Energy - "From Serial Renovator to Sensible Retrofitter'

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Summary

When people move home they often bring with them exciting plans to 'improve' their property. The focus is often on marble bench tops and luxury bathrooms at the cost of improving the energy performance of the home and hence, the comfort and health of the occupants. Why do we place such a high value on aesthetic 'renovation' whilst we ignore the real benefits that can accrue from energy efficient 'retrofit'? Beacon Pathway, a research consortium with the aim of bringing 90% of New Zealand's homes to a "high standard of sustainability" by 2012, is helping to define best practice in the provision of retrofit solutions. Beacon seeks to understand what New Zealanders value when thinking of 'renovating' their home, what people understand and value about 'retrofitting', and how the two can be aligned to raise the value case for energy efficient renovation. Beacon has developed a framework for decision making to analyse the best retrofit solutions for a range of New Zealand housing typologies and specific options for targeted users and consumers. The research is helping to determine the technical feasibility of improving the energy performance in existing stock and quantified the energy efficiency gains possible within the constraints of individual dwelling typologies. The research is also helping Beacon develop a range of appropriate delivery processes and marketing approaches for dwellings with different household and tenure characteristics, including owner-occupied dwellings / rental dwellings; high energy users and recent home buyers.

1. Introduction

Beacon Pathway Ltd (Beacon) is a research consortium that seeks to radically change the design, construction and renovation of New Zealand's homes and neighbourhoods. Beacon aims to bring about a significant improvement in the sustainability of the residential built environment in New Zealand through science-based New Zealand research.

Beacon's current research on energy is directed to a market transformation that will ensure that both suppliers and consumers act to improve the energy efficiency of New Zealand's housing stock. Beacon recognises that improving the energy performance of New Zealand's housing stock is primarily a matter of changing the performance of the existing stock through retrofitting. The issue for New Zealand's retrofitting initiatives, whether publicly funded or privately initiated by householders, is how to develop energy retrofit packages that most effectively improve dwelling performance and fall within the constraints of household affordability and willingness to pay. Beacon intends to use the findings of this research to develop a study of retrofit performance and take-up among 1000 New Zealand dwellings.

Beacon is addressing the problem of developing effective retrofit packages by a three pronged research stream that is directed to:

- establishing the relationship between retrofit and building typology
- identifying how to stimulate take-up among key consumers in the housing market, and
- identifying a set of evidence-based, robust promotional approaches, packages and tools to retrofit existing houses.

In this paper we present the findings from the second of those research prongs. That research has been concerned with four key questions. They are:

- What user/consumer segments are best targeted to achieve maximum take-up of energy efficiency retrofits of New Zealand homes?
- What are the motivations of these user segments and how should they be targeted?
- Are there common features of building typology of the priority user segments?
- What benefits do other end-users in the supply chain gain through retrofit?

Those questions have been explored through two surveys. One survey has focused on households that are high energy users and the second survey has involved households that have recently moved from one house to another. In the following discussion, we:

- set out the rationale for surveying those two sets of consumers
- provide the survey method and comment on the focus and rationale of the questionnaire
- present some of the key findings from the surveys, and
- comment on the implications of the findings for the development of effective retrofit packages and the potential for market transformation and stock sustainability.

2. Recent Movers and High Energy Users

New Zealand is an enormously mobile society. The 2006 census found that 57.7 percent of the population had changed place of residence in the previous five years. Young people and tenants tend to be the most mobile. Nevertheless, approximately 140,000 dwellings change hands annually. Recent Movers are unique in two ways. Firstly, home buyers have immediate selection choices. The factors that inform those choices regarding the energy efficiency and their assessment of the performance of their new home give a very real insight into: the value home owners place on energy efficiency, warmth and healthy living conditions; the characteristics of homes that home buyers use to assess the likely performance of a dwelling; and the probability of accurate assessments by buyers of the performance of a new dwelling. Secondly, home buyers are often in situations in which they chose a home which requires renovation and they finance their purchase to allow for renovation. That tendency allows us to better understand the extent to which energy and associated dwelling performance and retrofitting are elements within any renovation planning and financing.

