HR2420/5

Home*Smart* Renovations Phase One Report: Development of Procedures and Establishing the Pilot

Final

A report prepared for Beacon Pathway Limited

November 2008

The work reported here was funded by Beacon Pathway Limited and the Foundation for Research, Science and Technology

About This Report

Title

HomeSmart Renovations Phase One Report: Development of Procedures and Establishing the Pilot

Authors

Lois Easton, Beacon Pathway; June Gibbons, URS; Marta Karlik-Neale, URS; Verney Ryan, Element Consulting; Kay Saville Smith, CRESA

Reviewer

Vicki Cowan, Beacon Pathway

Abstract

The purpose of this report is to document Phase One of the Home*Smart* Renovation project. This phase covers all activities up to the launch of the pilot, Phase Two. The intended audience is Beacon shareholders and researchers although it is envisaged that selected parts of the report may be extracted for use in communicating our approach to partners and other stakeholders. Considerable effort and resources have been spent in Phase One to scope and establish the pilot, which is just being launched. In documenting the thinking and intent of the renovation programme at this time, this report will act as an anchor against which we can review and evaluate the outcomes of the pilot and project as a whole.

Reference

Easton, L., Gibbons, J., Karlik-Neale, M., Ryan, V. and Saville Smith, K.. November 2008. HomeSmart Renovations Phase One Report: Development of Procedures and Establishing the Pilot. Report HR2420/5 for Beacon Pathway Limited.

Contents

Tables

Figures

Executive Summary

The purpose of this report is to document Phase One of the Home*Smart* Renovation project. This phase covers all activities up to the launch of the pilot, Phase Two. The intended audience is Beacon shareholders and researchers although it is envisaged that selected parts of the report may be extracted for use in communicating our approach to partners and other stakeholders. Considerable effort and resources have been spent in Phase One to scope and establish the pilot, which is just being launched. In documenting the thinking and intent of the renovation programme at this time, this report will act as an anchor against which we can review and evaluate the outcomes of the pilot and project as a whole

Phase one of the Home*Smart* Renovations falls into five broad sets of activities. Those are:

1) Detailed scoping of the project
2) Establishment of partnerships for the project
3) Development of the Home*Smart* Renovations Procedures
4) Development of the monitoring and evaluation framework for the pilot project
5) Establishing the pilot project and recruiting participant homeowners.

Detailed scoping of the project:
A scoping process involving interviews with key industry representatives and workshop discussions was undertaken in order to identify the key processes, documents and organisations currently involved in sustainability retrofits and what was needed to develop these to deliver the Home*Smart* Renovations project. This process identified that there is currently limited capacity and capability in the industry for sustainable renovation and a low degree of consumer understanding and demand. From this understanding a scope of the Procedures and information to help shape the pilot project was developed.

Procedures identified for development were

- Principles and process
- Marketing and business case
- Project management for intervention providers
- Best Practice Guide for Installers
- Project Management for Participants
- Home Owner Manual
- Training

And two assessment tools

- Consumer Tool
- Industry Tool

Establishment of Partnerships for the Project:
Partnerships for the project were established with community retrofit organisations in particular because these organisations have the greatest experience with retrofitting and there were

organisations already operating in each of the localities considered for the pilot project. Memoranda of Understanding were specifically developed to formalise these partnerships. Partnerships were established with Community Energy Action based in Christchurch, EcoMatters Environment Trust in Auckland, Energy Options in Whakatane and EnergySmart in Wellington. Discussions with potential local government partners for the project were held; however, no firm commitments to engaging with the project were able to be established.

Development of the Home*Smart* Renovations Procedures:
The Procedures were developed from the existing body of Beacon research, including substantial information from the Papakowhai Renovations project (TE106) and information developed as part of the NOW100 project. Other Beacon research, in addition to information provided by the project partners was used to develop two of the Procedures.

In parallel with the development of the Procedures, two Assessment Tools – the HomeSmarts™ Consumer Tool and the In-Home Assessment Tool were developed.

The Home*Smart* Consumer tool is a web based addition to the www.homesmarts.org.nz website and enables homeowners to develop a list of measures for action in their home, prioritised and tailored to specific dwelling attributes and problems.

The In-Home Assessment Tool enables a trained assessor to evaluate the dwelling and its attributes and develop a Home*Smart* Renovation Plan for the dwelling. Both tools consider a number of key features including:

- House Typology
- House location and climate
- Sources of energy used in the home
- Hot water systems
- Heating systems
- Household Income
- No. of occupants
- House size
- House condition
- Insulation levels
- Outdoor water use
- Ventilation
- Toilet type

Development of the Monitoring and Evaluation Framework for the Pilot Project:

BRANZ and CRESA have developed a monitoring and evaluation framework that is designed to in the first instance use data generated by the assessment process and renovation plan development itself. It involves the collection and analysis of administrative data, direct monitoring of physical dwelling performance and self-report information from householders. The sample frame has been developed to provide enough statistical power for the analysis of the impacts of climate zones and household income on the take-up of renovation options as well as on the impacts of renovations on

dwelling performance. Within the In Home Assessment information around typology is also collected for all dwellings, enabling an analysis of the impact of typology to also be undertaken. It is intended that 750 dwellings participate in the research. A sub-sample of 200 dwellings will be subject to direct monitoring of temperature. One hundred of the dwellings monitored for temperature performance before and after interventions will also have surface humidity monitoring undertaken. Further sub-samples of will be monitored for water use through water metering and energy and water use associated with solar water heating.

Establishing the Pilot Project and Recruiting Participant Homeowners:

Homeowners are being recruited for the pilot project primarily through word of mouth, media articles and web links. Originally it was envisaged that the pilot partners would assist in recruitment, however they were initially very reluctant to do this. As a result, a homeowner registration webpage has been developed on the Beacon Pathway website and homeowners are asked to participate in a pre-assessment questionnaire about the performance of their home. Homeowners are then assessed by project partners using the in home assessment tool, the output of which is entered into a plan builder and a renovation plan is generated. Physical retrofitting will be undertaken by a range of mechanisms, including subsidized retrofits delivered by project partners, commercial renovation companies, trades people and DIY.

1 Introduction

The Home*Smart* Renovations Project was first envisaged in 2007 as part of the Homes Strategy (Easton, L. and Cowan, V. 2007). The intent of the project was to take the learning's from the Papakowhai retrofit project, and develop a set of tools and guidelines (the Procedures) which would assist the home renovation industry, and homeowners, to retrofit and operate their homes to achieve an HSS High Standard of Sustainability® (HSS®).

In order to test the Procedures developed, the research methodology proposed included a piloting phase for these Procedures, with a nominal 1000 homes participating across New Zealand. The intent of this phase is to evaluate the efficacy of the Procedures and their implementation in delivering homes to a HSS®. As part of the pilot, partner organisations from the home retrofitting sector were intended to be engaged and use the Procedures to implement the Pilot. As part of the pilot, a number of delivery models were considered. In the first instance partner organisations from the home retrofitting sector were intended to be engaged and use the Procedures to implement the Pilot.

The research hypothesis for this work is:

1. That Home*Smart* Renovations Procedures can be developed, which, when used by stakeholders in the existing homes value chain, will enable the retrofitting of existing homes to meet the Beacon HSS High Standard of Sustainability®.
2. That development of the Home*Smart* Renovations Procedures and their piloting will act as a key market transformation method in the wide uptake of retrofitting of existing homes to achieve an HSS High Standard of Sustainability®.
3. That there are a range of delivery models available which will facilitate the uptake of Home*Smart* Renovations Procedures within New Zealand's existing housing stock.
4. That local government policy can be developed (for example a differential rating system for Council rates) which, when used by local government agencies will promote and incentivise the retrofitting of existing homes and construction of new homes to meet the HSS High Standard of Sustainability®.

Though not the subject of this report, the fourth hypothesis component around local government policy has been developed through research being undertaken in parallel with the Home*Smart* Renovations project (see Howell and Birchfield, 2008a and 2008b).

The project implementation of the Home*Smart* Renovations falls into five broad sets of activities or components around which this report is structured. Those are:

Component/Activity of implementation phase		Status
1	Detailed scoping of the project	Completed
2	Establishment of partnerships for the project	Well established, ongoing activity
3	Development of the Home*Smart* Renovations Procedures	Version 1 for pilot complete
4	Development of the monitoring and evaluation framework for the pilot project	Completed
5	Establishing the pilot project and recruiting participant homeowners.	Underway at November 08

These sets of activities are necessary components of a successful demonstration research programme and have been by Beacon as a way of ensuring that as research progresses; it is reflected in project implementation. They are strongly inter-related and iterate off each other as the programme evolves. They require, however, different processes, resources and skills. Consequently, they tend to be managed as connected sub-components.

Phase Two, piloting similarly has a series of inter-related activities:

- Implementing procedures and processes of monitoring and evaluation framework
- Maintaining and extending, where necessary, partnerships associated with pilot
- Analysis and reporting of results.

2 Detailed Scoping of the Procedures and Pilot Project (Component 1)

2.1 Scoping Approach

In order to develop a scope for the Procedures, a Project Control Group was established and URS were contracted to undertake a process involving face to face and telephone interviews with key industry representatives, and workshop discussions with the project control group for the project (Lois Easton, Verney Ryan, Vicki Cowan, Kay Saville Smith representing Beacon, Lynda Amitrano from BRANZ, Marta Karlik-Neale and June Gibbons from BRANZ and Damon Birchfield from the policy project team) was undertaken.

Industry representatives were selected from those organisations known to be active in the retrofit space – and where some interest in sustainable renovation appeared to exist. It also included some of the tradesmen who had worked on the Papakowhai project. Table 1 lists the people and organisations who participated in the interview process

Interviewees were asked the following questions:

- What are the processes, documents and people that are *currently* involved in sustainability retrofits (cover both your practices and what you think is happening in the wider market)?
- What would be the *ideal* processes, documents and people that should be involved in sustainability retrofits?
- What are the key barriers to sustainability retrofits (including financial issues)?
- What would need to be in place for sustainability retrofits to become common place? What would convince current installers to offer full scale sustainability retrofits?
- What are the key benefits of the sustainability retrofits?
- From your experience, what are the key learning's and things to watch out for in sustainability retrofits?
- What process for carrying out the NOW Home® Renovation (subsequently Home*Smart* Renovations) project would work for you? How should this be handled post project?
- What support information (contracts, promotion, technical info) would you expect from Beacon Pathway (Beacon) during the NOW Home® Renovation (subsequently Home*Smart* Renovations) project?

As a result of the interviews a number of key findings were identified which are outlined in 2.2 below. These findings were documented in a 'preliminary' Scope of Procedures which were then refined in a workshop with representatives from four community retrofit organisations who were interested in working further with Beacon on the project. Discussions covered the preliminary scope document and some of the wider issues around sustainable renovation, including the experience of the Papakowhai Renovations. This resulted in a finalised Scope of the Procedures as outlined in Appendix One.

Person	Background	Organisation	Rationale for Inclusion
Government			
Mike Gaudin	Project Management Clean Heat Programme	Clean Heat Environment Canterbury (ECan)	ECan's Clean Heat is the most successful retrofit programme in the country
Mark Prosser	Energy efficiency retrofitting	EECA	Experience with EECA funded programmes
Ben Thompson	Water use co-ordinator	Kapiti Coast District Council	Water retrofit programme experience
Richard Morrison	Eco Design Advisor	Kapiti Coast District Council	Current provider of sustainable retrofit advice
Peter Joyce	Sustainable building, architect	Waitakere CC	Substantial experience in sustainable building methodologies. Practical design understanding.
Retrofit Organisations			
Ian McChesney	Energy efficiency retrofitting,	Community Energy Action (CEA)	Long experience on community retrofit sector
Matt Cutler	Energy efficiency – from a commercial perspective	Energy Mad	Successful market uptake of EcoBulbs – commercial provider of energy efficiency solutions
Jacob Rawls	Water retrofitting	EcoMatters	EcoMatters run the most successful water retrofitting programmes in the country
Albrecht Stoecklein	Energy efficiency	Right House	Commercial energy retrofit provider
James Hadley	IEQ and energy efficient retrofit technologies	HomeTech	Commercial provider of energy and IEQ retrofit technologies
Trades people			
Dave Auld	Carpenter	Self-employed	Carpenter who worked on Papakowhai Renovations

Table 1 Participants in Scoping Interviews

2.2 Key Findings from the Scoping Phase

2.2.1 Energy efficiency retrofitting is a highly competitive sector

One of the immediate findings of the interview process was that the retrofit industry is currently a highly competitive sector. Several of the interviewees were reluctant to share information with Beacon due to concerns about confidentiality and commercial sensitivity. On engaging these people further it became clear that one of the major drivers for this competitiveness was the way in which EECA administers its energy retrofitting subsidy programmes. These programmes are tendered on a competitive basis. When the process was first put in place, tenderers consisted almost entirely of community based organisations who freely shared information and "kept to their patch", however now the value of subsidies has been increased a number of more aggressive commercial players have been attracted to the sector. As a result, the community based organisations in particular felt that their know-how and intellectual property had been taken by these organisations to develop businesses which directly competed with them.

Implications for pilot:

In order to protect intellectual capital and intellectual property within the Procedures, care with the roll out of the Procedures through the pilot will be needed. By engaging significantly with community trusts, the ability to involve Right House or Energy Mad in the pilot is limited and release of the Procedures and Assessment Tools will need to be carefully handled.

