

# Market Transformation to Achieve Large Scale Uptake of Sustainable Residential Renovation in New Zealand

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## ABSTRACT

New Zealand's housing stock is acknowledged for its poor performance, particularly as relates to energy and water efficiency and indoor environment quality. The 1.4 million houses are mainly detached, timber framed houses with poor thermal efficiency and similar design across New Zealand's variable climate – from the moist warm north, to the cold dry south. Beacon Pathway, a research consortium of public and private stakeholders, has, over the past 4 years been researching approaches and developing tools and information aimed at increasing the uptake of sustainable renovation. Beacon developed the HomeSmart Renovations Project as a transformational programme to encourage effective retrofit and renovation take-up that would improve the performance of New Zealand homes. The programme includes: (a) undertaking case study sustainable renovations, monitoring and reporting on their effectiveness; (b) developing consumer and industry information about ways to improve the sustainability of houses; (c) working with the retrofit and renovation sector to increase their capability around assessment and implementation of sustainable renovation; (d) developing specific information on renovations targeted to individual homeowners based on the condition of their house; and (e) working with local government to improve plans, policies and processes to support and promote sustainable renovation.

This paper will present the research methods used to monitor and assess the effectiveness of the programme. This includes the direct monitoring of metered energy, water and temperatures in 200 homes, and the reporting of various performance indicators by a further 400 homes. The findings of the research processes will be presented.

Proposed Conference Theme: Resilient Societies

## INTRODUCTION

Beacon Pathway, a FRST funded research consortium, has been undertaking a range of research projects into renovating existing homes for improved sustainability. The HomeSmart Renovations Project was designed to take the learnings from Beacon's research into retrofit and sustainable renovation and develop a set of tools and guidelines (the HomeSmart Procedures) which would assist the home renovation industry, and homeowners, to retrofit and operate their homes to achieve a High Standard of Sustainability<sup>®</sup> (HSS<sup>®</sup>). The HSS<sup>®</sup> is a set of benchmarks around a sustainable home in the areas of reticulated energy use, reticulated water use, indoor environment quality, materials and waste (Easton and Howell, 2008).

The HomeSmart Renovations Project had five main objectives. They were to:

- Develop and implement HomeSmart Renovations Assessment, Procedures and Plans which will facilitate retrofitting of existing homes to meet the Beacon High Standard of Sustainability.
- Contribute to market transformation by providing householders independent advice on retrofitting and pathways to achieve effective retrofits which take into account the financial constraints that households face.

- Provide an opportunity for retrofit providers to develop capability to deliver broader home assessment and retrofit planning tools than those currently available.
- Assess the impact of HomeSmart Renovations Assessments and Plans on the pattern of take-up among renovating owner-occupiers.
- Identify the factors that motivate and/or deter householders from retrofit pathways that will bring their dwellings closer to Beacon's HSS®.

703 households expressed interest in participating in the late 2008-mid 2009 recruitment period of the HomeSmart Renovation Project. Implementation of the assessments commenced in November 2008 500 assessments and renovation plans were completed. This paper looks at the implementation of the project and outlines the key findings from the research.

## HOMESMART PROCEDURES & PROGRAMME IMPLEMENTATION

The first phase of the HomeSmart Renovation Project was the development of a set of HomeSmart Renovations procedures, delivery partners and the approach to the recruitment of householders.

The delivery model for the project involved industry partners (4 community based retrofit organisations) undertaking in home assessments for homeowners and developing a renovation plan for each household using the Beacon assessment tool and renovation plan builder. Actual renovations were paid for and undertaken by the homeowners, using either the industry partners, or their own preferred provider.

