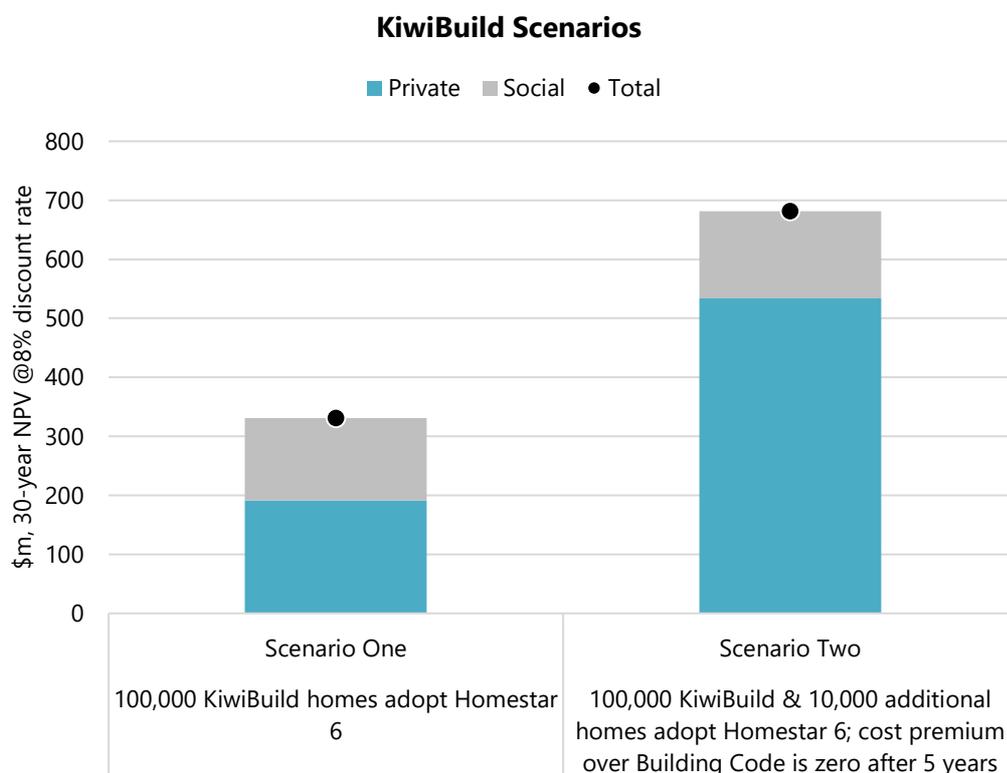
Despite strong evidence of benefits, moves to higher quality homes has been slow. There is resistance among consumers, builders, and capability. The inability to adopt beneficial design, technologies and processes that makes owners and society better off suggests there is some kind of market failure.

KiwiBuild is an opportunity to break the deadlock. It would be an opportunity to build capability in the sector to build to higher standard, showcase the private and social benefits of higher quality homes, and also an opportunity to pilot and evaluate a higher quality standard. International experience suggests that as industry capability increases, the cost premium of higher quality homes falls over time.

We estimate \$331m of total net benefits if KiwiBuild adopts Homestar 6, compared to the current code across the 100,000 homes. \$191m of that will be in private benefits and \$139 in social benefits. If the cost premium closes after five years and 10,000 additional homes to KiwiBuild use Homestar 6, the total benefit could increase to \$682m. Leading by example would build industry capacity and capability, and encourage adoption among consumers.

These conclusions are based on a review of the evidence on the benefits and costs of building houses to a Homestar rating of 6.

FIGURE 2: KIWIBUILD IS A 100,000 MORE REASONS TO CAPITALISE ON THE BENEFITS OF BETTER QUALITY OF HOMES





4. Homestar ratings and how they work

Homestar

Homestar is a tool that rates the environmental impact of new New Zealand homes. The aim is to improve the performance and reduce the environmental impact of homes, making them warm, healthy and comfortable places to live.