High Energy Users are also an important group of householders. Energy use by high users dominates the aggregate energy patterns of New Zealand households. Increasing their energy efficiency and, preferably decreasing their aggregate energy use, is critical to improving the overall energy performance of the residential housing stock in New Zealand. The Centre for Research, Evaluation and Social Assessment (CRESA) has established in a recent survey for the Energy Efficiency and Conservation Authority (EECA) that those households that see themselves as high or very high energy users generally are so. High energy use households may make up between 15 and 25 percent of households. That is, between 200,000 and 350,000 households in New Zealand (Saville-Smith, K. and R. Fraser, 2007). High Energy Users have the potential to reap the greatest returns on investment from increasing the energy efficiency of their dwellings. Understanding their patterns of renovation and their perspectives on retrofit is, consequently, critical to developing effective market transformation and a sustainable housing stock.

3. The Research Method

Both groups were surveyed using largely similar questionnaires. The High User Survey, however, was implemented through telephone interviewing and the Recent Mover Survey was a postal survey requiring the participant to self-complete and post back the questionnaire. Although there were some differences between the questionnaires to take account of the different population profiles of the participants and data collection, both questionnaires involved primarily closed-ended, pre-coded questionnaires with some opportunities for the participants to convey information in free-form. The latter were subsequently content analysed and coded.

The questionnaires focused on eliciting information from participants about the: size and physical characteristics of their current dwelling; renovation and retrofit activities in the year prior to surveying and associated costs; intended renovation and retrofit activities in the coming year and intended expenditure; energy consumption patterns and their perceptions of the drivers of their energy consumption; condition and performance of the dwelling in winter and summer including incidence of damp and mould; householders' understanding of retrofit and the impacts of various retrofit components; and the householders' attitudes to retrofit, the benefits they associated with retrofit and willingness to pay. The survey participants were also asked to report a limited set of socio-demographic information around household income, life stage and household size.

For the High Energy User Survey, data was collected from self-identified high energy use households. Participants for the survey were selected randomly from throughout New Zealand using telephone numbers extracted from white pages listings. Interviewing was undertaken over a two week period from 12 October 2007 to 26 October 2007. An initial screening question asked respondents to estimate their energy consumption compared to other households – only those respondents who estimated their household energy consumption as high or very high were eligible to complete an interview. In all 700 interviews were completed and assuming that the sample has captured high energy users, it provides a margin of error of ± 3.8 percentage points at the 95 percent confidence interval.

Participants for the Recent Movers Survey were selected randomly from a data extract of recent movers generated from the New Zealand Post Household Postal Address Directory. A 'recent mover' was defined as someone who had changed address between 1 April 2006 and 31 March 2007. The data extract was also limited to those households who identified themselves as owner occupiers. The data extract included some 33,700 households, divided into 11 broad regions using post code data. The final sample of 3,000 households was a stratified random sample where the number of households included in the sample from each region was intended to be broadly proportional to the total number of recent mover households in that region for the survey period. Surveying took place over a four week period beginning late September 2007. In all 724 completed surveys were received before the due date of 19 October 2007. The margin of error for the recent mover dwelling population is 3.7 percentage points at the 95 percent confidence interval.

The data from the surveys have been entered and analysed in the Statistical Package for the Social Sciences (SPSS) and subject to univariate and bivariate analysis. Statistical testing – usually chi-square tests – was also undertaken to establish whether there was systematic and statistically significant relationships between selected key variables.

4. Dwellings, Energy Use and Dwelling Performance

New Zealand has a homogenous dwelling stock in terms of dwelling size and type. This is evident in the dwellings occupied by the High Energy Users and the dwellings occupied by Recent Movers. The majority of dwellings are three bedroom dwellings and there is a strong preponderance of detached single-storey dwellings (Table 1).

Table 1: Dwelling Size and Type

Dwelling Characteristics	% Recent Movers		% High Energy Users	
	n	%	n	%
1 bedroom	10	1.4	16	2.3
2 bedrooms	104	14.4	75	10.7
3 bedrooms	354	49.0	300	42.9
4 bedrooms	212	29.4	210	30.0
5+ bedrooms	42	5.7	99	14.1
Total	***722***	***99.9***	***700***	***100***
A detached single-storey house	443	61.7	450	64.4
A detached multi-storey house	190	26.5	185	26.5
A semi-detached single-storey house	18	2.5	20	2.9
A purpose built flat or a flat in a converted building	19	2.6	18	2.6
A semi-detached multi-storey house	16	2.2	8	1.1
Other	19	2.6	8	1.1
An apartment (in a block two or more storeys high)	7	1.0	6	0.9
A terrace house	6	0.8	4	0.6
Total	***718***	***99.9***	***699***	***100***