Eight procedures were developed providing information for a range of participants in the value chain including industry assessors, installers, project managers and the homeowner. These are outlined in Table 1:

**Table 1: HomeSmart Renovations Procedures Developed**

Procedure	Purpose	Audience
<b>Industry Partner Support Material</b>		
Business Case and Marketing Support	To provide advice and support to people generating promotion around the HomeSmart Renovations project with view of unifying and clarifying external messages. The information includes an outline of the benefits of sustainable renovation, information on target audiences, sample letters, sample PowerPoint presentations and sample flyers.	Industry partners, marketing specialists, funding providers, local authority partners
Industry In-Home Assessment Tool	To provide in-home assessment which collect sufficient information to develop a individually tailored renovation plans for homeowners.	Industry partner assessors
Renovation Plan Builder	To develop consistent Renovation Plans and packages as an output of the in home assessment.	Industry partner assessors
Training Support	To ensure understanding of sustainable renovation assessment and enable accurate and consistent home assessments and renovation plans to be delivered by a range of providers.	Industry partner assessors, project managers, installers
Best Practice Guidelines and Project Management Manual	To guide implementation and ensure quality of installation.	Installers, project managers

<b>Homeowner Support Material (“Homeowner Kit”)</b>		
Home Manual	To provide information to homeowners on operating their home and the technology within it. To also provide assistance with choice of products for installation.	Home owners and occupiers
Project Management Manual	To provide training and tips on project management and common errors during the renovation from a homeowner perspective.	Home owners
Renovation Plan	To provide homeowners with a prioritised and justified plan for improvements required to bring their home up to a High Standard of Sustainability - outlining the key attributes of the house which will affect performance, a rationale in relation to these for improvements to be made and a prioritised list of packages with some indicative costings to undertake these.	Home owners

The implementation of the HomeSmart Renovation Project involved two additional processes. Firstly, recruiting providers that could assess householder’s dwellings and prepare a plan using the HomeSmart Renovations Plan builder developed by BRANZ for the project. The four community-based retrofit organisations who agreed to participate were Community Energy Action (Christchurch), Eco Matters Environment Trust (Auckland), Energy Options (Bay of Plenty, Marlborough), and Energy Smart (Wellington, Nelson, Dunedin and Southland). Secondly, HomeSmart Renovations involved recruiting homeowners to participate. Recruitment of the latter was shaped by a sample frame targeting the recruitment of the 750 dwellings in five areas with different climate conditions and across four income categories.

## **MONITORING AND EVALUATION**

The research methodology for the HomeSmart Renovation Project drew data from a mix of administrative, monitoring and survey sources supported by an attempt to establish and recruit to a sample frame which addresses issues of both household income and climatic differences. Table 2 sets out the data specification of the HomeSmart Renovation Project.

**Table 2: Summary of Intended Monitoring Methodology HomeSmart Renovation Pilot**

<b>Data Source</b>	<b>Instrument</b>	<b>Provider</b>	<b>When</b>	<b>Who/What</b>
Potential Participants	Self complete application and registration questionnaire	Householder via questionnaire	Pre-retrofit	All potential participants
Dwelling In Home Assessment	In Home Assessment Tool	Partner assessor	Pre-retrofit	All assessed dwellings
Renovation Plan	Renovation Plan	Partner assessor	Pre-retrofit	All assessed dwellings
Retrofit Installation	Householder Survey	Surveyor	Post-retrofit	All installed dwellings
Administrative data	Reticulated energy	Householder via energy bills or by through supplier	Pre and post retrofit	All assessed dwellings

	Reticulated water	Householder via water bills or through supplier	Pre and post retrofit	All assessed dwellings if separate water billing
Direct monitored data	Temperature	Direct monitored	Pre-retrofit Post retrofit	200 dwellings-temperature
	Water			Up to 150 installed water meters
	Hot water (solar)			Up to 50 dwellings solar water heating
	Humidity			200 dwellings Fuginex tabs* which change colour when exposed to >75% humidity for at least 4hours
Participant survey	Householder survey	Surveyor	Pre-retrofit Post retrofit	200 householders

Direct monitoring of consumption patterns in relation to water and energy was limited to a sub-sample of dwellings but all householders were asked to provide reticulated energy data by way of permissions to access billing data from the household's supplier. Water data, except where meters were installed, was only provided in areas in which the local authority meters water. Within the HomeSmart Renovations project this was households in Auckland, Nelson and Christchurch. BRANZ also approached monitored dwellings without water meters in an effort to install water meters. In all, 16 were installed. Overall, water data was acquired from 79 householders.

In relation to energy and water billing data, this was collected from suppliers where householders agreed that the project team could access energy and/or water billing records.