A Homestar Assessor would rate a home against sustainability criteria and if the score is high enough will certify a rating of between 6 and 10 Stars.

A star-rating of 6 or higher exceeds the accepted practice under the Building Code, in the following areas:²

Category	Desired impact
Energy, health, and comfort	Reduced energy use e.g. heating and lighting or improved thermal comfort (e.g. through insulation and ventilation), and accessibility
Water	Reduced water consumption (e.g. through low-flow tapware)
Waste	Support for household waste recycling and reduced construction waste
Management	Safe secure and adaptable home
Materials	Use of responsibly-sourced and healthy materials and products, and materials with reduced lifetime environmental impacts
Site	Effective stormwater management, sensitivity to local ecology, and good local amenities
Density	Reduced footprint and resources to build, operate and occupy

Benefits

Energy and water efficiency mean lower household bills

Homestar tests for the quantity of insulation, orientation of the house and use of natural light, ventilation, use of efficient and low emission space and water heaters and lighting, use of on-site renewable electricity sources, and water-efficient features.

eCubed estimated the power bill savings for a 180m² three-bedroom two storey house from increasing insulation levels and installing double glazing and water fixtures to Homestar 6 Star standard. Savings would be \$355-493 per year (around 20%), compared to a power bill for a house built to the Building Code. Adding heat pumps for space and hot water heating to achieve a 7 Star rating would save \$1,610-\$1,893 per year.³

² Homestar Technical Manual v4.02 Feb 2018

³ eCubed 2018



Lighting accounts for 10% of the electricity bill. Energy efficient lights tend to cost more up-front but are more energy efficient. For example, installing LED bulbs instead of a standard bulb could reduce annual running costs by 80%. While they may cost twice the price, they last more than 10 times longer than a standard bulb.⁴ One estimate is that, depending on wattage, use and the cost of the replacement bulb, the payback period is 2-12 months.⁵

Homestar encourages the use of water efficient fittings, rain water collection and reducing site runoff. These reduce costs for residents where there is volumetric charging (in Auckland) and reduced costs for the community through reduced consumption and reduced demand for infrastructure.

Water efficiency features can have significant impact on water consumption. For example, a water efficient dishwasher could save 10,000+ litres per year, and an efficient showerhead 10,000+ litres per person per year.⁶

Water efficiency often makes little difference to the purchase price of appliances or fixtures. But by being able to reduce water use by 25-50% per unit, potential savings for an average household are around 100 litres per day (or the equivalent of \$300 per year, including hot water energy savings).⁷

Homestar also considers whether rainwater is used in a way that reduces the use of drinking water. Rainwater could be used outdoors, or for the laundry, toilet and dishwasher. A BRANZ study finds that the payback period of the cost of the tank and plumbing is quite high (15 years), which makes it a marginal proposition. But the payback is better in warmer and wetter regions. It also reduces site runoff, diverting flow to stormwater of around 87 cubic metres per year in Auckland, for example.

When considering the additional costs of insulation, double glazing, rainwater tank and heating solutions, eCubed has estimated that, based on the model home simulation, building to a 6 Star rating would pay for itself in 2-5 years. The case for a 7 Star rating, in terms of 'hard savings' depends on local climate and occupant habits.

Fewer resources, more sustainable materials, and less waste

The Homestar rating favours more compact homes with smaller footprints. It recognises the environmental benefits of fewer resources needed to build and operate, and the benefits of higher density for urban planning, in terms of space and infrastructure.

Homestar allocates points for waste reduction features, associated with around 2.5 tonnes of reduced waste per year. The cost of waste is around \$209/tonne. There are additional benefits of reducing leachate and other externalities worth \$1-\$19/tonne.⁸

⁴ Based on scenarios run on <https://www.energywise.govt.nz/tools/lighting/>

⁵ Page 2016

⁶ See <http://www.mfe.govt.nz/fresh-water/we-all-have-role-play/water-efficiency-labelling-scheme>

⁷ See Page 2016. Costs are often not faced direct by households as they are usually part of rates.