The participants in the High Energy User Survey, by definition, saw their energy use as above average. However, around a fifth (21.5 percent) of the Recent Movers Survey participants also described themselves as high energy users. When compared to the Recent Movers, the High Energy User Survey participants tend towards simplistic explanations for their high energy use. The high energy users among the Recent Movers Survey participants have multi-dimensional explanations. Among the High Energy User Survey participants the common explanations for high energy use refer to having a large number of household appliances, while among the Recent Movers the most common explanation is around the amount of energy their house takes to heat (Table 2). The Recent Movers (including those of them who are high energy users) are much more concerned about the energy efficiency of their homes than the High Energy Users. Recent Movers are also considerably more concerned with the comfort or warmth provided by a dwelling (Table 3).

Table 2: Assessment of Likely Reasons for Their Households High Energy Use

Explanations for High Energy Use	% Recent Movers with High Energy Use (n=156)	% High Energy Users (n=700)
Our house takes a lot of energy to heat	60.3	35.3
House has many lights	44.2	6.6
Large number of appliances	42.3	37.1
Household members are wasteful with energy	31.4	18.0
We have old hot water tanks	25.6	4.3
We have many hot water tanks	3.8	2.9
Our house takes a lot of energy to cool	2.6	0.7

* Multiple Response

Table 3: Considerations of Energy Issues when Acquiring Current House

Energy Issues Considered	% Recent Movers (n=724)	% High Energy Users (n=700)
Comfort or warmth within the house	83.4	59.9
Whether house had insulation in the roof space or under the floor	64.8	47.4
Whether the windows and doors were tight fitting or draught-proofed	44.3	35.0
What the energy bill might be like	35.9	22.4
Whether the house had double glazing	25.4	15.3

* Multiple Response

This concern with warmth and comfort does generate a somewhat different insulation profile in the dwellings reported on by Recent Movers and High Energy Users respectively. Recent Movers are less likely to report dwellings with no insulation. They are more likely to report that their dwellings are fully or substantially insulated (Table 4). Notably, only 6.4 percent of Recent Movers report no insulation compared to 13.3 percent of High Energy Users. There is not, however, a strongly pronounced difference in the appliances that Recent Users and High Energy Users mainly use for heating (Table 4), although the latter show a slightly lower use of woodburners and heat pumps and a higher reliance of electric heaters and portable gas heaters than Recent Movers.

Table 4: Reported Insulation Profile of Recent Movers' and High Energy Users' Dwellings

Insulation	% Recent Movers (n=724)	% High Energy Users (n=700)
No insulation	6.4	13.3
Roof space only	25.8	25.9
Floors only	1.2	1.1
External walls only	3.5	2.7
Roof space and floor	6.9	8.3
Roof space and exterior walls	32.6	27.1
Floor and exterior walls	0.4	1.4
Fully insulated	16.3	15.9
Not sure	6.9	4.3
Total	***100***	***100***

Table 5: Main Space Heating Used

Heater Type	% Recent Movers (n=724)		% High Energy Users (n=700)	
	n	%	n	%
Enclosed woodburner	168	25.9	158	22.6
Heat pump	144	22.2	109	15.6
Electric heater e.g. fan, bar, convection heater	68	10.5	105	15.0
Fixed electric radiator or oil column heater	65	10.0	80	11.4
Fixed and flued gas heater	58	8.9	66	9.4
Portable gas heater e.g. LPG	50	7.7	64	9.1
Open fire	26	5.7	40	5.7
Underfloor heating	15	4.0	21	3.0
Fixed unflued gas heater	17	3.3	23	3.3
Other	35	2.6	25	3.6
No heating used	*3*	*1.3*	*9*	*1.3*
Total	***649***	***100.0***	***700***	***100***

It is notable that, while only a very small proportion of High energy Users Survey participants explain their high energy use in terms of the age of their hot water cylinders their hot water cylinders have a distinctly older profile than the hot water cylinders in the houses of recent movers. Almost half the hot water cylinders of High Energy Users are aged more than 10 years and less than a third (28.4 percent) of hot water cylinders are less than five years old. In addition, 51.4 percent of High Energy Users report that the pipes from their hot water cylinders are not lagged at all. By way of comparison, 38.4 percent of hot water cylinders in the houses of recent movers are less than five years old and 38.9 percent of the Recent Movers report that their hot pipes are unlagged.