## RESULTS

### *The Households*

The participants in HomeSmart Renovation Project have a profile distinctly different from New Zealand households as a whole. They tend to be concentrated in the middle age and earning cohorts. Their incomes are higher than the New Zealand income pattern and they tend to be free of both young children and of older household members. In summary, the key characteristics of the participant households are:

- Almost two-thirds are aged 31-50 years (64.7 percent).
- 64.3 percent have household annual incomes in excess of \$70,000, and 79 percent of households have household incomes in excess of \$50,000.
- Less than a fifth (18.9 percent) report being eligible for a Community Services Card.
- The largest single proportion of households has only two people, but 61.4 percent are households with 3 or more people.
- The vast majority (90 percent) of households have no household members aged 65 years or more.

The vast majority (75.7 percent) of households have no children in the household aged 5 years or less.

### ***Stock and its Typology***

Data related to the stock were collected by an In-Home Assessment instrument used by community providers (Community Energy Action, EcoMatters Trust, Energy Options, and Energy Smart) and in the householder's interviews. This section presents data on dwelling age, type, configuration, size and orientation.

#### Dwelling Age

Almost half the dwellings assessed had been built prior to 1957. 15.6 percent of dwellings were built in 1978 or subsequently. Figure 1 compares the age profile of HomeSmart Renovation Project dwellings to the age profile of the National Stock.

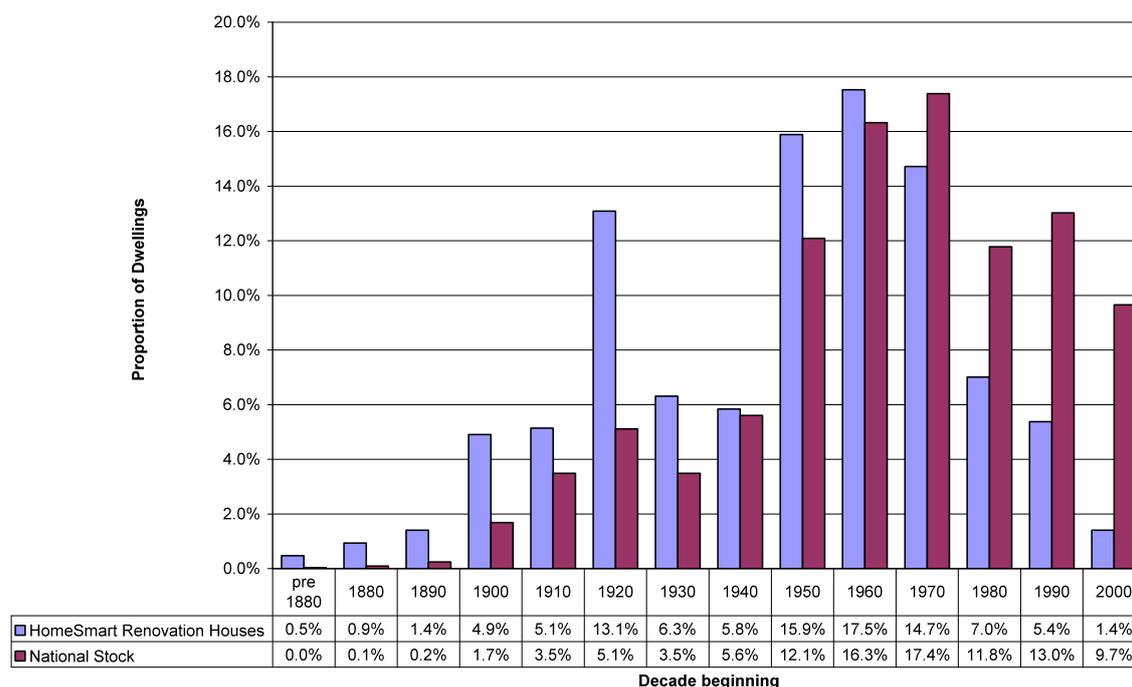
Not surprisingly, the HomeSmart Renovation Project houses have an older age profile than the national stock. The bulk of the HomeSmart Renovation Project dwellings are in an age cluster spanning the 1950s through the 1970s. There is a smattering of dwellings being renovated that are less than twenty years old.