⁸ Covec 2012, rated forward using CPI inflation for waste removal



Lower carbon emissions

Based on reduced electricity use and reduced waste, there is a potential for reduced carbon emissions. We estimate reduced carbon emissions of \$4 to \$5 a year per home at the current carbon price of \$20/tonne.

There is considerable uncertainty on the future path of carbon price. For example, the Productivity Commission⁹ assesses a carbon price scenario increasing to \$250/tonne by 2048. Which would equate to \$26 to \$34 a year, excluding the effect of inflation.

In our analysis, we assume the futures curve for carbon prices to 2025 (rising gradually 20 \$22/tonne), then trending higher to the Productivity Commission scenario of NZ\$250/tonne by 2048.

We are mindful that some of these carbon savings may not occur. Households may choose to use some or all their electricity bill savings to make homes warmer, or cool during summer months. This would still be a benefit to consumers but would divert this benefit of reducing total electricity use and carbon emissions.

There are other ways Homestar can help reduce carbon emissions. But these are difficult to quantify and attribute savings.

For example, Greenstar assesses the resource efficiency of a project, by considering the lifecycle cost assessment of building materials and encourages eco labelling. This can help to choose materials that have lower embodied emissions for example, but the choice is made over the whole of life.

Greenstar gives credits for proximity to public transport amenities and for encouragement of active transport such as walking and cycling. It is difficult to know the full impact on transport choice, but this encouragement fits with a wider move towards a lower carbon economy.

Homestar encourages recycling and composting, reducing landfill methane emissions and embodied energy in new materials as well as in demolition and construction waste management.

Health and comfort

Homestar ratings also consider health benefits, comfort levels, and accessibility (to meet the demands of people with sensory impairments or mobility issues – the demand for which is growing with an ageing population).

An insulated, warm home is associated with better health outcomes. A 2011 evaluation of Heat Smart measured health service use of households that had retrofitted their homes.¹⁰ It found that these households experienced lower mortality, fewer hospitalizations and pharmaceutical costs for circulatory and respiratory illnesses, fewer medical visits, and fewer days off school – compared to otherwise similar households in similar houses but without retrofitted insulation.¹¹

⁹ Productivity Commission (2018)

¹⁰ Heat Smart involved a subsidy was available for homes built before 2000

¹¹ Telfar-Barnard, Preval, Howden-Chapman, Arnold, Young, Grimes & Denne 2011



These findings will not apply in full to new homes, to which the benefits of homes with a Homestar rating should be compared. Nevertheless, some health benefits are expected, though we are not aware of relevant studies that quantify this.

One of the reasons health benefits can be expected relates to ventilation. According to BRANZ research, ventilation is insufficient in about a third of surveyed homes. This issue particularly applies to newer homes which are becoming more airtight.¹² Insufficient ventilation causes humidity, which affects air quality and leads to mould, and is associated with respiratory illness and other health issues. Dampness can also degrade furniture and drapes and make it harder to heat the home. Homestar can be a way to reduce the likelihood of future potential dampness and mould in homes.

Another reason that health benefits can be expected is that Homestar also gives points when houses are built with interior finishes with recognized eco-standards, on the basis that this would reduce exposure to air pollutants and allergens, though the impact is unknown.

Resale values

There is also international evidence that certified sustainable or green homes attract a price premium over otherwise similar houses. These findings are based on studies that compare sale prices of houses with and without certification that are otherwise similar on other characteristics that explain house price differences. Certified rental properties also attract a higher rent.

There are different reasons for the differences in resale value. It may reflect that people value the lower power bills or healthier interiors implied by insulation and double glazing, or it may simply reflect a strong preference for a guarantee that the home is built to be environmentally sustainable.¹³

Studies tend to find the premium on resale is in the region of 7-10%¹⁴; premiums on rents¹⁵ are about a third of that. An improvement in the rating by one star increases the market value by 3%.