2.2.2 The retrofit and renovations sector is fragmented and ad hoc

Full-scale sustainable renovations are generally limited to small groups of environmentally active people and usually privately funded. Government funded renovation is limited to insulation and clean heating for low and middle income households. Local councils and some other organisations such as utilities support renovations aimed at certain issues such as reducing energy or water use. Retrofit organisations compete to obtain some of this funding, and the renovations they offer are limited as a result.

Identified barriers to sustainability renovations include low financial incentives and intangible benefits, public acceptance of low quality housing, and lack of regulation or government intervention.

Implications for pilot:

Development of the capacity of the sector to actually deliver sustainable renovation is needed. The Procedures will need to include information which helps with this eg Best Practice Guide, Training.

2.2.3 There are a range of intervention providers currently involved in the sector

Intervention Providers are organisations who:

- Interact with the customers to agree on the scope of the renovation (through assessments and sales);
- Secure government funding;
- Co-ordinate product selection and installations; and,

- Provide overall project management.

Key differentiators between the Intervention Providers relate to their legal form, target customers and types of renovation undertaken.

Table 2 gives some examples of the different legal forms. It must be noted that the boundaries between the different groups are not always clear: local government sometimes provides funding to other groups (eg ECan) and commercial companies sometimes operate under the control of or in close association with social organisations, (eg EnergySmart).

Legal Form of Organisation	Examples
Community Trusts (non-profit organisations) or companies owned by community trusts	Community Energy Action Trust EcoMatters Environment Trust Energy Options Community Company EnergySmart Limited Company but owned by a community trust
Commercial Companies (private organisations)	Energy Mad Right House Home Tech Eco Insulation
Local Bodies	Environment Canterbury Waitakere City Council Kapiti Coast District Council Wellington City Council Waitemata District Health Board

Table 2 Legal Form of Intervention Providers

The organisations target different types of customer. The boundaries for customer groups are largely determined by the main funder, which usually targets low and middle income households. Most retrofit organisations are not strict about market differentiation, for example Home Tech has contracts with Housing New Zealand Corporation to renovate state houses to improve ventilation as well as targeting higher income private customers.

Target Customer	Examples
Low Income (Community Service Card holder)	EnergySmart Community Energy Action Energy Options Environment Canterbury Eco Insulation Sustainability Trust Other EECN (Energy Efficiency Community Network) Members
Mid-income (<$100,000 household income)	Environment Canterbury EnergySmart Community Energy Action Energy Mad Terra Lana Eco Insulation
High-income (>$100,000 household income)	Home Tech Right House Energy Mad

Table 3 Target Customer of Intervention Providers

Organisations also display wide variation in the scope of renovations they undertake. Table 4 presents the interventions envisaged for the Home*Smart* Renovations project and which organisations were providing them at the time of the scoping.

	EnergySmart	EcoMatters	CEA	Energy Mad	Right House	HomeTech	ECan Clean Heat	Kapiti Coast District Council	Waitakere District Council
Insulation	*		*	*	*				
Ventilation						*			
Heating			*	*	*		*		
Hot Water System (HWS)	*		*		*	*			
Glazing					*	*			
Potable water		*			*			*	*
Wastewater and storm water		*						*	*
Other energy efficiency eg lighting	*			*	*	*			

Table 4 Providers of HomeSmart Renovations Interventions

2.2.4 There are a limited number of partners for the HomeSmart Renovations Pilot

No organisation currently operating in New Zealand provides the holistic sustainable renovation that Beacon Pathway is aiming for. A number of Intervention Providers stated that they were directly opposed to the idea of extending their services as they believe that even within the existing scope they are only starting to develop good practice ("Learn to walk before you run"). The idea of a holistic renovation was always considered difficult by the interviewees from a customer perspective – the majority of the organisations said they try to be responsive to customer requirements and believe that forcing the customer into holistic renovation ("take all or nothing") will drastically limit the number of customers willing to participate.

This suggested that the approach needed for the pilot is to develop partnerships between a range of organisations to deliver the package and development of a long term renovation plan allowing the customer to manage finances and time.

Community Trust Intervention Providers were decided on as the key partner of the Home*Smart* Renovations pilot and primary route for the pilot project delivery. Key reasons for this decision were:

- The scoping undertaken as part of the Homes Strategy and RIB already identified this group as a key partner;

- Of all the intervention providers community trusts have the most extensive experience in both assessment and intervention as they have been operating in this sector for many years. For example CEA have been running for 14 years. This compares to Right House and EnergyMad who, at the time of scoping, had been undertaking this kind of work for less than a year, and had done very few retrofits;
- Through a combination of four different community trust partners coverage for the pilot for the whole of the country was able to be achieved;
- Beacon already had strong relationships through other projects with three of the four community trust providers (EcoMatters, Energy Options and EnergySmart) meaning there was a base of trust and existing relationship to build off;
- All of the community trust providers have been involved in research projects previously;
- At the time of making this decision all of the partners were providers for EECA grants programmes (EcoMatters has subsequently pulled out of this programme but is still involved in delivery of water retrofit programmes for Waitakere City Council);
- By selecting one "type" of partner in the first instance it enables a simplification of management of what is a very complex project and creating an efficient way to co-ordinate the assessment and renovations of large numbers of homes across New Zealand.
- Community trusts were considered a "safer" partner in dealing with the risks of protecting IP when compared to commercial operators.

The intention is that once the pilot is established Beacon would look at other delivery models for inclusion in the pilot.

2.2.5 There are Significant Public Awareness Barriers to Sustainable Renovation

A major barrier identified by many of the interviewees was the lack of public awareness and understanding of sustainable housing. Some interviewees felt that not enough information was available, while others considered that information existed but was fragmented and poorly presented. There appears to be little general advertising which promotes holistic home renovations, and most communication focuses on energy efficiency.

In some specific locations both energy efficiency and water efficiency is promoted, however, with the exception of the TUSC Tool developed by Waitakere City Council, there has been little "joined up thinking" around these two issues. Even Waitakere City Council, which has funded single providers (eg EcoMatters Trust) to implement both energy efficiency and water efficiency programmes, at the time of the interview process did not require of providers that these interventions occur in the same dwellings. It should be noted that during the course of 2008, and in part as a result of ongoing discussions with Beacon, some of this more integrated thinking has started to come through, in some areas.

There does remain however a significant gap between the public understanding of sustainable building and the whole of house, multiple aspects of dwelling performance as contained within the HSS High Standard of Sustainability®.

2.2.6 Role of Home Sustainability Advisors and Promoters

Organisations currently working on disseminating the information on home sustainability include:

- Central government agencies (e.g. EECA, MfE, DBH and District Health Boards) who produce information brochures, place advertising, run television campaigns, manage web resources and eco-labels.
- Eco Design Advisors from local councils (Waitakere, Auckland, Hamilton, Tauranga, Western Bay of Plenty, Kapiti, Wellington, Porirua and Queenstown Lakes), who provide up to 2 hours home assessments and free advice on what can be done to improve a home's performance
- Intervention providers promote their services and in the process increase the awareness of the need and increase demand for sustainability renovations. Energy Efficiency Community Network (EECN) is an umbrella organisation representing various community energy trusts who is in the process of setting up a call centre able to provide advice on sustainable renovations.
- Manufacturers of sustainability products and materials advertising in mainstream media also contribute to the awareness. This was especially effective in generating demand for heat pumps.
- Private media initiatives – Wa$ted, Green Pages in newspapers, Change the World publication.

Implications for pilot:

Beacon needs to develop comprehensive material that 'introduces' whole of house approaches to consumers to support the pilot.

2.2.7 Funding Providers

There are a range of public funding sources available for components of sustainable renovations. However, each fund has its own eligibility criteria, timing and process for application, and geographic range. This makes funding complex to access and distribute. There are no public funding sources which cover an entire sustainable home renovation. The major public funders are listed below:

- EECA: The biggest provider of funding for energy efficiency is EECA. The insulation interest-free loan scheme began in 2008 and the initial round of providers has been administering the programme. EECA also provides a small rebate on some solar hot water systems (it was $500 but has now been increased to $1000) and provides some assistance to regional councils in areas with poor air quality. EECA provides the following funding:

  - Insulation Grants: Available to households which are Community Service Card holders and whose house was built before 2000 (was 1978 until 17th October 2008). Landlords whose tenants fit this profile may also apply. EECA puts out a tender process for project management organisations to apply for funding. Project management, including recruiting customers and financial control, is delegated to the successful organisations. EECA provided roughly 25-30% of installed cost (now increased to reflect the higher costs of under floor insulation), and the project management organisation has to find the rest. This is usually from DHBs, community groups such as Plunket or GreyPower, and community

trusts. Generally the homeowner pays nothing, or makes a relatively small contribution (less than $500) to the costs. The range of interventions is limited to: ceiling and under floor insulation; hot water cylinder wraps and pipe lagging where required; draft excluders; low flow shower heads, polythene vapour barriers (in limited circumstances) and CFL light bulbs. Different providers offer different combinations of products as only ceiling and under floor insulation, draught stopping and hot water cylinder wraps/pipe lagging are core "required products. The level of ceiling insulation is required to be at least R2.6 in the North Island and R3.2 in the South Island. Under floor insulation required was foil only, however recent changes to the programme have stepped this up to a minimum R1.5 installed product – meaning that more bulky insulation products are now being used.

- Insulation interest-free loans or grants. Available to households whose income is less than $100,000 per year and whose house was built before 2000 (was 1978 up until 17th October 2008). This scheme is still in the start up phase, and the second tender round is now underway. The money is available for basic energy efficiency measures, insulation and efficient space heating.

- Other funds: The solar hot water grant is available for systems which meet eligibility criteria. The grant is for $1000 (until recently this was $500) towards systems which have a pay-back period of up to 20 years. The scheme has not been successful to date and has been re-organised to make accessing the funds easier. EECA provides some funds to regional councils with poor air quality areas for clean heating (Waikato, Nelson, Canterbury, and Otago).

- Ineligible interventions: EECA will not fund the following interventions, as they do not consider them to be value for money: double glazing, wall insulation, distributed renewable energy generation, heat transfer systems.

- Housing New Zealand: Housing NZ maintains most social housing stock in New Zealand. They have a tender process for large maintenance works on their properties. This includes a healthy housing programme, which in some areas is focussed around improving IEQ by methods such as installing extract fans in bathrooms.

- Councils: Environment Canterbury provides funds for approved heating appliances as part of their Clean Heat programme to improve air quality in certain areas. There is a similar programme in Nelson (Clean Heat Warm Homes), Waikato, Otago and Bay of Plenty. Other regional Councils such as Hawkes Bay, Auckland and Wellington are considering starting up these programmes also. Conserving potable water is targeted by Waitakere City Council with a range of subsidised products and services in their Water Wise-up Programme. Kapiti Coast District Council is considering a similar programme.

- District Health Boards: Some DHB's provide funding, usually in conjunction with EECA insulation grants, for renovations which improve the health of at-risk households.

- Community Energy Trusts: Fund energy efficiency renovations generally in low income households eg CEA Warm babies programme.

Private funding is also becoming available as conventional banks introduce green loans at reduced rates. These are currently mostly available through private arrangements with suppliers or Intervention Providers. Savings and loans are the most common method to fund a home renovation for most households. Utilities, e.g. Meridian, are also starting to provide funding for sustainability renovations to fulfil their mandate for contribution to efficiencies on the demand side (e.g. electricity and water).

Implications for the pilot:

There needs to be clear information for homeowners so they are made aware of what support they are eligible for and where this can be accessed.

2.2.8 Manufacturers, Retailers and Installers

There are an increasing number of products and materials required to undertake the Home*Smart* Renovations. Some carry environmental labels. The majority of Intervention Providers source their products from retailers and often have long-term supply deals. Many Intervention Providers and some Fund Providers only work with a specific, limited range of pre-selected products.

Installations are carried out by their own staff, general trades people or installers on contract to specific manufacturers or distributors. Intervention Providers usually have in house teams for some aspects (e.g. insulation installation) and also work with specific teams of trades people/ installers who have developed experience with the process, have appropriate certifications and are known to deliver quality. In this way the Intervention Providers capitalise on the "on the job training" undertaken in early stages of the operation.

The interviewed installers emphasised the need to create a strong team, who can work together on each house. The better the team works together, the less likely are delays and cost overruns due to mistakes and miscommunication. The installers considered that actual installation of a single intervention, such as a range hood, is not complex and no different to their normal work. The challenge for whole house sustainable renovations was the number and breadth of interventions, which required plumber, electrician and insulation installer working together.

It was recognised that the Intervention Providers might resist introduction of a wide variety of new products and new trades people during the Home*Smart* Renovations project with resultant increases in costs and potential impacts on quality.

Tapping into existing agreements was likely to generate best results. It was considered that Beacon-led project-wide agreements should be considered with caution as the situation and appropriateness of different solutions is likely to vary across the country. Using sponsored products could lead to quality issues (where they are forced in inappropriate situation) and funding challenges. In addition there were concerns that Beacon endorsement could also provide risk to Beacon around actual product performance.

Close co-operation between trades and strong project management along with a clear programme of action developed at the early stages was identified as a key part of the project requirements. Re-using the same team on multiple projects will be beneficial.