#### Dwelling Condition

A multitude of research has found that high proportions of New Zealanders tend to assess their dwellings as in *Excellent* or *Good* condition. Indeed, New Zealanders tend to believe that their dwellings are in better condition than they are.

In 2004 a matched data set of dwellings subject to both independent house condition surveying by BRANZ, and householders participating in an associated repairs and maintenance telephone survey, found that while 27.8 percent of dwellings were reported by householders to be in excellent condition only 16.8 percent met a House Condition Score of 'excellent' when independently surveyed (Clark et al, 2005). Table 3 provides a cross study comparison of the New Zealanders' self assessment of their house condition.

What is striking about the interviewees in the HomeSmart Renovation Project is the skew of assessed house condition towards *Average* and lower house condition categories. Just under half (47.6 percent) of participants considered their dwelling to be in *Average* or worse house condition



**Figure 1: Dwelling Age of the National Stock and Dwellings in the HomeSmart Renovation Project**

**Table 3: Comparison of Assessed Dwelling Condition Across a Range of Studies**

Study and Year	Percentage Assessed Dwelling Condition				
	Excellent	Good	Average	Poor	Very Poor
2004 Repairs and Maintenance Survey (Saville-Smith, 2005)	27.8%	50.9%	18.8%	2.3%	0.2%
Recent Movers Survey 2008 (Saville-Smith, 2008)	45.6%	37.4%	15.2%	1.7%	0.1%
High Energy User Survey 2008 (Saville-Smith, 2008)	32.7%	43.4%	19.7%	3.6%	0.6%
National Older People Repairs and Maintenance Survey 2008 (Saville-Smith, James and Fraser, 2008)	46.1%	42.7%	10.2%	0.8%	0.3%
HomeSmart Renovation Households 2010	13%	39.3%	35.1%	10.2%	2.3%

The evidence from the HomeSmart Renovation Project does suggest, however, that participants may have a somewhat more realistic understanding of their dwellings than New Zealanders in general. The In-Home Assessment process found that of a series of fundamental deficiencies were found, including only 16.4 percent of dwellings being fully insulated. These are set out in Table 4 below.

**Table 4: Assessed Dwelling Deficiencies in HomeSmart Renovations Houses**

Assessed Problem	Number of Dwellings	% Dwellings
No ceiling insulation	32	7.2%
<75% ceiling insulation or <76mm thick	216	50%
Roof leaks	27	6.3%
Damp under floor	99	22.9%
Ponding underfloor	25	5.8%
No underfloor insulation*	189	41.2%
Window frames need replacement	41	9.5%
Draught stopping of doors needed	234	54.2%
No cylinder wrap	228	52.8%
No fire alarms	138	32.1%
External maintenance	250	57.9%

\*where able to be retrofitted

### ***Temperatures in Monitored Dwellings***

183 dwellings were monitored over the course of the HomeSmart Renovation Project of whom 163 completed a 1<sup>st</sup> wave interview and 161 completed a 2<sup>nd</sup> wave interview. A number of temperature loggers were not retrieved or failed to download requisite data. Consequently, winter living room temperature data was captured for 163 dwellings and 151 dwellings provided winter bedroom temperature data. For living rooms in summer, data for 156 dwellings are available while 166 dwellings provided bedroom summer temperatures.

The data confirm that these dwellings tend to be cool. Patterns found in the Household Energy End-use Project (Isaacs et al, 2006) which indicate a pattern of heating later in the day into the evening and in living zones rather than bedrooms is also characteristic of the patterns found among the participants in the HomeSmart Renovation Project.

Average winter living room temperatures in the morning from 7am to 9 am are a little under 14° C, rising to almost 16° C over the period 9am to 5 pm. Between 5pm and 11pm average living room temperatures are closer to 18° C but then fall again over night with the night average being just over 15° C (Table 5). Over the whole 24 hour period the average temperature of winter living rooms is 16° C.