¹² White and Jones 2017

¹³ Kok & Kahn (2012) found that in California the premiums were bigger in areas with a high registration of hybrid vehicles

¹⁴ DEWHA, 2008, Griffin et al 2009, Kok & Kahn 2012, Hyland et al 2013, Matisoff et al 2016

¹⁵ Hyland et al 2013



Typical costs

The cost to build a typical house at a Homestar 6 standard is higher than current code. Analysis by Rawlinsons and eCubed finds that the typical house costs 1.7% more to build in Auckland and 2.3% more in Wellington and Christchurch.

For context, the costs equate to 3 square metres of floor space in Auckland, and 4 square metres in Wellington and Christchurch.

The higher costs come from a number of sources. For example, some of the products are not yet standard, meaning they are more difficult and expensive to source. Managing building waste effectively requires additional effort and cost.

Some of these costs will reduce over time as material and products become more easily available, and as the industry learns by doing.

For our analysis, we assume that the additional cost of building is added to cost of the house, rather than people deciding to reduce the size of the house to avoid the cost. Experience in the UK suggests that costs will gradually converge over time.¹⁶

We also account for the cost of Homestar certification (\$300 per home) and assessment (\$300-\$800 per home). This increases the total cost of building by 2%-2.6%. Note the assessment costs are based on larger schemes or those building at volume.

Evaluate the local experience in practice

A potential shortcoming associated with tools that rate the environmental impact of homes is that often their stated benefits are based on engineering simulations, or studies of a small number of model homes.

Such approaches cannot consider the impact of site specific requirements, or differences in households' energy habits or appliances used, which will affect actual energy or water use.¹⁷

For example, in an evaluation of the Warm Up New Zealand scheme – a subsidy for retrofitting insulation and installing heat pumps – it was found that insulation did reduce energy use on average (and more so in cooler regions). But the installation of energy efficient heat pumps was associated with *increased* energy use. This might be a substitution effect (where, instead of saving on the energy bill, people choose to heat or cool the house more) or a rebound effect (where people use their heating more as they become used to a warmer house).¹⁸

Our analysis compares heating a home to a healthy level at a standard home compared to Homestar 6, rather than trying to account for this potential and varied behaviour shift.

¹⁶ Element Energy 2013

¹⁷ Australian Productivity Commission 2005; Matisoff, Noonan & Flowers 2016.

¹⁸ Grimes et al 2011



Construction costs may also be higher in practice, by a factor of 3 according to one source.¹⁹ However, this may not relate to the newer version (Version 4) of the tool, which is significantly simpler and cheaper to implement.

Further, it is not always the case that building solutions that reduce annual energy use are better for the environment, for example when their embodied energy use (energy used in extraction, production and transport) is very high. To illustrate, the emissions payback-period of a concrete slab compared to a timber floor is perhaps 50+ years.²⁰

While international evidence does show people are willing to pay more for homes with a good sustainability rating than for a similar home without such a rating,²¹ these studies are not good at controlling for self-selection – for example, that people who purchase these homes, which are still relatively scarce, are different than the general population, and value the green rating not for its performance, but for the idea it is sustainable.

Also, the point of interest is not the premium or performance of a home designed and built to a Homestar-rating home compared to an average home, but to a home that would now be built instead under the Building Code. The engineering studies try to do this, but as noted above cannot adequately control for all the variables that will impact on performance in practice.

The implication of the resulting uncertainties is as follows. The clear promise of better environmental outcomes and lower operating costs from building homes with a good Homestar rating makes for a strong case for a large-scale demonstration project, properly evaluated, to settle the score on the evidence.