Implications for pilot:

The Procedures need to provide information that helps develop capacity and capability in project management. They need to provide information to enable the specification of performance standards not specific products. This also supports the decision to initiate the pilot using community trusts as main mechanism to deliver assessment and plan, with the intervention being left to the market, something the research will capture.

2.2.9 Homeowners

Interviewees indicated two distinct groups of people are currently undertaking sustainability renovations:

- Low income households referred by community organisations, utilising available government grants and motivated by possible savings and health benefits
- High income households initiating the renovations due to an increased awareness of comfort needs and/or environmental issues, who are funding the project and often project managing the process. These people are more likely to be motivated by long-term increase in house overall value than any on-going savings on utilities

Low income home occupiers rely on the advice and portfolio of products offered by the Intervention Providers, and interventions tend to have low specification and scope but relate to key priorities e.g. insulation and heating. It was considered that they are unlikely to be able to finance any expansion of the scope, and that other avenues for funding have to be explored.
Higher income home occupiers tend to scope the market before contacting the Intervention Providers and are likely have pre-conceived ideas of what solutions they require. Limited scope for additional advice exists at this stage and these renovations often result in costly interventions with low performance impact – e.g. installing heat pumps in an uninsulated house.

Implications for pilot:

A pre-sell process, which would highlight the benefits of holistic renovations and undertaking renovations in the right order will be needed. An on-line Assessment Tool and mainstream media promotion were considered likely to be most efficient.

2.3 Key processes for sustainable renovation

Customers as homeowners and likely funders of at least the majority of costs need to be considered as key decision makers during the pilot phase. It is therefore useful to look at the renovation process from the perspective of consumer needs and the decision making process that they are likely to go through during the renovation period.

It should be noted that sustainable renovation per se is currently not actually occurring – what is being undertaken are partial renovations with an energy efficiency focus. Figure 1 identifies a process from both the homeowner and installer perspective. However, differences will of course occur. An example from the homeowner perspective are where homeowners directly approach providers for involvement in an energy efficiency retrofit as part of a healthy housing or low income fully subsidised retrofit, as they may have alerted to this by their health provider.

In the case of intervention providers, while most claim to do some form of post intervention monitoring, in reality this is small scale and generally ad hoc, with little robust methodology provided.

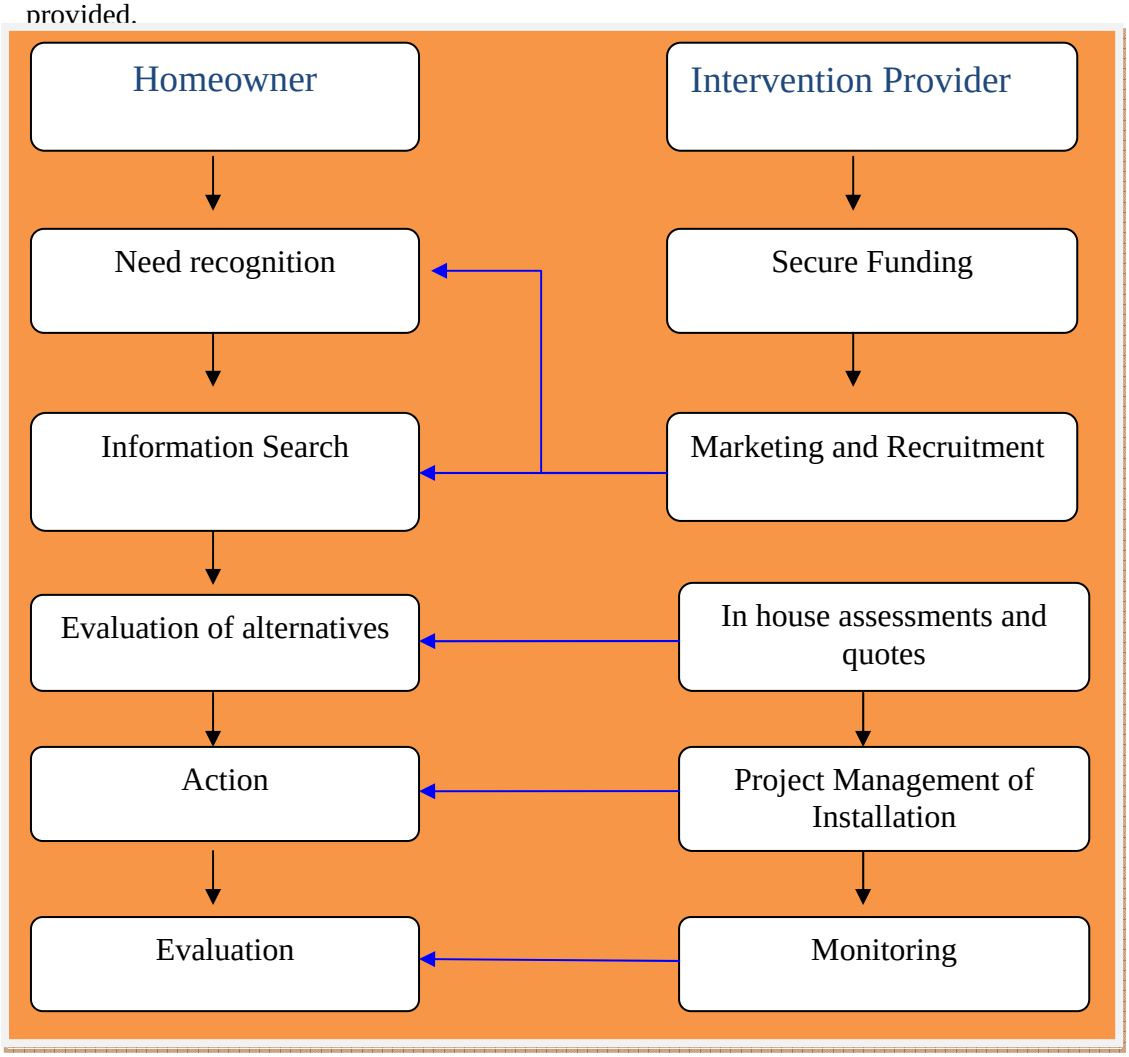

Figure 1 Alignment of the Homeowner Decision Making Process and work of Intervention Providers

2.3.1 Perspectives on funding

Homeowners

- Homeowners are not likely to look at the funding options until the stage where they are evaluating specific options and have established a budget.

Pure Commercial renovators (e.g. Home Tech)

- Customer is generally responsible for funding. Price incentives and special deals are in place to be discussed.
- Sometimes access government subsidies, using them as the basis for a wider renovation.

Grant based renovators

- Need to compete for funding at regular intervals and then schedule the activities based on available budget and its restrictions.

Others

- Funding options are advertised by agencies mainly through usual tendering channels and local authorities.

2.3.2 Perspectives from Interviews on need recognition/recruitment

Homeowners

- The need recognition for sustainability renovations is related to awareness of costs and potential benefits of the house performance: health, social peer pressure, running cost savings, potential impact on the capital value, moral obligation i.e. environmental responsibility.
- Level of awareness is considered to be very low. Key motivators tend to be either financial or comfort/health related. Environmental issues carry low weight but are increasing.
- Key sources of information supporting need recognition come from mainstream media and advertising or word of mouth.

Commercial renovators

- Some Intervention Providers promote their services and focus on generating awareness of problems. “Have you got this problem? – We have a solution.” Marketing methods applied include mail drop, home shows, TV and newspaper advertising and websites. Promotion is also carried among designers and architects as an indirect channel to customers. Most organisations rely on customers to respond to promotional activities with a phone call requesting a quote.

Grant based renovators

- Those working with public grants usually rely on fund providers to market and raise awareness. They focus their efforts on highlighting benefits and promoting the opportunities. One of the interviewees said that they had changed their marketing away from creating environmental guilt over air pollution and towards focusing on personal needs for health and comfort which they were able to fulfil.

- Recruitment of the customers often takes place through community and DHB referrals, community service card holders and other social services for low income households.

Others

- Public agencies and local authorities promote house sustainability usually focusing on savings from energy efficiency and environmental issues. Key media used are: local magazines, direct mail, brochures, internet resources.

2.3.3 Perspectives on information search / recruitment

Homeowners

- Home occupiers trying to establish what they should do in their house to fulfil the need of a warmer, healthier and more efficient home use one or more of the following sources:
  - Advice from friends, neighbours
  - Advice from trades people, retailers, producers
  - House renovation magazines and web pages
  - Advertising and consultation with producers
  - Home shows

Commercial renovators

- Private renovators face a challenge in assisting the information search as they are often associated with specific products and have only limited trust from the customers. Nonetheless some are trying to position themselves as independent advisors e.g. Right House Solutions Centre.

Grant based renovators

- Grant based renovations usually have a pre-determined scope and there is little assistance possible for evaluating wider options. There are currently discussions about developing a call centre providing tailored advice for individual homes for free in co-operation with renovation trusts.

Others

- Local authorities and public agencies generated a number of resources supporting information search including Smarter Homes, Level, Energy Wise, SolarSmart. Advice can also be received from free Eco Design Advisors employed by some councils and a number of sustainable show homes.
- The limitation of the current information sources is the fact that they are accessible either in main urban centres or over the internet leading to exclusion of significant proportion of the society. The sources are also poorly aligned with usual places where consumers look for information. Internet is not the preferred source of information for many households.

2.3.4 Perspectives around evaluation of alternatives/ assessments and quotes

Homeowners

- Evaluation of specific alternatives (this relates to selection of specific technology, products, installation methods leading to detailed cost estimate) usually requires higher level of knowledge than an average homeowner is likely to have. Nonetheless many try to take decisions independently due to lack of trust with people selling services. They are likely to take decisions contrary to advice of specialists (as this advice can often be conflicting coming from different sources) and are often resistant to expanding the scope of the initial plan for renovations. One of the interviewees disclosed that only 10% of customers were interested in an in-house assessment (for which they were charged a fee refundable on renovation sale), while another 70% were interested in insulation only.

Commercial renovators

- Private renovations often respond to direct request by a customer to install a specific solution but some also offer in-house assessments, using electronic (PDA or laptop) and paper checklists. Assessors visit the household and check existing uses of electricity, insulation, heating and water as required, takes measurement and often signs the contract (this might also happen on later visits with specific installers).
- Private companies are worried about customers getting free assessments and then managing the renovations independently. Assessors have a variety of relationships to the organisation but are generally salaried employees rather than contractors. This helps maintain the perception of assessor independence as they do not rely on sales or product referrals for income. Often the assessors act as the point of contact and project manager for the renovation, responsible for the project outcome. Assessment might also include an office visit to use their computer simulations.
- Key factors influencing decisions about the interventions are the cosmetic state of the house, products available and the customers' budget.
- Installed products are often sourced through special deals at below retail cost. Customers usually have some choice within a certain range of products. Inventory (cost of materials) can be a major cost for private sector organisations (up to 50% of turnover).

Grant based renovators

- Once candidates are recruited, non-profits provide a free home assessment to confirm whether the candidate meets funding criteria and to gauge the size and amount of retrofit required. Some non-profits simply inform the customer about what retrofits need to be made. Other non-profits take this further and recommend certain products or supplies. Quotes are either provided on the spot or during the follow up to avoid the perception of 'hard-selling' and maintain the independence of assessors. Simple water retrofits, fully financed by councils, are often installed immediately during the first visit.
- Relationships with products and suppliers are varied. Some non-profits provide a range of products which the customer is able to select, while in other cases only a set product is offered. Supply agreements are either directly with manufacturers or with retailers.
- Publicly funded renovations usually offer less choice of products.

Others

- Trade people and retailers are also likely to play a role in evaluation of specific options. Their role is less official and sometimes might be contrary to that of the Intervention Provider.

2.3.5 Perspectives from Interviews around action/ installation

Homeowners

- New Zealand has a strong DIY culture with many people trying to reduce costs by installing product themselves. This can result in poorer installation or a poor choice of products, although equally DIYers can take more care over their own home than some tradesmen do.

Commercial renovators

- Private sector organisations retain tight control around installation of their product to ensure high quality installation, seen as a key part of their brand management. All organisations retain project management functions. They use accredited local installers who are paid per installation, or retain installers on pay-roll.

Grant based renovators

- Grant based installation providers also retain project management function. Installers are either employed directly, accredited or undertook tailor-made training. There is no industry standard for training however, and the level of training given can vary significantly from provider to provider. Some non-profits transfer the customer to the installer (for small scale specific product interventions), allowing them to quote, install and invoice (either the non-profit or the customer). In other cases, the non-profit retains control of the financial aspects, and brings in a contractor only for physical installation (EcoMatters, CEA).

2.3.6 Perspectives around evaluation / monitoring

Homeowners

- Customers evaluate the renovation in terms of customer service and the 'ease' of the renovations. They compare the renovation to their expectations at the start, in terms of energy efficiency and comfort, but also in terms of design and 'look'. Most retrofit organisations already target the customer service side; satisfaction is important because much of their business relies on word-of-mouth referrals.
- Other Beacon research (Saville Smith, 2008a) suggests that the current expectations are low with customers usually accepting marginal increases in performance.