**Table 5: Median, Mean and Minimum Average Living Room Winter Temperatures (n=163)**

Period	Minimum	Mean	Median
Morning 7am-9am	8.78° C	13.98° C	13.88° C
Day 9am-5pm	9.85° C	15.91° C	15.87° C
Evening 5-11pm	11.86° C	17.79° C	17.85° C
Night 11pm-7am	10.05° C	15.26° C	15.29° C
24 hours	10.63° C	16.01° C	16.07° C

Although those winter living room temperatures do not meet optimal temperatures for health, they are considerably higher than average New Zealand winter bedroom temperatures. Table 6 shows that average temperatures in bedrooms over winter through twenty-four hours were well below 16° C at 14.4° C. The highest average bedroom winter temperature is found between 5pm and 11pm at 15.2° C but bedrooms are coldest in the mornings, on average in winter, 13.2° C.

**Table 6: Median, Mean and Minimum Average bedroom Winter Temperatures (n=163)**

Period	Minimum	Mean	Median
Morning 7am-9am	7.98° C	13.18° C	13.42° C
Day 9am-5pm	8.13° C	14.57° C	14.64° C
Evening 5-11pm	8.45° C	15.18° C	15.38° C
Night 11pm-7am	8.26° C	14.00° C	14.10° C
24 hours	8.24° C	14.43° C	14.61° C

***Damp and Mould in Renovators’ Dwellings***

Of the 676 householders that initially signed-up with the HomeSmart Renovation Project, 380 completed a preliminary questionnaire. The data from that questionnaire probably provide the clearest indication of mould and damp among householders seeking to renovate their homes. This shows that 31.5 percent used dehumidifiers and 47.1 percent had mould or damp related stains on more than an occasional basis. 13.7 percent reported that their home’s interior walls or ceilings had black stains or mould on them ‘always’ or ‘often’.

In addition, 320 householders reported on the extent of musty or artificial smells in their dwellings. Those smells are frequently a sign of poor ventilation and/or damp. Only 43.4 percent reported that after a week of closing up the house, such smells were never evident. 13.4 percent reported smells throughout the house, while over a third reported them in some rooms.

The impression of widespread moisture and damp in New Zealand homes that emerges from the Preliminary Questionnaire is reinforced by the data emerging from the In-Home Assessments undertaken by the independent providers working with the HomeSmart Renovation Project. Data is available for 500 households from the In-Home Assessment process.

Those assessments found that 316 dwellings subject to an In-Home Assessment (63.2 percent) had mould or mildew evident inside the house. Of those 316 dwellings: 57.9 percent had mould in the bathrooms and 55.7 percent had mould or mildew in bedrooms. Mould and mildew were also evident in kitchens, living rooms, laundries and wardrobes, but the incidence of each was less than 10 percent of dwellings.

In-Home assessors also reported that 55.4 percent of householders found that moisture formed on bedroom windows on winter mornings either ‘always’ or ‘often’. Less than a quarter of householders found that condensation on bedroom windows was a rare event or entirely absent in winter.

***Surface Humidity in Monitored Dwellings***

Humidity at the surface was measured in 122 dwellings using Fugenex humidity gauges. Those gauges incorporate a single-use indicator strip. A blue dye is released into some, or all,

of the indicator strip if moisture levels exceed a set threshold (moisture levels in excess of 75 percent relative humidity) for a period of at least 4 hours. Each gauge comes on an adhesive backing so householders are able to install these easily themselves.

Householders installed the humidity gauges themselves following the instructions provided. The first was to be installed in their main bedroom (the bedroom where they had a temperature logger already) and the other outside the bathroom door of the main bathroom in the house. Householders were asked to check the gauges regularly. If the indicator strip on the humidity gauge changed colour to blue, householders were asked to leave it in place for 2 days then remove it from the wall, note the date it was removed on the gauge and return to BRANZ, sealed in the plastic bags provided.

In all a total of 133 strips in 73 households were triggered – indicating an instance of relative humidity levels in excess of 75 percent for a period of at least 4 to 8 hours in around two-thirds of the dwellings with humidity gauges. Sixty-seven households returned a bathroom humidity gauge and sixty-six returned a bedroom humidity gauge. Table 7 sets out the pattern of humidity gauge activation based on gauges returned from the 122 households.