Another implication stems from the New Zealand Productivity Commission (2018) finding that an effective price on emissions is the most efficient way to incentivise the transition to buildings with lower embodied emissions, which is one element of the Homestar value proposition. An effective price on emissions will improve the attractiveness of building to Homestar 6 or higher.

¹⁹ Australian Productivity Commission 2005

²⁰ New Zealand Productivity Commission 2018, Australian Productivity Commission 2005

²¹ See for example, Hyland, Lyons & Lyons 2013



5. KiwiBuild to lead change in practice

Why we can't wait for the market to make it happen

The uptake of Homestar has been rising fast, but certified houses are still a small portion of new builds, and the standard is not yet mainstream. We know that when presented with the option, new construction purchasers will opt for a larger-sized home rather than invest the equivalent cost in features that might reduce lifetime costs of ownership and occupying the home.

There are a number of reasons that are standing in the way of take-up of Homestar and higher quality homes:

- Information asymmetry – the different ways to achieve sustainability and the complexity of information make it difficult for consumers to verify costs and benefits of different design choices, or to verify whether a house marketed as sustainable is in fact that. This deters investment.²²
- Split incentives – developers do not face the ongoing operating costs so may choose building solutions that have low up-front costs to raise their own returns, but which are not necessarily the best option over the lifetime of the asset.
- Hyperbolic discounting – consumers may prefer lower costs right now over a far greater reduction in costs in the future. This could reflect current budget constraints or uncertainty that they will enjoy the future benefits.
- Externalities – to the extent that sustainable building practices benefit the local community of society in general, rather the household or the builder, the risk is that people underinvest in sustainability features.
- Capability – for Homestar's sustainability concepts to become mainstream requires the knowledge to be well diffused among builders and consenting authorities.²³

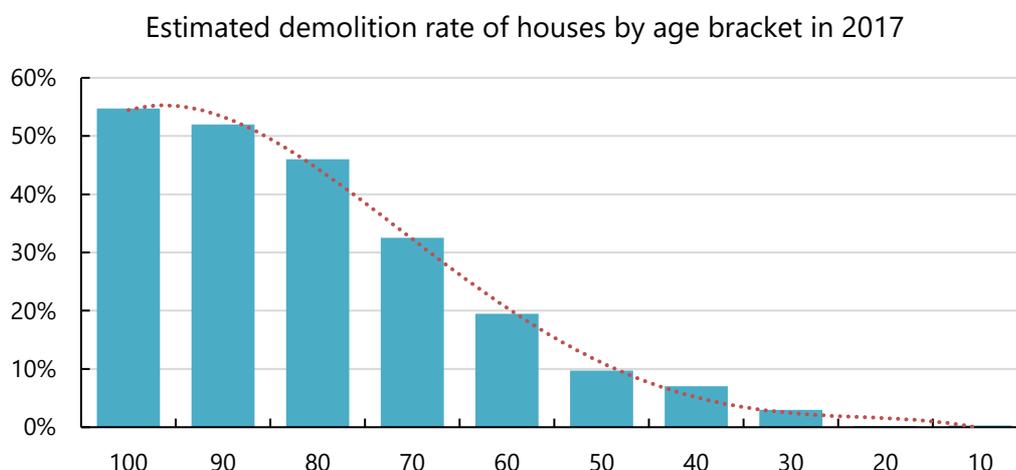
We are trapped. There are building solutions that will lead to better whole-of-life outcomes, but they are not taken up. The problem is that, once homes are built, we are stuck with them for many decades. Very few homes are demolished before they are 50 years or older.

²² In his famous market for lemons analogy, George Akerlof (1970) demonstrated how the information problem may drive out higher quality assets (in his case, cars).

²³ US evidence on the diffusion, or spreading uptake, of innovation in residential building highlights diffusion follows a familiar S pattern. See Koebel C et al, 2004. In terms of energy efficient building standards, the diffusion is stronger in areas with higher incomes, a stronger property market, higher energy prices, and also building capability (though it is less clear whether this is a causal or associative link). See Kok N et al, 2011.