Commercial renovators

- Monitoring is focused on quality control, mostly targeted during product choice and installation.
- One exception to this is Right House who has a comprehensive monitoring and evaluation system. They require installers to take photographs of their insulation work in every house which provides a record as both quality control and protects against liability in the future. Right

House uses an infra-red camera to record areas of heat loss before and after installation. Blower-Door or smoke detector tests are also occasionally completed. Right House also provide a maintenance checklist and manual which include which products were installed, details of any warranties or guarantees, who installed the product, and any additional work needed.

Grant based renovators

- Non-profits provide after-installation service in case of any after installation problems. Some also survey customer satisfaction. Actual improvement in performance is generally monitored by checking electricity bills before and after, and by customer satisfaction surveys.

2.3.7 Summary of Advice from Interviewers for the HomeSmart Renovations Pilot

The commercial companies like Home Tech are better at improving awareness (need recognition) and providing initial information but tend to be too responsive to customer requests and install the technology requested, rather than advising on a better option. For example, installing a heat pump of home ventilation system as requested by a homeowner into an uninsulated house without recommending insulation. This can lead to a mismatch in prioritising technology and/or fragmentary programmes.

Influencing customer expectation and educating customers to be able to evaluate the success of a sustainable renovation is important for creating widespread demand for future renovations. One of the key barriers for retrofit organisations is to overcome the desire to 'do a little bit at a time' in favour of creating a holistic renovation. A full sustainability renovation is likely to cost in the region of $15-30,000 which is more than most households spend on renovations at one time.

The implications of this advice are outlined in Table 5 below.

Advice	Implication
Commercial companies better at need recognition than community organisations	If we engage first with community trusts, then we will need to support their marketing efforts with information on how to reach different segments of the market
Commercial companies respond to customer requests – may result in technology prioritised and fragmentary response	Supports decision to engage first with community trusts – as less likely to try and sell technology to solve a fundamental performance problem (eg rising damp)
Need to influence customer expectation and educate customers to evaluate success of a renovation.	Need to provide information directly for homeowners which has educative component.
Price of a renovation to the HSS™ is likely to be too high – people want to do a bit at a time.	Supports parallel work in energy retrofit stream that people need a prioritised plan of what they need to do. Major implication for pilot is that it is unlikely that all renovations will be to a HSS – within the pilot timeframe.

Table 5 Implications of Advice from Scoping of HomeSmart Renovations Project

2.4 Marketing sustainable renovation

2.4.1 Current situation

Promotion, marketing and advertising tools will need to play a critical role in increasing uptake of sustainable renovations. A major change in attitudes to renovations (recognising capability limitations with DIY, short term full scale intervention) is required of customers and they need to be convinced that this is the *right thing to do* and sold the idea that it is *what they want to do*. All interviewees agreed that a lack of credible, understandable information was a major barrier to uptake by the public, but only some thought that general advertising campaigns were a useful way to present information. Even though all the interviewees stressed the importance of word-of-mouth referrals, most have some form of additional promotional activities. The analysis of the process indicates that the information available on the internet and during the house assessments is only useful at later stages – the convincing and selling need to happen in the main stream.

Key benefits promoted in selling the need for sustainability renovations are related to payback periods, utility savings, improved health and warmer more comfortable homes. One interviewee commented that the renovations should be re-branded as 'intelligent, sensible or smart' to avoid perceptions of green hippies and push the common-sense associated with such renovations.

Marketing and recruitment tools include

- Letters to potential customers (Energy Mad)
- Letter box drops (Home Tech)
- Ads in paper or TV (Home Tech, Right House)
- Website (Home Tech, EnergySmart)
- Field days and home shows (Right House, KCDC
- Billboards (Right House)
- Radio slots (KCDC)
- Word of mouth referrals
- Referrals from partnering organisations

Initial market segmentation has been attempted by Right House who assesses customers based on the benefits sought as part of automatic screening process (e.g. greenies, comfort seekers) and uses the resulting categories to inform recommendation of products and interventions.

Implications for pilot:

A Marketing Procedure to support the promotion and uptake of sustainable renovation needed to be developed. Beacon has considerable research information to support this, from the market segmentation, market transformation and energy retrofit consumer work in particular. The existing HomeSmarts website was identified as also being a mechanism for marketing and recruitment.

2.5 Assessment tools

Assessment tools are designed to guide and structure decisions on what kinds of interventions are needed for a specific house. They can be aimed at the home-owner or can be detailed tools for project manager organisations and installers. A number of assessment tools are already in use with some players (e.g. Energy Mad, EnergySmart, Right House).

Access to specific information about assessment tools was restricted due to concerns about loss of IP. Nonetheless it was anticipated that the information was likely to become more accessible when organisations become official Home*Smart* Renovations partners – though as discussed further in Section Five this was not the case. There is a increasing awareness that presence of multiple tools leads to confusion and duplication of effort and first steps have been taken to standardise the assessment tools among grant based Intervention Providers.

2.6 Risks and lessons learnt for the pilot

Initial risks to the Home*Smart* Renovations pilot were identified by the interviewees based on the lessons learnt during the on-going interventions:

- In-home assessment needs to be independent. Hard-sell actions can result in increased sales, however most renovation organisations felt that it decreased customer satisfaction, lead to poor choices for interventions and created a poor reputation for the company.
- Keep to mandate of funder organisations as well as the mandate of Beacon. This is especially important when mixing public funds and private profit-oriented organisations (CEA). Recommending certain brands or products can also cause difficulties with independence.
- Limited liability clauses will be needed in contracts (EcoMatters). Interviewees suggested that, Beacon should retain the right to pull out of a renovation following the in-house assessment if major structural work is required or if there are major safety issues such as asbestos (Home Tech). Photographic evidence of sound installation can act as quality control and help to limit exposure to liability in the future (Right House).
- Keep a comprehensive Customer Management Database (Energy Mad, EcoMatters). Keep close details on customers, interventions, costs, outcomes, follow-ups, installers and products. Aim to make the process easy for the customer even though it makes it more complex for the organisation.
- There are some cultural differences to be aware of when doing the in-house assessment, but also in terms of appropriate renovations. For example, Pacific Island cultures tend to keep the doors closed in the house, which means that heating in a hallway is ineffective in warming bedrooms. Many Asian cultures remove shoes at the door, increasing the need for under floor insulation. There are also differences in window-opening behaviour.

2.7 Key Questions from the Scoping Process for the Home*Smart* Renovations Pilot

The consultation with the potential partners and the analysis of their advice highlighted that the Home*Smart* Renovations Pilot is likely to face a number of critical challenges as the market doesn't appear to be ready for holistic sustainability renovations as anticipated within the initial Research Information Brief. Three possible scenarios were considered to address this:

1) Beacon continues with the RIB scope and objectives – it was identified that this would require a larger budget and longer time scales than had been allowed for in the RIB. The main reasons for this would be a need for greater interaction with consumers (to generate awareness of the need for holistic sustainability renovations and change renovation behaviour), with intervention providers (to generate tools, skills and product portfolio) and also with funding providers to put in place incentives that will be required to implement the project
2) Beacon reduces scope of the project and takes an opportunistic approach – intervening with the existing intervention providers, using existing channels and tools, and supporting or slightly extending the existing scope of renovations. It was recognised that this is likely to result in fragmentary interventions where different elements are tested in isolation and the High Standard of Sustainability™ is unlikely to be achieved. Nonetheless the project will still provide an opportunity for learning and monitoring.
3) Two stage approach – procedures and project clarification followed by the pilot stage. **This was the approach adopted.**
   - This involved engaging with the partners without finalising the decision on the scope of the project and work it out in partnership with Intervention Providers. The pilot stage could be then be more clearly scoped and may need to be limited to fewer houses and focused on specific segments.
   - If achieving an HSS High Standard of Sustainability® is not feasible for a house, a holistic renovations plan would be developed but only the actions practical within the owner's budget would be implemented.

3 Establishment of partnerships (Component 2)

3.1 Community Retrofit Organisations

From the scoping work undertaken early in the project, it became very clear that there was need for early establishment of partnerships with organisations involved in the retrofit sector. The RIB proposed that a wide range of partnerships, across a range of different types of organisations be developed. Relatively free information sharing between the partners was anticipated as part of this process. The finding that the retrofit sector was far more competitive than Beacon had been aware of, and that potential partners were reluctant to share information with Beacon, let alone other organisations due to concerns about commercial sensitivity required a substantial rethink of the proposed process.

Instead it was decided that in the first instance, the most useful partnerships formed – both in terms of input to the development of the Procedures and for the implementation of the pilot, would be with some of the community based energy retrofit organisations. This decision was made because:

- The scoping undertaken as part of the Homes Strategy and RIB already identified this group as a key partner;
- Of all the intervention providers, community trusts have the most extensive experience in both assessment and intervention as they have been operating in this sector for many years. For example, CEA have been running for 14 years. This compares to Right House and EnergyMad who, at the time of scoping, had been undertaking this kind of work for less than a year, and had done very few retrofits;
- Through a combination of four different community trust partners coverage for the pilot for the whole of the country was able to be achieved;
- Beacon already had strong relationships through other projects with three of the four community trust providers (EcoMatters, Energy Options and EnergySmart) meaning there was a base of trust and existing relationship to build off;
- At the time of making this decision all of the partners were providers for EECA grants programmes (EcoMatters has subsequently pulled out of this programme but is still involved in delivery of water retrofit programmes for Waitakere City Council);
- By selecting one "type" of partner in the first instance it enables a simplification of management of what is a very complex project and creating an efficient way to co-ordinate the assessment and renovations of large numbers of homes across New Zealand.
- Community trusts were considered a "safer" partner in dealing with the risks of protecting IP when compared to commercial operators.
- Several of the community retrofit organisations had some experience with retrofit beyond energy efficiency, for example, EcoMatters Environment Trust has been working in the area of water and waste retrofitting for several years.
- The community and geographic focus of these organisations meant they were likely to be able to substantially assist with recruiting homeowners into the pilot project.
- All of the community trust providers have been involved in research projects previously;
- Organisations delivering EECA subsidised retrofits are required to collect data for EECA, so have systems already in place for data collection.

Accordingly a preliminary approach was made to four community retrofit organisations about whether they would be interested in being involved in the project: Community Energy Action, EcoMatters Environment Trust, Energy Options and EnergySmart.

3.1.1 Experience of the partnership process

The approach consisted of a series of meetings and phone conversations to establish the relationship and discuss the possible roles, development of a more formal project proposal to each organisation, and then agreement to enter into a process of developing a Memorandum of Understanding (MOU) between Beacon and the partner organisation.

The response of each of the organisations was different, and different styles and scales of relationships have developed between Beacon and each organisation.

Community Energy Action (CEA)

CEA were keen to be involved in the development of the Procedures, and after discussions between management and CEA's Board confirmed that they were interested in pursuing the idea of expanding the range of services they currently offer to their community, to include sustainable building assessment and interventions. However without much more detail on how the pilot project would work, and the exact requirements for their involvement they were reluctant to confirm involvement in that part of the project. Accordingly the MOU between Beacon and CEA allows for the possibility of involvement in the pilot, but the initial agreement was only for involvement in development of the Procedures.

Once the project had been progressing for some months, and the details of how the pilot project would work and partner roles had been developed further, CEA agreed that they would be involved in delivering the in home assessments of the pilot homes in the Christchurch area, and had started investigating the potential options for their greater involvement in the pilot project as a provider of sustainable retrofit interventions and/or project management services to homeowners.

As the Procedures progressed, CEA became progressively more involved, and interested, as they started to see the potential offered by the project and how it could intersect with their current operations. They have been particularly engaged in the development of the In Home Assessment Tool and the Marketing Procedure.

EcoMatters Environment Trust

EcoMatters Environment Trust initially expressed verbal interest in being involved in the development of the Procedures and attended the first partner workshop on the project. However it quickly became clear that wider issues were impacting on the ability of EcoMatters to be involved in the development of the Procedures. EcoMatters' energy retrofit project and team became a casualty of the fierce competition for the subsidised energy retrofits in the Auckland market. When Eco Insulation won a tender from the Waitemata District Health Board for its healthy homes programme, EcoMatters decided it could no longer continue in the energy retrofit sector. In addition tensions existed between EcoMatters Trust and EnergySmart's over its expanding

operations into areas currently served by other Energy Efficiency Community Network (EECN) members. EcoMatters, CEA and Energy Options are all EECN members, but EnergySmart is not. Accordingly EcoMatters withdrew from the project and its involvement in the development of the Procedures. They did however leave the door open for involvement in the In-Home Assessments as part of the pilot project, as they saw synergies between this and sustainable household assessments they are undertaking as part of a Sustainable Management Fund funded project.

Once the procedures were near completion and recruitment of homeowners to participate in the project commenced, EcoMatters agreed to participate in the delivery of the In-Home assessments and production of the Renovation Plans. They see this as a way of expanding their capability in the sustainable homes assessment area in a funded way, while also allowing them to dip their toe in the water around the potential project management of sustainable renovations. Although the relationship developed is now a contractual one, the synergies with their other programmes (Sustainable households, Water Wiseup, Twin Streams) mean that they are also able to play a role in recruitment of households (through referring their customers from other programmes), particularly at the lower income levels, where Beacon's recruitment process has been less successful.