Both household sets report similar patterns of efficient light bulb use. Two-thirds (66.1 percent) of High Users reported using energy efficient light bulbs. However, only around a fifth (21.6 percent) reported that energy efficient light bulbs make up 76 percent or more of the light bulbs in their dwelling with a little over two-thirds (67.3 percent) of High Users reporting that half or less of their light bulbs are energy efficient. Similarly, 70.4 percent of Recent Movers reported using energy efficient light bulbs, but only 14.9 percent reported that energy efficient light bulbs make up 76 percent or more of the light bulbs in their dwelling. Almost two-thirds (61.4 percent) of Recent Movers report that half or less of their light bulbs are energy efficient

5. Renovation and Retrofitting

It appears that both the energy and thermal performance of dwellings of High Energy Users and the dwellings of Recent Movers could be significantly improved through quite simple retrofitting interventions. It is of enormous importance that a considerable proportion of dwellings have been exposed to significant investments in renovation in the year prior to surveying, but few of those renovations have actually involved retrofitting for higher levels of energy efficiency.

Among the Recent Movers, 46.3 percent they have undertaken renovation or retrofit work in excess of $2,000. 43.6 percent of Recent Movers also report intending to expend more than $2,000 on renovations and retrofitting in the coming year. The average reported expenditure on renovations/retrofit is $22,477 and the median is $7,000. Among the High Energy Users, a third (33.3 percent) report renovation or retrofit work in excess of $2,000. 35.9 percent of High Energy Users intend to expend more than $2,000 on renovations and retrofitting in the coming year. The average reported expenditure by High Energy Users on renovations/retrofit is $25,284 and the median is $9,500. Table 6 sets out the renovation activities reported by High Energy Users and Recent Movers.

Most of this renovation work is not prompted by a belief that their dwellings are in poor condition. Among the High Energy Users, 43.4 percent reported that their dwelling was in good condition only needing minor maintenance. Nevertheless, High Users made up 51.7 percent of the High Energy Users intending to undertake substantial renovations, repairs or retrofitting in the coming year. Among the Recent Movers the group that reported that their dwelling is in good condition are also over-represented among those intending to expend more than $2,000 in the coming year on renovations, repairs or retrofitting. This does not mean, however, that renovations do not include attempts to deal with dwelling performance problems.

43.6 percent of High Energy User reported that their dwelling had problems of mould or damp and over a third (36 percent) of High Energy Users and 31.9 percent of Recent Movers reported on ways they have tried to address mould, cold and damp problems in their houses through repairs or renovation or acquisition of appliances. Their strategies are almost entirely dominated by the installation of Heat Recovery Ventilation (HRV), Distributed Ventilation System (DVS), or similar systems with installation of heat pumps and dehumidifiers not far behind. 46 percent of the High Energy Users that reported attempting to address mould and damp in their houses put in HRV/DVS systems, but less than 4 percent installed insulation. Similarly, 28.6 percent of Recent Movers used dehumidifiers while 19.5 percent installed HRV/DVS systems and 17.7 percent installed heat pumps to deal with mould, damp and cold. Less than 8 percent installed some form of insulation despite 83.7 percent of the Recent Movers dwellings having only partial or no insulation.

Table 6: Renovation & Retrofitting Activities

Renovation or Retrofit	Recent Movers (n=724)		High Energy Users (n=700)	
	n	%	n	%
Interior repainting and/or wallpapering	155	45.7	46	19.7
Replacement of kitchen appliances	117	34.5	22	9.4
Carpeting	104	30.7	31	13.3
Replacement of kitchen cabinetry	90	26.5	19	8.2
Installing a heat pump	81	23.8	23	9.9
Replacement of bathroom whiteware	77	22.7	37	15.9
Replumbing	66	19.5	8	3.4
Installing an extractor fan in the bathroom	64	18.9	3	1.3
Installing a rangehood/extractor fan in the kitchen	64	18.9	1	0.4
Full exterior re-paint	63	18.6	28	12.0
Replacement of bathroom cabinetry	62	18.3	15	6.4
Rewiring full or significant part of the dwelling	54	15.9	5	2.1
Installing ceiling insulation	46	13.6	13	5.6
Installing wall insulation	46	13.6	7	3.0
Installing a new hot water cylinder	44	13.0	7	3.0
Replacement of interior cladding	41	12.1	15	6.4
Installing a ventilation system e.g. HRV, DVS	40	11.8	17	7.3
Installing underfloor insulation	35	10.3	8	3.4
Adding rooms	31	9.1	16	6.9
Installing a wood burner	26	7.7	6	2.6
Roof replacement	25	7.4	15	6.4
Polishing floors	24	7.1	3	1.3
Upgrading hot water systems to instant gas	24	7.1	1	0.4
Venting drier to the outside	23	6.8	1	0.4
Installing a low flow showerhead	21	6.2	1	0.4
Replacement of significant amounts of exterior cladding	20	5.9	7	3.0
Installing double glazing	17	5.0	4	1.7
Installing a rainwater tank	11	3.2	1	0.4
Installing a pellet burner	7	2.1	1	0.4
Installing a solar hot water system	6	1.8	4	1.7
Installing a wet back hot water system	3	0.9	1	0.4
Installing a heat pump hot water system	2	0.6	4	1.7
Installing passive vents in windows	1	0.3	0	0.0