FIGURE 3: LESS THAN 10% OF HOMES ARE DEMOLISHED BEFORE THEY ARE 50 YEARS OLD



Show, don't impose

Certification, such as the Homestar rating, is one part of a solution of getting out of the trap. It gives home owners, and any future owners, confidence that a house is built to a given sustainability and performance standard. This matters, because correct installation is critical to ensure that good design delivers better performance of the home.

There is gradual uptake of Homestar. 20,000 homes are going through Homestar, to be built over the next six years.

The risk is that relying on voluntary uptake of the certification alone is going to be too slow, given the amount of home building that is intended. The lesson from the diffusion of innovation is that people want to see more evidence, and the sector needs more capability, before building to the standard becomes the norm.

When a way of doing things is not yet common, showcasing can help.

An alternative would be to impose new requirements in the Building Code. But to do so rapidly may impose large costs to building and disruption in the sector. The experience internationally is that compulsion can lead to unintended consequences, such as sudden increase in cost and complexity. It may also force solutions on home buyers that they simply do not want.

Allowing the knowledge and expectations of homeowners, and the industry's ability to deliver it, to adapt over time through showcasing is preferable to compelling all new builds to meet a new, higher standard, without having built up sector-wide experience. Eventually, if it is proven to stack up but uptake is still found wanting, then regulation can be considered to replace any voluntary sustainability standard.



KiwiBuild - a 100,000 homes opportunity of a lifetime

KiwiBuild presents the second part of the solution to escape the trap. KiwiBuild aims to build 100,000 over the next decade, meaning 100,000 opportunities to showcase the benefits and the scale to give developers and suppliers confidence to buy in to the Homestar standard.

By offering scale, KiwiBuild can help drive capability-building among builders, across product suppliers, and local authorities. As the value chain learns and adapts to the new standard of building, the cost of doing it 'differently' will fall over time.

Importantly, KiwiBuild aims to offer affordable homes for people on modest incomes. Building at the Homestar standard means that households will benefit from the lower operating cost of their home over a lifetime. Upfront costs could be kept comparable to traditional building methods by building slightly smaller homes, so not imposing additional costs on first home buyers.

As more home are built, a stronger body of evidence will emerge. This stronger proof of building performance over time, in practice rather than in theory, will be important to definitively establish the benefits of the Homestar standard to consumers and builders. It will also serve as an important way to assess which parts of certification are working, and which are not, as there is considerable flexibility in how a Homestar rating is reached.

There is an opportunity to design implementation in such a way to allow full evaluation of the costs, benefits and lessons of building to the higher Homestar standard.

Building to the Homestar standard is easier and less costly than retrofitting to improve the energy efficiency and sustainability of a home, which would be a difficult and expensive process.



6. Total benefits could be substantial

Results

We summarised the available literature and estimates to total costs and benefits of a Homestar 6 versus the Building Code. We used a number of sources, including reports by eCubed and Rawlinsons for the Green Building Council, as well as wide range of New Zealand and international literature.

We assessed the difference in construction costs and the additional cost of certification (\$300 per home) and assessment (\$300-\$800 per home). The cost differences are small, at 2%-2.6%. We assessed this over a 30-year mortgage term.

There are upfront savings from reduced waste of around 2.5 tonnes, which equates to cost savings of a little over \$500.

We took a conservative approach on benefits, but the energy savings, and water savings in Auckland (other jurisdictions do not have volumetric charges and the benefits are social), are sufficient to justify the additional upfront cost of building to a higher quality.

We assumed a starting carbon price of NZ\$20 per tonne, although the commitment to net zero carbon by 2050 might see that price rise substantially. To reflect this, we use available carbon futures prices to 2025 (rising gradually to \$22) and then trending higher to \$250/tonne by 2048. We only considered the carbon savings from reduced electricity consumption. Other encouragements to reduce car use, build smaller homes, or compost do not have sufficient local or comparable evidence to quantify confidently. But they should be monitored in the future to better quantify these potential benefits.