Energy Options

Energy Options were initially enthusiastic in being involved in the project and promptly signed a MOU with Beacon around their involvement. However, without much more detail on how the pilot project would work and the exact requirements for their involvement, they were reluctant to confirm involvement in that part of the project. Accordingly the MOU between Beacon and Energy Options allows for the possibility of involvement in the pilot, but the initial agreement was only for involvement in development of the Procedures.

However, like EcoMatters Environment Trust, at the partner workshop concern was expressed about the impact of sharing intellectual property with potential rivals. In this instance Energy Smart who were actively in competition with Energy Options in the Hawkes Bay subsidised energy retrofit market. In addition resources at Energy Options have been stretched to capacity in dealing with the addition of the EECA Loans programme into their portfolio of work, with both new personnel coming on board to implement the programme and new requirements for under floor insulation

As a result Energy Options did not participate in the development of the Procedures and Tools, but have agreed to participate in the assessment and plan development phase on a contractual basis, as well as assisting Beacon in recruitment (through referrals of customers from their subsidy programmes) of homeowners in the Marlborough and Rotorua/Taupo areas. Recruitment in both those areas is slow but they are areas in which there is a proportion of dwellings requiring retrofit. Accordingly a contract has been developed with Energy Options on this basis.

EnergySmart Limited

EnergySmart worked with Beacon on the Papakowhai Renovation project and have been keen to be involved in Home*Smart* Renovations since the project's inception. An MOU was signed relatively quickly, and EnergySmart have contributed to the development of the revised HomeSmarts website (consumer tool), the In-Home Assessment, and also undertaken the development of the Project Management Procedure in its entirety. This substantial contribution has been despite the organisation being in a significant state of flux due to changes in senior personnel – including the Chief Executive, a physical move to new premises, and a massive expansion in their programmes to include a substantial Invercargill, Southland and Otago based programme. Recruitment in the latter, however, is slow. Beacon has been unwilling to stimulate recruitment in this region until other areas have been filled and EnergySmart has expressed more confidence in its readiness to take on the work in the south.

3.2 Local government partners

While a large number of local government partners (the 20 largest Councils) have been involved in the policy work undertaken as part of the wider work programme only Waitakere City, Kapiti Coast District, Wellington City, Christchurch City and Environment Canterbury have engaged in any significant way with the Home*Smart* Renovations pilot. Despite a significant number of meetings, and numerous discussions, as well as several iterations of proposals, no firm commitments of involvement in the project have been made.

Only Environment Canterbury however have specifically stated they do not want to be involved – because they want to retain their focus on the core matter of air quality, and don't see a justification in terms of their role with wider sustainability renovation.

This lack of engagement by local government was a considered unfortunate by the project team. In hindsight perhaps the greatest barrier to achieving outcomes beyond engagement and interest from Councils again relates to timing. Budgets are set on an annual basis – but based on a 3 yearly Long Term Plan process. All Councils are required to produce a Long Term Plan by June 2009, for implementation July 2009-June 2012 and those engaged with Beacon through this and other programmes may well choose to fund measures within those plans which reflect the discussions and advocacy undertaken.

3.3 Issues and Learnings

One of the biggest issues affecting the capacity of CEA, Energy Options and EnergySmart to be involved in the Home*Smart* Renovations pilot has been the introduction of the EECA Energywise middle income loans assistance programme for insulation and clean heating for all three organisations are providers. The introduction of the additional administrative requirements (which are different to the long established low income Energywise Grants scheme) has put substantial pressure on the organisations, as well as the expansion of services being delivered (clean heating as well as the insulation package). The gearing up to deliver these programmes, and also for Energy Options and CEA, the rental subsidy programme has been significant. It is notable that at the time

of October 2008, all three organisations have been delivering the loans programme for 5 months, but only now feel sufficiently on top of the paperwork to consider how they will manage the expansion of their organisations to meet the demand for this new service.

Another significant change these organisations have faced this year has been the change to requiring a higher R-value under-floor product as part of subsidised schemes. Ironically this measure, which has been lobbied for by Beacon as well as these same organisations, has created significant cost and logistic stress. The change from foil products to bulk insulation has meant the new purchase of plant (storage areas and depots, truck and trailer units) to deal with the distribution and installation across wide geographic areas.

There are lessons here for Beacon about the ability of community based organisations to grow in size and capability, and the speed at which the sector is able to gain the depth of capability to deliver whole house sustainable renovation.

At this stage it appears that it is unlikely that any of these partner organisations will expand their services within the short term to whole house sustainable renovation. It does seem however that they will use the pilot project to test the water, and that some at least are likely to expand beyond the basic energy efficiency retrofitting to include simple water, waste and IEQ measures, however more invasive measures such as wall insulation, double glazing and rainwater tank installation seem to be unlikely to be delivered by these organisations, even in the medium term.

4 Development of the Home*Smart* Renovations Procedures (Component 3)

4.1 Overview of procedures

Ten procedures were developed providing information for a range of participants in the value chain including industry assessors, installers, project managers and the homeowner.

The RIB for the project envisaged that Beacon's existing base of research (most notably the work underpinning Smarter Homes, HomeSmarts and the Papakowhai renovations) combined with the experience of community partners with current retrofit programmes to provide the bulk of the information needed to develop the Procedures. As discussed in Sections 3 and 4 of this report, there was less willingness to share information, intellectual property and know how than initially expected, due to the fierce competition in the subsidised retrofit sector. As a result, development of the Procedures (see Appendix One and Table 6) drew on a wider range of sources and required the project to commission supportive research. The following sections describe the core activities undertaken to develop the procedures.

Procedure	Audience	Purpose
Project Principles and Process	Potential Partners	To introduce the project and clarify its scope and requirements. This is intended to be used to introduce potential partners (recruiters, assessors, implementers) to the project and give a quick overview of the research and why it is being done. The information is presented as a power point and also a supporting document.
Business Case and Marketing Support	Marketing specialists of Intervention Providers, Funding Providers, TLA partners.	To provide advice and support to people generating promotion around the Home*Smart* Renovations project with view of unifying and clarifying external messages. The information includes an outline of the benefits of sustainable renovation, information on target audience, sample letters, sample power points and sample flyers.
Consumer Home Self-assessment Tool	General public/ potential customers	To increase understanding of what a sustainable home is, and to provide initial customised advice on possible interventions. Encourage customers to participate in the HomeSmart Renovation Project and request a more detailed in-house assessment. Provide some more tailored advice on sustainable renovation options than is currently available. Is a web based assessment tool developed as an extension to the existing HomeSmarts tool.
Industry In-Home Assessment Tool	Industry Assessor	To provide in-home assessment which collects sufficient information to be able to develop a relatively tailored renovation plan for homeowners.
[Renovation Plan Builder –not included in original scope]	Industry Assessor	To develop consistent Renovation Plan and packages as an output of the in-home assessment.
Best Practice Guidelines and quality checklist	Installers Project managers	To guide implementation and ensure quality of installation.
Training	Installers, assessors, PMs	To ensure understanding of sustainable renovation assessment and enable accurate and assistant home assessments to be delivered by a range of providers.
Home manual	Customers	To provide information to homeowners on operating their home and the technology within it. To also provide assistance with choice of products for installation.
Project Managing HomeSmart Renovation	Intervention providers	To provide training and tips on project management and common errors during the renovation
Project Managing HomeSmart Renovations	Customers	To provide training and tips on project management and common errors during the renovation from a homeowner perspective.

Table 6 Summary of procedures.

The full final Procedures are contained in a separate document (Amitrano et al, 2008), which acts as a companion to this research report.

4.2 Learnings from Papakowhai and other Beacon research

The core of the information required to generate the Home*Smart* Renovations Procedures was learning from the Papakowhai renovations. In order to extract this information a workshop with the Papakowhai researchers from BRANZ and Beacon and project managers from EnergySmart was held. The participants discussed the experience of the renovations, key points from each of the homes and practical aspects of implementation were drawn up. This workshop was supplemented by further discussion and interrogation of the experience of the Papakowhai project and written up as a Home*Smart* Renovation project research report (Buckett, Hancock and Burgess, 2008).

In parallel with this, a preliminary analysis of the monitoring data and experience of the homeowners in relation to the retrofit was undertaken. These findings were also written up as two Home*Smart* Renovation research reports (Burgess and Buckett, 2008; Saville Smith, 2008b).

The key points from these three reports on the Papakowhai Project were drawn out into a summary report that was suitable for sharing with partners (Appendix Two)**.** This summary report, and the more detailed research reports behind it, provided the core information for the development of several of the Home*Smart* Renovations Procedures, notably:

- Principles and Process Procedure
- Project Management Procedure
- Best Practice Guide
- Project Managing Your Home Renovation

The NOW Home® Procedures (Easton, Karlik-Neale, Saville Smith and Jaques, 2008) were also drawn upon to provide significant information for two of the Procedures, specifically:

- Best Practice Guide
- Home Owner Manual

The Energy Retrofit Users and Consumers research (Saville Smith, 2008a), the Market Segmentation work (Amitrano et al, 2006) and Market Transformation work (Trotman, 2007 and Woodley, 2007**)** provided a substantial core of information for the Marketing and Business Case Procedure.

4.3 Input from Partners

Two procedures in particular had substantial input from partner organisations. In the case of the Project Management Procedure, EnergySmart developed the draft versions of this procedure, and Community Energy Action provided substantial input into the Marketing and Business Case Procedure. All of the procedures were also reviewed by the project partners.

The Training Procedure was developed by BRANZ Limited and included a combination of information developed as part of Beacon research and existing training material developed by BRANZ.

4.4 Supplementary research

While the Papakowhai project provided a solid core of information for the development of the Procedures, all of the Procedures required additional research and some required completely new work. This additional work related in particular to the Project Management for Home Owners Procedure. Beacon therefore commissioned researchers from BRANZ, URS and consultants who had worked with community trusts to support the development of components of the Procedures.

4.5 Assessment Procedures

4.5.1 HomeSmarts Consumer Tool

During 2006, Beacon was part of a consortium contracted by MfE to develop the Smarter Homes website (now hosted by DBH). In order to add value to this, and provide a mechanism to both engage directly with consumers, and collect data on their homes, Beacon developed in parallel the HomeSmarts website.

The scoping work identified the value of having a 'whole of house' resource for consumers. It was intended that the resource would play these roles:

- Introduce consumers to whole of house approaches
- Provide a user friendly mechanism to enable homeowners to check the performance of their homes
- Generate high level advice that was to some degree 'house' and 'user' specific, to improve performance.

Given Beacon had already invested and owned HomeSmarts, revamping this resource was considered the most effective way of providing this consumer facing tool for the Renovation pilot.

Accordingly the HomeSmarts Consumer Tool was developed as an additional module to the existing HomeSmarts website with the web design undertaken by Chrome Toaster, the original developers of both the Smarter Homes and HomeSmarts websites.

The process for the review and development of the additional tool involved:

- User testing of the existing HomeSmarts website, with a report developed outlining aspects of the site which did not meet expectation, were unclear, or incorrect. Testers included a range of people from partner organisations and Beacon.
- Updating the Smart Home Tour – making it easier to read, and better reflecting the key aspects of a more sustainable home
- Modification of the existing Home Health Check to reflect research learnings since the site was developed in 2006. This included reducing the number of questions and sections within the check in order to focus on the things that were most significant to achieving a high standard of sustainability.
- Development of a new Home*Smart* Renovations tool (the "Consumer tool").

The Home*Smart* Renovations tool has been developed in order to provide more specific, tailored advice for users of the tool about how to renovate their home to be more sustainable. Specific parameters addressed within the tool include:

- House Typology (based on information from Ryan, Burgess and Easton, 2008)
- House location and climate (based on HERS Climate Zones from EECA, 2007**)**
- Sources of energy used in the home
- Hot water systems
- Heating systems
- Household Income
- Number of occupants
- House size
- House condition
- Insulation levels
- Outdoor water use
- Ventilation
- Toilet type

The answers to these questions result in a set of recommendations for the homeowner, including

- Behavioural changes
- Low cost measures (generally less than $1000)
- Higher cost measures

These recommendations are filtered and prioritised according to the results of the Home Health Check for that house. So for example, a house which scored worst in relation to Indoor Environment Quality and Energy aspects of the Home Health Check would have displayed the recommendations for these factors.

The "back end" of the tool is an excel spreadsheet holding the answers and prioritisation. An example of the output of this tool is attached in Appendix Three. As development of the HomeSmarts website tool progressed in parallel with the development of the other Procedures and slightly ahead of the In Home Assessment Tool, some issues arose which were not able to be addressed as part of this stage of the project. In particular, a desired link between the HomeSmarts web tool and the In Home Assessment was not able to be included, as significant complexities arose. In particular there is currently no "back end" mechanism enabling the extraction of information from HomeSmarts and importation to the In Home Assessment Tool to occur. Because of the significant cost implications to develop such a piece of web infrastructure this was not addressed, but parked as part of a wider discussion around the possible integration of the two tools and development of a piece of proprietary software following the pilot.