**Table 7: Proportion of Households with Humidity Gauge Activations by HomeSmart Renovation Study Areas**

Research Area	Humidity Gauges		
	Number of Households with Gauges Installed	Number of Households with Gauges Activated	Proportion of Households with Gauges Activated
Auckland	29	21	72.4%
Bay of Plenty	13	9	69.2%
Wellington	26	18	69.2%
Nelson/Marlborough	9	6	66.7%
Canterbury	31	12	38.7%
Dunedin/Southland	13	6	46.2%

### ***Renovation Activities***

The HomeSmart Renovations participants are serial renovators. More than half (60.3 percent) of the householders reported that they had invested in excess of \$2,000 in renovation work in the year prior to interviewing. 82.8 percent report that they intend to invest in excess of \$2,000 in renovations and retrofits in the coming year. Table 8 shows these households have a strong orientation towards insulation in their future renovations.

**Table 8: HomeSmart Renovation Household Top 15 Past and Intended Renovations (n=432)**

<i>Renovation Activity*</i>	<i>Renovations &gt;\$2000 Undertaken in Previous Year % of Households – 1<sup>st</sup> Interview</i>	<i>Intended Renovations % of Households – 1<sup>st</sup> Interview</i>	<i>Renovation Activities between first and second interviews % of Households</i>
Install ceiling insulation	15.5	31.0	24.8
Install underfloor insulation	13.9	32.4	18.3
Install heat pump	9.5	8.8	8.0

Install wall insulation	9.3	15.0	12.3
Install double glazing	6.9	15.0	9.3
Full exterior repaint	5.1	3.0	3.8
Replumbing	4.9	4.4	2.0
Roof replacement	4.2	4.9	2.8
Replace bathroom whiteware	3.9	3.7	3.8
Rewiring	3.7	1.9	1.8
Replace bathroom cabinetry	3.5	3.9	4.3
Install dual flush toilet	3.5	3.0	3.5
Install ventilation system (HRV/DVS/Moisture Master type)	3.2	2.5	2.8
Carpeting	3.2	2.1	2.0
Adding rooms	3.2	2.1	2.3

### ***Impact of the Plan***

It is clear from the pattern of renovations undertaken by HomeSmart Renovation Project participants that they have a distinctly different profile of renovation activity from the renovation activities reported by participants in other research exploring renovation behaviours and investments.

As the previous section has shown, both previous and intended renovations reported by the HomeSmart Renovation Project were strongly directed to improving the thermal performance of their dwellings. This contrasts with the activities of the serial renovators that emerged among the households participating in Beacon's High Energy User Survey and Beacon's Recent Movers Survey (Saville Smith, 2008).

Those surveys show that general populations to be directed to more cosmetic renovation activities despite there being considerable evidence that many of their dwellings were performing inadequately. Interior repainting and/or wallpapering attracted the highest proportion of Recent Movers (45.7 percent) and High Energy Users (19.7 percent). That activity occupied only 2.8 percent of HomeSmart Renovation Project participants in the year prior to their Wave 1 interview and 3.5 percent of householders in the period between their Wave 1 and Wave 2 interviews. Similarly, among the households in the Recent Movers and High Energy Users Surveys only 13.6 percent and 5.6 percent respectively installed ceiling insulation. By comparison, 15.5 percent of HomeSmart Renovation Project households had in the year prior to their Wave 1 interview and 22.9 percent between Wave 1 and Wave 2 interviews.

### ***Perceptions of the HomeSmart Renovation Assessment and Plans***

Among the 432 participants in the Wave 1 interviews, 46.1 percent of the householders reported that they have amended their renovation focus because of the HomeSmart Renovation Plan. In addition, 61.8 percent of those in this phase of the interviewing reported that they had acted on the recommendations of the HomeSmart Renovation Plan.

That is consistent with the relative high satisfaction levels expressed by householders with the assessment process and the HomeSmart Renovation Plan itself in the Wave 1 interviews, although there was a persistent desire for greater specification around the plan recommendations. At the Wave 1 interviews, 87.5 percent of householders reported that they

saw the assessor as having *Good* or *Excellent* competency. With regard to the HomeSmart Renovation Plan:

- 86.8 percent of householders reported that the plan was comprehensive.
- 81.7 percent of householders reported that the plan was good or excellent at identifying key priorities.
- 76.4 percent of householders reported that the plan provided new and useful information.
- 74.6 percent of householders reported that the plan provided detailed recommendations.
- 69.7 percent of householders reported that the plan helped with decision-making.