We used Auckland prices for water, and BRANZ estimates of drinking water cost in other regions. We used rainfall and other measures to estimate the potential diversion of water runoff from sites, and priced it at waste water to capture the avoidable cost of water runoff and the additional ecological costs given paucity of data. We used MBIE data on residential electricity prices. We assumed these costs will increase at the pace of the last decade of 3.6%pa for electricity and 3.4%pa for water, as recorded in the official Consumer Price Index.

We found that in each of the three major cities of Auckland, Wellington and Christchurch, Homestar 6 adds initial cost, but savings pays that off over time. These are the private benefits. Assessed over a 30-year period, we estimate that Auckland homeowners would be better off by around \$2,200 on a net present value basis, using a discount rate of 8%. A Wellington homeowner would be better off by \$1,500 and Christchurch \$1,600. In Wellington and Christchurch savings on water accrue to all ratepayers.

When we count the wider benefits, for example reduced carbon emissions from reduced energy use and reduced site runoff, the total benefits of Homestar 6 are higher. The total benefits range between \$2,900 and \$3,700, depending on location.



FIGURE 4: THE BENEFITS OF HOMESTAR 6 OUTWEIGH THE COSTS

Element	Beneficiary	Location		
		Auckland	Wellington	Christchurch
Upfront cost				
Cost of building	Private	(\$5,692)	(\$7,060)	(\$6,920)
Certification & assessment	Private	(\$850)	(\$850)	(\$850)
Diverted waste	Private/Social	\$523	\$523	\$523
Annual savings				
Energy	Private	\$379	\$490	\$494
Carbon	Social	\$4	\$5	\$5
Water	Private/Social	\$105	\$101	\$70
Wastewater	Private/Social	\$523	\$523	\$523
Runoff etc	Private/Social	\$66	\$63	\$22
NPV over 30 years, @ 8% discount rate				
Private		\$2,281	\$1,519	\$1,588
Social		\$934	\$2,226	\$1,295
Total		\$3,216	\$3,745	\$2,883

Source: Sense Partners estimates

Note: Blue shaded area represents social benefits, unshaded areas represent private benefits.

Scenarios

We assess two scenarios of the impact of building KiwiBuild homes to Homestar 6 standard. The first scenario is where the cost of building remains high across the whole decade of KiwiBuild and all 100,000 KiwiBuild homes are built to Homestar 6.

The second scenario looks at the cost premium falling over time. Experience in the UK suggests that cost premiums tend to fall over the course of around 5 years.²⁴ We also assume that an additional 10,000 homes will be encouraged to use Homestar 6, leveraging the experience in KiwiBuild.

We estimate that the private benefits from adopting Homestar 6 could deliver private benefits, that is make home owners better off, by \$186m to \$528m, on a net present value assessed over 30 years of ownership using an 8% discount rate. The total benefits, including social benefits, would be much higher at \$331m to \$682m.

²⁴ Energy Solutions (2013)



FIGURE 5: THE CUMULATIVE EFFECT OF USING HOMESTAR 6 FOR KIWIBUILD WOULD BE LARGE

Scenario	One	Two
Homes affected	100,000	110,000
Total benefit of adopting Homestar 6, NPV @8% over 30 years (\$m)		
Private	186	528
Social	145	154
Total	331	682

Key assumptions:

Homes affected Spill over of additional 10,000 Homestar 6 homes in scenario Two
Costs Cost differences persist in scenario One; disappear after 5 years in scenario Two

Conclusions

The evidence is clear. There is an upfront cost of building at Homestar 6, compared to the current Building Code. But the private benefits outweigh the costs, and there are also substantial social benefits. There is compelling evidence to move towards higher quality homes and KiwiBuild is an excellent opportunity to test this, build capacity and collect evidence at scale.



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