4.5.2 HomeSmart Renovations In-Home Assessment Tool

Based on findings to date (scoping, Papakowhai and energy retrofit projects) and the intended outcome (i.e. a home renovated to an HSS High Standard of Sustainability®) it was clear that Beacon had to generate a standalone comprehensive assessment of individual houses. The assessment had to meet the following requirements:

- Standardise approaches across our partners who all collect very different amounts of information and in different ways as part of their own retrofit procedures. Some utilised simple paper based systems; others captured data using electronic PDAs and some simply quoted for basic insulation requirements in the house as they assessed it.
- Collect the minimum of information from a home to generate robust advice about interventions that will improve that home's performance.
- Collect the right information to inform whole of house assessment: currently used assessment tools commonly fall short in this respect, particularly around water and waste.
- Support the research evaluation by collecting the range of information needed to enable meaningful interpretation of the database being generated by this pilot.
- Capture information to incorporate the range of schemes and incentives available to homeowners to support the funding of renovation interventions.
- Not take too long to carry out – resist danger of collecting too much information and disengaging homeowner and the assessor.
- Provide an informed 'check' on the information provided by the homeowner about their home
- Be carried out by a trained assessor to ensure consistency and accuracy of information.

The culture of competition between the partners meant that a decision was taken early on for Beacon to draft the beginnings of an assessment system and then use the partners as a sounding board to develop and fine tune the result (as opposed to basing the new tool on any of their existing systems). This resulted in a more collaborative approach and clearer ownership of the final tool.

During the development of the In-Home Assessment Tool, Beacon explored the potential to use the data collected in an automated way to deliver an output report for participants. Project partners agreed that this would be beneficial to them in their delivery of services to homeowners (with only some organisations providing a written report to homeowners, and some charging for this service). Partners also expressed a strong desire for the tool to be able to reduce the time that they needed to spend on site and in generating a report for homeowners on their return to the office. This resulted in the In-Home Assessment Tool being developed alongside the Renovation Plan Builder (see 4.5.3 below) so that one could inform the other. This also has significant benefits in terms of the consistency of renovation advice provided for homeowners as part of the project. In short, the two tools together provide the basis of an expert system that can be used to assess whole house performance and provide a Renovation Plan for homeowners to address shortcomings and achieve an HSS High Standard of Sustainability®.

The process for the review and development of the Home*Smart* Renovations In-Home Assessment Tool involved:

- Drawing up a draft list of data requirements needed by the research team to adequately monitor houses as part of the research
- Drawing up a draft list of data requirements and questions for homeowners which would capture data used to inform the detail of any suggested retrofit solutions
- Circulating these two lists to project partners and seeking comment and input
- Developing the lists of data and information requirements into a set of paper based questions for assessors to use on site to capture data

- Laying out the questions into an easy format for assessors to use on site (including analysis of the correct order of questioning and providing a logical sequence of assessment as the assessor moved through the house)
- Field testing the input questionnaire and assessment procedure on 4 test houses
- Further iterations of in house assessment procedures and the paper based assessment tool
- Co-development of the final version of the in house assessment tool with the plan builder (see below) to ensure that the data captured was both necessary and sufficient for delivery of a renovation plan for each house.
- Development of training to teach assessors how to use the in house assessment tool

The In-Home Assessment Tool is now being used in the field to assess households that have signed up to be part of Home*Smart* Renovations. As with all tools of this nature, further work may be required to fine tune the tool as the project progresses. At a later stage it may be possible to develop the tool as an electronic input available as software on a PDA. This could speed up the input process and allow faster manipulation of the data back at the office for retrofit organisations.

4.5.3 Home*Smart Renovation Plans*

As described above, the In-Home Assessment Tool provides a variety of data to inform Beacon's research frame as well as providing source data for developing retrofit plans for a house. The data gathered using the In-Home Assessment Tool provides the basis for delivery of a Home*Smart* Renovation Plan for the homeowner. An example of such a plan is provided in Appendix Four.

One of the goals of Beacon's energy research was to design a series of appropriate retrofit packages suitable for application across the range of New Zealand houses and households. Inputs to this process, including work on house typologies (Ryan et al, 2008, Page, 2008) and consumer research (Saville Smith, 2008a), helped to define the parameters of standard retrofit interventions. However, discussions with Home*Smart* Renovations partner organisations and particularly field testing of the In-Home Assessment Tool showed that, despite some common parameters, every house requires a tailored solution that responds to the detail of the unique physical aspects of the house, as well as many other variables such as occupants, location, orientation, maintenance and condition. The desire for a standardised set of intervention 'packages' that can be implemented for New Zealand's 1.4 million homes is in conflict with the reality of the individual nature of each house and household makeup. In addition to this, findings from the Papakowhai Renovation project (Burgess and Buckett, 2008) suggest that a high level of intervention will be required to bring each house up to Beacon's HSS High Standard of Sustainability®. The chosen components of each package will depend on a range of variables that not only affect the technologies employed, but also have a bearing on the choices that consumers will ultimately make in trying to meet the sustainable standard. A range of ***modifiers*** and ***determinants*** has been outlined which can be used to help inform the development of a renovation plan for each house:

Key Determinants (what we need to know to get a house to the HSS®)

- Typology and type of house (including number of levels)
- Construction type - light timber framed, solid timber, concrete, brick
- Types of house systems (mainly roof, walls, floor, windows and glazing)

- Location (including factors such as climate, local issues, air shed, user charges, available subsidies, reticulated services)
- Maintenance and condition
- Current energy mix and availability of energy sources (electricity, reticulated gas, bottle gas, wood, generator, solar and what it is supplying)
- House performance (Cold, draughty, mouldy, condensation, energy use, water use, overheating, glare, noise)
- Previous retrofit interventions present at time of assessment
- Existing renovations/modifications

Critical modifiers (Based on previous research - these are the things we expect will influence the choices that people make)

- Household makeup (number and age of occupants)
- Local authority influence, attitude and consenting processes
- Health of occupants
- Motivation (sustainability, comfort, cost savings)
- Current or future renovation plans
- Ownership (landlord or occupant)
- Household income and willingness to spend - also includes access to capital and available funding mechanisms
- Current or future renovation plans (i.e. if are about to renovate)

This is a complex set of variables that are required to provide each homeowner with the optimum renovation plan. Working through this list manually for each home requiring retrofit would be a time consuming task. Therefore the opportunity was taken to automate this process by combining the detail of these modifiers and determinants with an In-House Assessment and use a decision making framework to define the final plan details. The Home*Smart* Renovation team worked with researchers at BRANZ to develop the Home*Smart* Renovation Plan Builder to meet this task. At the core of the Plan Builder is a spreadsheet based application which automates the process of considering the key variables and outputs the resultant decisions into a report plan document.

The methodology for the review and development of the Home*Smart* Renovation Plan Builder was as follows:

- A list of prioritised interventions were developed and discussed within the Home*Smart* Renovations project team - these were drawn primarily from the energy, IEQ and water research streams and informed by prior Beacon research which provided the basis for specifications and priority of interventions.
- A framework Home*Smart* 'output report' was developed for partner organisations to use as the basis of a feedback report for homeowners. This was set out with an introductory section followed by advice in the following sections:
  - Cosy - covering the thermal envelope and providing advice on ceiling, floor and wall insulation, double/secondary glazing as well as basic draught stopping and provision of thermal curtains etc

- Warm - covering space heating and providing advice on retrofitting an efficient heating source, providing heat transfer and outlining the pros and cons of the proposed options to enable a wise consumer choice (thus allowing a comparison between heat pumps and wood burners for instance) Hot water - covering the provision of hot water including advice on replacing cylinders where required, provision of cylinder wrap and pipe lagging, solar and heat pump hot water heating.
- Smart Lighting and Appliances - providing information about retrofitting efficient lighting and appliances
- Healthy - covering IEQ, ventilation and source control, providing advice on installation of polythene ground sheets, kitchen and bathroom extract fans and passive venting
- Water - providing advice on water saving features such as low flow shower heads, tap flow controllers and dual flush toilets as well as advice for external rain-water storage.
- Waste - covering composting and provision of worm farms[1]

- A series of output paragraphs were developed to detail each intervention modified by the variables collected using the In Home Assessment Tool (described in 5.4.2). For instance, if during the assessment 75 mm of insulation is discovered in a ceiling with good access, the output paragraph suggests topping this up using a blanket of R2.8 to achieve a final R-value above R3.5. If no insulation is found in the ceiling the recommendation paragraph specifies installing new insulation to achieve an R-value of at least R3.5.
- A spreadsheet based application was developed by BRANZ drawing on the data gathered from the In-Home Assessment Tool and utilising simple calculations to provide outputs on costs and other features such as space heating specifications.
- Data from local authorities and funding schemes (mainly EECA and local Council programmes) was also added to the tool to modify the advice provided and make consumers aware of the grants and funding available in their area.
- A Microsoft Word mail merge document was developed that takes the outputs of the spreadsheet application and presents them as a high quality report for homeowners. This report is able to be further tailored by the partner retrofit organisations before sending to the homeowner.
- A brief training module and support information was developed to show how to use the Renovation Plan Builder.
- The tool was tested with Home*Smart* Renovations partner organisations and within the Beacon Home*Smart* Renovations team, reviewed and modified, and then released to partner organisations to begin assessments.

The Plan Builder provides a level of tailoring which optimises solutions for each house whilst still taking a relatively short period of time for partners to produce. Part of the aim was that the In-Home Assessment Tool and the Renovation Plan Builder would allow retrofit partner organisations to complete an In-Home Assessment, finalise the scope of intervention and generate cost estimates and provide a report for homeowners within three hours.

[1] ***Note reference to the REBRI guidelines and management of construction waste is part of the information included in both the Home Owner Manual and the Best Practice Guide***

The development of 'costs packages'

Beacon's experience with the renovations at Papakowhai (Burgess and Buckett, 2008) indicates that high levels of interventions will be required to bring a house up to the HSS High Standard of Sustainability®. This presents a further hurdle for consumers who are not used to spending large sums of money on improving house performance in relation to retrofit (Saville-Smith, 2008a). The Renovation Plan provides consumers with a comprehensive overview of all of the interventions that are required to improve their house performance and to meet the HSS®. This is then broken down into three core 'cost packages' which allow the consumer a staged approach to their house retrofit. Consumer research (Saville-Smith, 2008a) indicated that the most favourable cost packages would be in the range of $3,000-$5,000; $5,000 - $8,000; $10,000 - $15,000 (and above).

4.6 Final v1 Procedures

All of the Procedures were subject to repeated review and input from a number of key stakeholders and partners throughout their development before the final V1 Procedures were developed. Review and input in particular was provided by:

- The Project Control Group (Lois Easton, Verney Ryan, Kay Saville Smith and Vicki Cowan from Beacon, Lynda Amitrano from BRANZ and Marta Karlik-Neale and June Gibbons from URS)
- Project Partner representatives (Phil Hancock, Graeme Burgess and Ingrid Downey from EnergySmart; Bede Martin, Gary Robertson and Katie Nimmo from Community Energy Action, Jo Hunt, Nik Gregg and Steve Hanna from Energy Options and in the later stages Aaryn Barlow from EcoMatters and Jane Cuming from Placemakers)
- Beacon management (Nick Collins).

5 Pilot Project Research - Monitoring and Evaluation Framework (Component 4)

A monitoring and evaluation framework has been developed to answer some key questions about renovation take-up and subsequent dwelling performance. Those key questions are:

- Do people act on advice and action plans to improve the performance of their houses?
- What are the patterns of those actions (i.e. what do people do?)?
- What are the determinants of those actions?
  - Socio-demographic characteristics
  - Dwelling characteristics
  - Climate characteristics
- Do sustainability directed renovations impact on house performance?
- What renovations and dwelling conditions optimise house performance in relation to the HSS® benchmarks?

This section describes the monitoring and evaluation framework for the Home*Smart* Renovations. The approach is driven by Beacon's aim of market transformation so aims for research outcomes that will inform better decision making by those with a stake in New Zealand's existing housing stock. That framework has been designed to allow for:

- Analysis of the impacts of household incomes on renovation take-up.
- Analysis of the impacts of climate zones on renovation solutions and take-up.
- Analysis of the impacts of urban and provincial contexts on renovation solutions and take-up.
- Analysis of impacts of policy settings and subsidies on renovation solutions and take-up.

5.1 Sample Frame and Size

The framework has involved specifying two key sampling parameters. Those are:

- Location; and,
- Household income.

Location selection was determined by a set of both analytic and implementation considerations. Analytically, it is desirable to have a sample that represents the range of provincial and urban contexts in which New Zealand dwellings operate. There was also a desire to ensure that a range of climate zones were included to ensure that renovation packages were tested under different environmental conditions. The HERS climate zones were used as an initial point of climate distinction. There was also a need for a set of areas that represented a range of policy settings. Some areas were selected because they have relatively few local subsidies and programmes in addition to EECA's national programmes such as Marlborough. Other areas have significant programmes and/or regional or district plan requirements around dwelling performance such as Christchurch and Nelson.

In relation to implementation, it was desirable for areas to be selected which:

- Are accessible to researchers;
- Fall within the coverage of community partners;
- Provide access to a wide range of dwellings;
- Provide access to a substantial quantum of dwellings;
- Provide access to a range of households;
- Collectively provide different policy settings; and,
- Have potentially sympathetic local authorities.

The sample size was initially established at 1000 dwellings. Significant resource constraints have meant that the sample size has been realigned to allow for 750 dwellings of which 200 dwellings will be directly monitored. The sample frame is set out below. The numbers sought for direct monitoring are in parentheses.