Of course many householders had had a relatively short period of time participating actively in the HomeSmart Renovation Project when they undertook a Wave 1 interview. Those householders remaining in the project showed consistently high levels of satisfaction with the various elements of the HomeSmart Renovation Project. Of the 400 householders interviewed in Wave 2 interviews:

- 87.5 percent reported that the In-Home Assessment had been useful.
- 70.8 percent found the newsletters useful.
- 70.5 percent reported that the Homeowner Manual was useful, but 4 percent had not read it.
- 68.5 percent found the Project Management Guide was useful, although 2.8 percent had not read that document.

***Recommended Actions and Household Action***

The HomeSmart Renovation Project has been limited in duration and it could be expected that some households at least will act on recommendations after the research period. Consequently, analysis of responses to Renovation Plan recommendations should be treated with care and levels of activity can be considered as conservative. Table 9 outlines the proportion of households acting on recommendations from their in home assessment.

**Table 9: Proportion of Households Acting on Dwelling Issues Identified as Requiring Action In Home Assessment**

<i>Required Action</i>	<i>Households Acting on Requirement</i>	<i>% Households Acting on Requirement</i>
Ceiling insulation (n=191)	125	65.4
Underfloor insulation (n=176)	99	56.3
Heating (n=226)	107	47.3
Wall insulation (n=214)	71	33.2
Double or secondary glazing (n=255)	62	24.3
Thermal curtains (n=156)	12	7.7
Bathroom extractor fan (n=111)	8	7.2

Rangehood kitchen extractor (n=104)	7	6.7
Pelmets (n=241)	2	0.8

## DISCUSSION

The HomeSmart Renovation Project participants have dwellings somewhat older than the national stock, but even dwellings less than twenty years are being renovated by this group of householders. But they are not, by New Zealand experience, the coldest dwellings. These dwellings are, indeed, somewhat warmer than those recruited into the HEEP study and monitored between 1997 and 2005 (Isaacs et al, 2006). In the HEEP study, 98 percent of dwellings had average living room temperatures over 24 hours of less than 18°C. By contrast a lower proportion, 80.4 percent, of the HomeSmart dwellings did so. Similarly in the HomeSmart Renovation houses, 87.8 percent had average winter bedroom temperatures over 24 hours less than 18°C while 98 percent of HEEP dwellings did so.

HomeSmart Renovation participants do have a pronounced desire to improve their dwelling performance, particularly in relation to comfort and warmth. Moreover, they act on that goal with a strong predilection toward addressing insulation issues. There is less evidence in this group of householders of a focus on superficial “prettifying” activities compared to participants in Beacon’s earlier Recent Movers and High Energy User Surveys.

Notwithstanding the focus of these householders on improved performance, the idea of what constituted improved performance was relatively narrow. The proportions acting on plan recommendations and assessments of required action varied from 65.4 percent of those from whose ceiling insulation was recommended to 6.7 percent of households recommended to install a range-hood or kitchen extractor. It would appear that the insulation message is increasingly grasped, but the issue of dealing with humidity is less clearly understood among householders. Similarly, opportunities for water and electricity saving are also less likely to be taken advantage of. Relatively small proportions either took up or reported that they intend to take up solar water heating despite the majority of dwellings having a suitably orientated roof. Take-up of water saving options was also relatively limited. The lack of focus on those issues by renovators, combined with their water use patterns, confirms the importance of charging users directly for their reticulated water use if household water demand is to be minimised.

It can be concluded then, that although support through In-Home Assessment and subsequent Renovation Plans both stimulated and shaped renovation action, the opportunities for further resource efficiency and dwelling performance gains are still considerable. It must be asked why only 18 percent of householders had enquired about retrofit subsidies with only 13.3 percent taking up subsidies.

It is clear that householders still feel anxious about purchasing products and services. While many found both the In-Home Assessment and Renovation Plan helpful, participants in the course of interviewing and in other communications with the programme frequently sought advice on selection between products and service providers. It appears that, in the interaction with the market, householders feel particularly vulnerable.

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