* Multiple response

Not surprisingly, considerable proportions of householders find that they continue to have mould, damp and cold problems. Among the High Energy Users, for instance, of the 313 householders reporting they have a mould in their dwelling, 45.4 percent have previously attempted to address the problem through renovation, retrofit or appliance use. Similarly, of the 252 High Energy Users who have taken measures to rectify problems with mould, 56.3 percent report still having mould problems.

Not only do the participants in the High Energy User Survey and the Recent Movers Survey appear to be misdirected in their efforts to improve dwelling performance, many are unaware of the term ‘retrofit’. Only 28 percent of High Energy Users and 41 percent of the Recent Movers reported that they had heard of the term. In both surveys, the participants showed considerable variation as to the activities they identified as retrofit. As Table 7 shows, installation of ceiling insulation is associated with retrofitting by substantial proportions but many of the lowest cost and most basic options such as use of curtains are less likely to be associated by householders with retrofitting.

Table 7: Activities Identified by Recent Movers and High Energy Users as Retrofit*

Activities	Recent Movers (n=296)		High Energy Users (n=252)	
	n	%	n	%
Installing insulation/batts in the ceiling	238	80.4	66	33.7
Installing double glazing	220	74.3	44	22.4
Installing underfloor insulation	218	73.6	57	29.1
Installing insulation in the walls	213	72.0	46	23.5
Draught stopping the doors and windows	192	64.9	11	5.6
Installing heat pump	167	56.4	19	9.7
Putting in an HRV/DVS or similar ventilation system	158	53.4	11	5.6
Upgrading hot water systems to solar hot water	148	50.0	12	6.1
Installing an extractor fan in the bathroom	148	50.0	4	2.0
Venting the drier to the outside	143	48.3	0	0.0
Installing efficient wood burner	143	48.3	6	3.1
Installing a low flow shower head	139	47.0	0	0.0
Putting heavy thermal curtains with pelmets	139	47.0	4	2.0
Installing a rangehood/extractor fan in the kitchen	133	44.9	3	1.5
Installing passive vents on the windows	121	40.9	2	1.0
Upgrading hot water systems to instant gas	121	40.9	5	2.6
Putting in a wetback hot water system	113	38.2	2	0.0

* Multiple response

6. Wanting Retrofit and Willingness to Pay

There are considerable differences between High Energy Users and Recent Movers in relation to their expressed desire for retrofits. As Table 8 shows, the High Energy Users are strongly oriented towards associating comfort and health benefits with reduced energy costs. Among the Recent Movers, however, over a quarter see comfort and health benefits as being attractive in themselves irrespective of energy cost savings. This is despite the fact that High Energy Users show a substantially higher monthly expenditure than Recent Movers. The average electricity bill for the previous month was $194 for Recent Movers but $282 for High Energy Users. The median electricity bill for Recent Movers for the previous month was $170 compared to a median for High Energy Users of $250. Just as the Recent Movers appear more amenable to retrofitting for comfort without the added incentive of energy cost savings, so too are Recent Movers less likely than High Energy Users to report that expense is a barrier to retrofit (Table 9).