Climate Zone	$0-25k	$25-50k	$50-100k	$100k+	Total
Auckland	30 (7)	30 (7)	48 (13)	42 (9)	150 (36)
Rotorua/Taupo	39 (8)	39 (8)	50 (10)	23 (5)	151 (31)
Wellington	35 (7)	35 (8)	47 (10)	34 (8)	151 (33)
Nelson/Marlborough	43 (9)	41 (9)	48 (10)	18 (4)	150 (32)
Christchurch	40 (9)	38 (9)	50 (11)	23 (6)	151 (35)
Dunedin/Invercargill	45 (10)	41 (9)	47 (10)	18 (4)	151 (33)
Total	232 (50)	188 (50)	290 (64)	158 (36)	904 (200)

Table 7 Sample Frame for HomeSmart Renovations

It should be noted that this sample size totals to 904 as over-recruitment is expected to be needed in order to allow for a full 750 homes to actually participate in the pilot.

5.2 Data Collection

Data will be collected from dwellings in five ways. Some data are collected prior to retrofit and other data are collected post-retrofit. In summary, data will be collected from:

- Households wanting to participate in the study by way of the householders' own checklist – this is pre-retrofit data.
- The community partners undertaking in-house assessments – pre-retrofit data.
- Community partner's renovation plans – pre-retrofit data.
- Householders regarding retrofit take-up and renovation activities – pre and post retrofit.
- Directly measure monitored data for temperature, water and hot water related energy for sub-sets of households – both pre-retrofit and post-retrofit data.

A unique identifier will be assigned to every dwelling/household participating in the Home*Smart* Renovations pilot and will be used for every transaction with the household. The direct monitoring of dwellings will be kept to a minimum. Water use, IEQ and energy data for the remaining 550 houses will be collected through self-report, possibly supplemented by energy and water supplier data.

200 hundred homes will be monitored for temperature and householders will be asked to meter their water use. It is estimated that of the 200 house sample about 150 will require water meter installation. If a home cannot be metered at the benchmark cost and no additional co-funding is available from either the householder or the local council, a meter will not be installed. Where a participant in the 200 household sub-set is seeking to install solar hot water and no separate hot water meter is available a meter will be installed up to a maximum of 50 houses.

A range of data will be collected by way of the data collection processes set out above. Those data fall into six categories:

- IEQ performance
- Energy performance
- Water performance
- Other components of the HSS®
- Dwelling characteristics
- Household characteristics

5.3 Summary of Methodology

Table 8 below provides a summary of the data collection activities and the participants in that data collection.

Data Source	Instrument	Provider	When	Who/What
Potential Participants	Self complete application and registration questionnaire	Householder via questionnaire	Pre-retrofit	All potential participants
Dwelling In Home Assessment	Home*Smart* Renovations 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
	Installer report	Installer		
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 with separate water billing
Direct monitored data	Temperature	Direct monitored	Pre-retrofit Post retrofit	200 dwellings-temperature
	Water			Up to 50 dwellings solar water heating
	Hot water (solar)			Up to 150 installed water meters
	Humidity			200 dwellings – Fuginex tabs
Participant survey	Householder survey	Surveyor	Pre-retrofit Post retrofit	200 householders

Table 8 Summary of Monitoring Methodology HomeSmart Renovations Pilot

The full sample will involve householder and partner reporting and sub-populations will be used for:

- Water meter monitoring
- Direct monitoring of temperature and humidity
- Solar water monitoring.

The research methods and the sample frame have been designed to:

- Be flexible and adaptable
- Optimise data collection opportunities and reduce costs
- Allow triangulation of different data sources.

It has also been designed to provide for robust analysis of:

- Take up patterns and the determinants of those take-up patterns.
- Intervention evaluation of before and after performance.
- The comparative impacts on both take-up and performance of:
  - Dwellings characteristics
  - Household characteristics
  - Climate
  - Plans and packages, and
  - Local policies.

6 Establishing the Pilot Project – Recruitment and Delivery of Renovation (Component 5)

6.1 Recruitment Process

6.1.1 Original process proposed in RiB

The process for the Pilot Project as envisaged in the RiB envisaged that the partner organisations would undertake the primary role in relation to recruitment of the homeowners for the pilot. In addition recruitment was expected from Housing New Zealand Corporation and local Council housing stock.

With regard to partner recruitment it quickly became clear that this was well outside the comfort zone of what these organisations would do, and that Beacon would need to play a more active role in recruitment than envisaged. Specific concerns partner organisations had about recruitment related primarily to market confusion – in that they are already well known in their community as providers of energy efficiency services, and didn't want to confuse (or put off) their existing customers by asking them if they also wanted to participate in the Home*Smart* Renovations project.

With regard to recruitment of public housing stock for inclusion within the project, this has had a disappointing result. While approaches and discussions have been held with Housing New Zealand, Christchurch City Council, Wellington City Council, Waitakere City Council, Auckland City Council and Kapiti Coast District Council about involvement of some of their housing stock within the project, there has been a reluctance to commit to involvement in the project. Specific concerns appear to lie around three issues:

- Public housing tenants being involved in the project and concerns about impacts on the tenancy;
- Public housing retrofits being very low level (and concerns that the basic health and safety / maintenance requirements should take priority); and,
- Difficulty with modifying existing programmes which are following a particular course to deliver on outcomes required by the asset managers.

It is likely that all of these barriers could have been overcome, given sufficient time and substantial effort put into negotiations. In the interests of managing the timeline and budget of this pilot, active pursuit of these organisations as partners in the pilot is no longer progressing. Note the door has been left open for subsequent engagement.

6.1.2 Recruitment Process Used

As a result of the issues described, Beacon has revised its recruitment process. Beacon has taken an active role in recruiting participants for the project primarily through low level word of mouth (e.g. through Eco Design Advisors, presentations to interest groups), newsletter promotion, promotion on sister websites (eg EcoBob, NZ Government MfE Sustainability website, HomeSmarts) and provision of media releases.

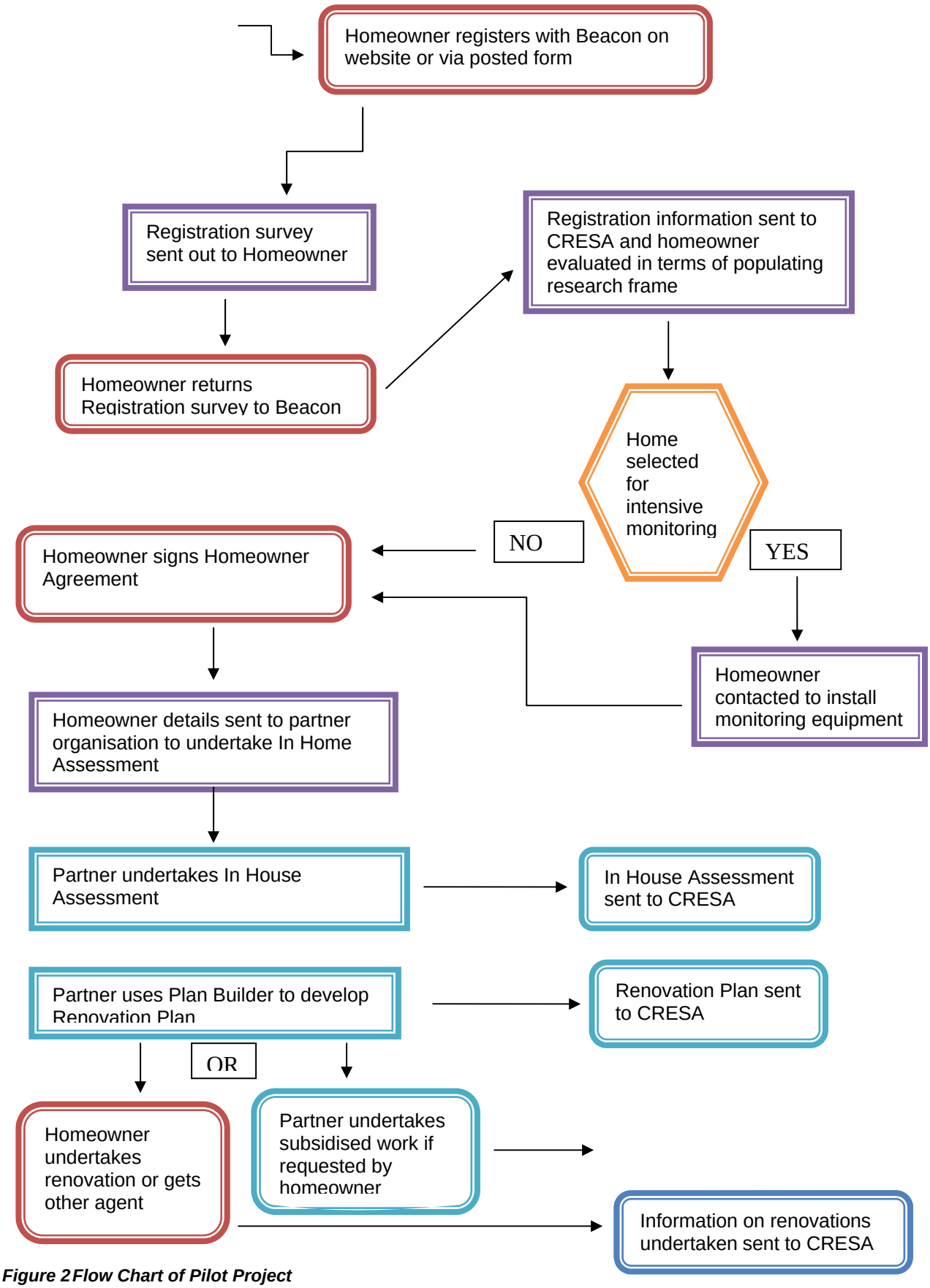

Figure 2 Flow Chart of Pilot Project

6.2 Options for Delivery of the Renovations

The RIB envisaged that a range of delivery models for the pilot project would be possible. The capacity of the project to establish and manage all these different delivery models has forced a re-evaluation. This section details current understanding and documents decisions made in relation to how the actual retrofit will be undertaken.

6.2.1 Public Private Sector Models

Of all the possible retrofit delivery methods, this model appears to be the one with the most traction. Since the development of the RIB a substantial change in the level and targeting of energy efficiency subsidy programmes has occurred. This can be partly attributed to the intense engagement Beacon has sought with EECA, DBH, MfE around this project and the direct provision of research results to these agencies.

As of mid-October 2008 a large proportion of homeowners (Household income less than $100,000, homes built before 2000) are now eligible for a grant of up to $1125 off the cost of core energy efficiency measures (ceiling and under floor insulation). Alternatively, an interest free loan to the value of up to $1400 is available for these same measures. Higher minimum standards than previous EECA programmes are included including heavy ceiling and under floor insulation, efficient heating devices, polythene on ground, hot water cylinder wraps, low-flow shower heads and other smaller scale measures. In order to implement this programme, EECA is trying to ramp up the number of delivery agents and a wider range of organisations are engaging with this programme. Substantial changes have also been made to rental housing subsidies, low income subsidies and solar hot water grants.

Approximately 75% of the participants in the Home*Smart* Renovations project are likely to be eligible for an EECA grant or loan for energy efficiency measures (based on the household incomes of the sample) under these new and expanded programmes, and all participants would be able to access a subsidy for solar hot water systems. This makes the public–private sector models of delivery likely to be the norm for a good proportion of the energy efficiency components of the interventions. In order to facilitate this, information about what subsidies are available, and how to access these, is a core component of the Renovation Plan output to be provided to the homeowners. In addition three of the partner organisations undertaking the assessments (CEA, EnergySmart and Energy Options) are delivery agents for these energy subsidy schemes, and the fourth (EcoMatters) deliver water efficiency retrofits, with all of these organisations therefore being likely to undertake a proportion of the retrofits themselves.

6.2.2 Commercial Models

Another option identified in the RIB is a commercial model, for example via an energy utility company. This has been difficult for the project team to move beyond the “lukewarm interest” expressed in early meetings to actual concrete engagement. The scoping work undertaken at the beginning of the project identified that this was likely to be an issue – as it became clear that in the current environment (low interest from homeowners, poor capacity in the industry) commercial models would struggle. Ongoing discussions with Right House, the energy efficiency arm of

Meridian Energy, indicate that consumer uptake for their offering has been low, and that few people are willing to pay for an energy efficiency assessment. Right House appears to be supplementing their income by retailing efficient technology (e.g. Heat Pumps, heat recovery systems, hot water heat pumps).

Concurrent with the Home*Smart* Renovations programme a number of government initiatives have also muddied the commercial waters. In particular the substantial increases in government subsidies for energy efficiency retrofit mean that additional commercial models are less palatable to the sector. The onset of the election and differing views from different political parties (e.g. National wanting to remove Building Code requirements for solar hot water, proposing amendments to the Emissions Trading Scheme, and being uninterested in supporting the extent of energy efficiency subsidies proposed by Labour) means that there is also a "wait and see" approach within the sector.

Ultimately while commercial models may prove to be viable their timeframe appears to be well outside that of the Home*Smart* Renovations pilot.

6.2.3 Public Housing Models

As discussed above, engagement with the public housing sector has been relatively difficult – again moving them beyond interest to commitment has been a struggle. There is however a strong degree of interest, in particular from local government, in the policy aspects of the project (Howell and Birchfield, 2008**)** and in the outcome of this research project.