Table 8: Attitudes to Retrofitting Current Houses among Recent Movers and High Energy Users

Attitude Statement	Recent Movers (n=724)	High Energy Users (n=700)
Retrofit for comfort, warmth and health if power bill savings	38.3	46.0
Retrofit for comfort, warmth and health even if no power bill savings	26.9	17.6
Will not retrofit current house	22.0	21.9
Already retrofitted	7.9	8.0
Don't know	5.0	6.6
Total	***100.0***	***100.0***

Table 9: Barriers to Undertaking Retrofit (n= 670)*

Attitude Statement	Recent Movers (n=724)	High Energy Users (n=700)
Too expensive	41.2	50.8
I don't know what my particular house needs and/or how to get the best value for money from a retrofit	27.9	2.6
I don't know how to do it myself	9.4	0.5
I can't get access to credible information	5.7	2.5
It would be inconvenient	4.9	13.5
I can't get trades people	2.5	1.1
I have other priorities	0	4.8

* Multiple response

This is not to suggest that expense and affordability are unimportant. Even among Recent Movers, expense is the most commonly cited barrier to retrofit. However, for Recent Movers, the inability to assess value for money is a strong barrier to retrofit take-up. Financial preoccupations are also evident among both High Energy Users and Recent Movers when they reflect on their willingness to pay for retrofit activities. In Table 10, Recent Movers appear less likely to be prepared to take-up retrofit recommendations than High Energy Users. This may indicate that Recent Movers have selected dwellings to a level of performance and comfort that suits them. Overall, both sets of households are characterised by the low investment that they are willing to make in retrofit. Over a quarter of High Energy Users reported that they might act on retrofit recommendations that cost less than $500. Around another quarter reported that they were either unlikely to take up recommendations or did not know how they would respond, while 18 percent of High Energy Users reported that they would take up measures costing between one to three thousand dollars. Among the Recent Movers, almost two-thirds (63.9 percent) would spend less than $5,000 on recommended measures.

Table 10: Amount Willing to Spend on Recommended Measures for Improved Energy Efficiency

Willing Investment	Recent Movers (n=724)	High Energy Users (n=700)
Less than $100	7.3	15.0
$101-$500	8.4	11.4
$501-$1,000	16.0	11.7
$1,001 to $3,000	19.9	18.1
$3,001 to $5,000	12.3	10.9
$5,001 to $8,000	4.0	3.9
$8,001 to $10,000	2.9	3.4
$10,001 to $15,000	1.7	1.0
$15,001 to $20,000	0.8	0.4
More than $20,000	1.4	2.4
I am unlikely to act on recommended measures	17.4	11.7
Unsure	7.9	10.0
Total	***100***	***100***

7. Getting a Sustainable Stock through Householder Take-Up

It is clear that both Recent Movers and High Energy Users are resistant to investment in retrofitting. High Energy Users show little interest or ability to select dwellings that are likely to be resource efficient. Recent Movers are more likely to seek dwellings that are warm and comfortable, but even their newly acquired dwellings still have very basic sustainability features missing. This data suggests that achieving high standards of sustainability in future housing stock is critically dependent on ensuring that any new housing stock is built to optimise energy, thermal and other resource performance. Rather than being satisfied with minimal standards, the difficulties in getting reinvestment in retrofit suggest that sustainable new housing is a fundamental pathway for the future.

Notwithstanding, the fact is that existing housing stock in New Zealand does not perform well. If that is to be remedied we need to give up on our desire to transform serial renovators into sensible retrofitters. Retrofitting has no resonance. Certainly some householders want to reduce exposure to energy costs and others want improved comfort. But the reality is that while these households are prepared to pay for renovation, they do not do retrofit despite many of their dwellings having basic energy deficiencies easily retrofitted at low cost. Basic deficiencies include draughty doors and windows; poor insulation of hot water cylinders and pipes; partial roof and underfloor insulation, and inefficient heating and lighting. Indeed, it appears that where householders do undertake work that might be considered ‘retrofit’ they undertake to put in complex systems rather than address basic issues of thermal performance.

The data shows that willingness to pay for energy performance improvement is complex among these high energy user dwellings. Less than a third of high energy users reported that they would pay more than $5,000 for measures that would improve the energy efficiency of their homes. However, the median expenditure on renovations in the previous year was $9,500. Nevertheless, High Energy Users and Recent Movers both reported making renovations and appliance investments directed specifically to address mould, cold and damp problems. This suggests that the pathway to improved energy, and probably other resource efficiency lies in: connecting retrofitting to the renovation decisions and investments that high user households make in relation to their dwellings; developing a range of low cost retrofit packages; aligning renovation solutions that improve the thermal envelope to addressing concerns about cold, dampness and mould; and providing advice on the relative impacts and appropriate sequencing of retrofit products and packages.

References

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