6.2.4 Working with shareholder - PlaceMakers

In terms of the delivery of the renovations to these plans, discussions have taken place with PlaceMakers. A potential route is linking both the use of the HomeSmarts consumer tool in store with interested DIYers and PlaceMakers linking with the pilot project – both in terms of promotion and in assisting DIYer participants put in place their renovation. Discussions continue as this report is finalised.

6.2.5 Research approach taken

The research team have structured the research framework around renovation delivery being provided by the market (e.g. our partners, DIY, separately contracted builders) with the plan linking homeowners to sources of public money. Homeowners are advised to seek 3 quotes for their work. As noted, discussions are ongoing with range of partners who may seek active engagement with the pilot. Any subsequent agreements around 'add-ons' to the pilot will take into account the established research framework (including householder recruitment, assessments, collection and management of data) and Beacon's limited capacity to resource additional research.

7 Conclusions and Next Steps

The activities that constitute the Phase One of the Home*Smart* Renovations project are now complete – development of the v1 Procedures, establishing the partnerships and form of the Piloting Process including research frame for monitoring and evaluation. Work is now underway testing the Procedures and implementing the Pilot project – Phase Two.

The scoping work undertaken and development of the project over time has had some deviations from the original ideas as expressed in the RIB as a better understanding of the nature of the research and the actual state of the retrofit industry capability has become clearer.

A high degree of interest and engagement with stakeholders across the value chain (government, industry, homeowners) has been developed through these first stages of the project.

Phase Two, the next steps for the project are as follows:

- Proceed with the pilot, maintaining the research frame and set of procedures, backstopping partners as necessary.
- Revise the Procedures and Assessment Tools and issue a Version 2 set in November 2009.
- Monitoring of homes, which has commenced and will continue until February 2010.
- Document Phase Two of Home*Smarts* Renovation, i.e. outline the implementation of the pilot, and preliminary findings into the usefulness and efficacy of the Procedures and Assessment Tools. This report is due in June 2009.
- Analysis and interpretation of research findings and preparation of relevant technical reports to document. The final list of reports and their form will be determined as the pilot proceeds.

8 References

Amitrano L., Kirk N. and Page I. (2006) *Market Segmentation of New Zealand's Housing Stock.* Report PR106/2 for Beacon Pathway Limited.

Amitrano L., Easton L., Downey I. Gibbons J., Jaques R. Ryan V., Shayer S., Van Beurden L. (2008) *HomeSmart Renovations Procedures*. Draft report for Beacon Pathway Ltd.

Buckett N., Burgess J. and Hancock P. (2008) *Learnings from the Papakowhai Renovation Project.* Report TE106/11 for Beacon Pathway Ltd

Burgess J. and Buckett N (2008) *Interim Performance Monitoring from the Papakowhai Renovation Project.* Report TE106/13 for Beacon Pathway Ltd.

Easton L. (2008) *Papakowhai Renovations: Summary of Interim Reporting to Inform HomeSmart Renovations.* Report TE106/12 prepared for Beacon Pathway Limited.

Easton, L. and Cowan, V. June (2007) *Homes Research Strategy 2007-2010*. Report for Beacon Pathway Limited.

Easton L., Karlik-Neale M., Saville Smith K. and Jaques R. (2008) *NOW 100 Project.* Draft report for Beacon Pathway Limited

EECA (2007) HERS Climate Zones Map.

Howell, M and Birchfield, D. (2008a) *Best Practice Policy Approaches to Encourage Sustainable Residential Building and Retrofitting: Survey and literature review results.* Report HR2420/2 for Beacon Pathway Limited.

Howell, M. and Birchfield, D. (2008b) *Best Practice Policy Approaches to Encourage Sustainable Residential Building and Retrofitting: Evaluation and shortlist of initiatives*. Report HR2420/3 for Beacon Pathway Limited.

Page I. and Fung J. (2008) *Housing Typologies – Current Stock Prevalence.* Report EN6570/8 for Beacon Pathway Ltd

Ryan V., Burgess G. and Easton L. (2008) *Typologies to inform energy retrofits.* Report EN6570/9 for Beacon Pathway Limited.

Saville Smith K. (2008a) *House Owners and Energy – Retrofit, Renovation and Getting House Performance***.** Report EN6570/3 for Beacon Pathway Ltd

Saville Smith K. (2008b) *Papakowhai Renovations – Impacts on Householders and Dwelling Performance.* Report TE106/9 for Beacon Pathway Ltd.

Trotman R. (2007) *Qualitative Consumer Study: Perceptions of "Sustainability" and Uptake of Sustainable Solutions by Householders.* Report MT102/2 for Beacon Pathway Ltd.

Woodley A. (2007) *Quantitative Consumer Study: Household Uptake of Sustainable Solutions.* Report MT103/2 for Beacon Pathway Ltd

9 Appendix One: Home*Smart* Renovations Procedures Scope

Procedure	Audience/Purpose	Content	Format
Project Principles and Process	Potential Partners To introduce the project and clarify its scope and requirements.	What is Beacon What is a High Standard of Sustainability™ (HSS™) How the Home*Smart* Renovations project aims at achieving HSS™ through holistic sustainability renovations Key learning's from Papakowhai project Process for participating in the Home*Smart* Renovations project Future beyond the Home*Smart* Renovations project	4 page document. Power point presentation
Project Principles and process: an introduction for potential customers	Potential customers To introduce the project, explain what will be happening and who will be involved	What is Beacon What is a High Standard of Sustainability™ (HSS™) How the Home*Smart* Renovations project aims at achieving HSS™ through holistic sustainability renovations Key learning's from Papakowhai project Process for customer participation in the Home*Smart* Renovations project including who and what is involved, and the responsibilities of each. Key contact list. Future beyond the NOW Home® Renovation Project	4 page document.
Business Case and Marketing Support	Marketing specialists of Intervention Providers, Funding Providers, TLA partners. To generate a consistent message around possible benefits and likely costs. To provide advice and support to people generating promotion around the NOW Home® Renovation Project with view of unifying and clarifying external messages.	The role of promotion in the HomeSmart Renovations project – what are we trying to achieve Who is our audience – segmentation and characteristics of customers (based on house typologies and benefits sought) What types of interventions are best suited to each category and what benefits can be achieved. Advice on types of media (forms of promotion) are best suited for each category Advice on what messages are likely to work best with each category. Examples of successful marketing executions and promotion shells (ready made adverts and mailers that can be easily adapted by the partners.	8 page document

Procedure	Audience/Purpose	Content	Format
In-House Assessment Tool	Project Managers with Customers To provide in-house assessment, finalise the scope of intervention and generate cost estimate.	Option 1 is to develop a set of requirements which the Intervention Providers could implement into their own assessment tools and processes. Beacon Pathway will scope the assessment and process requirements and discuss these individually with partners to develop an appropriate set of requirements. Option 2 is develop an assessment tool will have the following features: Easily updated by the user as prices change and new products and technologies come on the market. Recommends options based on a number of social variables including family size, consumption patterns and budget, as well as on house variables such as climate, typology, condition, and size. Includes sufficient information that the assessor can create a quote if required. Saves or prints out a report for the householder. Includes a house condition assessment to ensure that the house is structurally sound before renovations commence, or to factor in the cost of structural work into the recommendations. Includes the full range of sustainable renovation areas, not just energy or heating. Technically, the assessment tool must fulfil the following functions: Be accessible by PDA or laptop with a back-up paper based function. Save customer data for download to a variety of database systems. Able to be shared across organisations without compromising IP surrounding pricing, product information, and customer information.	Excel sheet Computer programme or database Hard copy to be available
Best Practice Guidelines and quality checklist	Installers Project managers To guide implementation and ensure quality	Details of the Home*Smart* Renovations project intervention packages and in what situations they are to be installed. Details of monitoring programmes to be initiated. Advice for installers (bullet point's key issues and drawings) for critical items. Checklist designed for individual intervention packages to ensure and document quality	Document, electronic and hard-copy
Training	Installers, assessors, PMs To ensure understanding of key requirements and risks	Training requirements for the installers, assessors and project managers. Specific training material could be developed by the professional organisations or provided by retailers/producers. It should be of sufficient quality that it can be incorporated into industry training, for example via the ITO's.	4 page document
Home manual	Customers To ensure behaviours maximising house performance. Keep service record. Add resale value.	What has been done? (details of interventions) How does your home run? What can you do to make it better? Monitoring and post-installation service.	20 pages

Table 9 Original Planned HomeSmart Renovations Procedures Scope (February 2008)

10 Appendix Two: Papakowhai Renovations: Summary of Interim Reporting to inform Home*Smart* Renovations

By Lois Easton

A copy of Report TE106/12 prepared for Beacon Pathway Limited

30 April 2008

This is a Confidential Report to Beacon Pathway Limited and its partners in the HomeSmart Renovation Project. Please do not copy or circulate this report which contains Confidential Intellectual Property.

10.1 Papakowhai Renovations

Beacon Pathway Limited is undertaking a research project to renovate nine homes in Papakowhai, Wellington, with energy, water, waste and indoor environment quality (IEQ) features which will enable the homes to meet a high standard of sustainability. The key focus areas for the retrofits and their evaluation are in the areas of:

- Energy use in the home
- Water use by the household
- Indoor Environment Quality (temperature and humidity)
- Waste (construction waste and waste produced by the households).

10.1.1 Project Objectives

The project has two key objectives:

1) **To identify the best (most cost effective and easy to implement) packages and** combinations of retrofit options to significantly improve the standard of sustainability of the homes.
2) To develop the cost benefit analysis at a house level for a range of retrofit technologies in the areas of energy, water, IEQ and waste

The project to date has involved the selection and pre-retrofit monitoring of the nine homes (originally 10, but one dropped out due to a change of ownership), an evaluation of potential retrofit options and implementation of the retrofits. Monitoring has been undertaken throughout the retrofit period and will continue until mid September 2008.

BRANZ Limited have to project managed the research and undertaken the monitoring and analysis and worked with EnergySmart Limited to project manage the physical retrofitting side of the project. The physical work was undertaken by a range of qualified tradespeople, and all consents required were applied for prior to the work being undertaken. Porirua City Council has engaged with the project, both as the Consenting Authority, and in providing financial assistance by waiving the cost of the Building Consent Fees.

10.2 Papakowhai & the Home*Smart* Renovation Project

One of the most important aspects of the Papakowhai study is its contribution to the development and implementation of the Home*Smart* Renovation Project.

The HomeSmart Renovation Project is a large scale research and demonstration project with the goal of developing the tools, guidelines and procedures needed to see large scale sustainable home retrofitting. The project envisages the retrofitting 1000 homes around New Zealand to Beacon's HSS High Standard of Sustainability®, a set of performance benchmarks to measure a sustainable home.

A key point of difference to other retrofit programmes is that sustainable home renovation focuses on whole of house solutions extending beyond a package of energy efficiency initiatives (insulation, space heating, lighting, hot water and other appliances), to water (low flow shower heads, dual flush toilets and urban rainwater tanks), waste and indoor environment quality.

This Papakowhai working paper has been prepared to inform the Home*Smart* Renovation Project and the development of procedures, tools and guidelines around retrofitting of homes to achieve an HSS High Standard of Sustainability®.

10.3 The Scope and Purpose of this Working Paper

This working paper summarises the findings of the *Interim Performance Monitoring from the Papakowhai Renovation Project* report and considers the implications of those findings for the Home*Smart* Renovation Project. The working paper is particularly concerned to identify learnings from Papakowhai by considering the Papakowhai findings in relation to a series of Beacon research reports including:

- A range of BRANZ reports on the project to Beacon as follows:
  - Sustainability Options for Retrofitting New Zealand Homes – Energy (August 2006)
  - Sustainability Options for Retrofitting New Zealand Homes – Theoretical Cost Benefit (April 2007)
  - Beacon Renovation Project – Stage 1 Report (April 2007)
  - Learnings from the Papakowhai Renovation Project (March 2008)
  - Interim Performance Monitoring from the Papakowhai Renovation Project (March 2008)
  - HERS Assessment.
- A background report 'Sustainability Options for Retrofitting New Zealand Homes – Water" (Birchfield, 2006).
- Working papers on energy retrofits and recent mover and high energy households emerging from Beacon's Energy Research (Saville Smith, 2008).

The remainder of the working paper is structured as follows:

- Section 4 summarises the preliminary findings from the Papakowhai monitoring data.
- Section 5 summarises the findings from a set of householder interviews undertaken with householders early in 2008.
- Section 6 sets out the learnings from Papakowhai and places those in the context of other research findings.
- Section 7 sets out the implications for HomeSmart® Renovation Pilot Project and the progress in that project.

10.4 Preliminary Findings of the Papakowhai Monitoring

10.4.1 Research Methodology

The research methodology involved attempting to standardise some of the factors to enable robust outcomes from the research. Specifically the houses were all located in the same climate zone and indeed the same, middle income suburb. This eliminates climactic differences from influencing the data collected and to some extent also income. There was an attempt to control for household composition. Indeed, participants were selected on the basis of household composition but this control could not be achieved because all households changed composition over the period of study.

Because the focus of the selection was on households, not the dwellings themselves, there was considerable variability in the dwelling typology. The suburb was largely developed over a 15 year period and it was expected that this would remove variability from the housing typology. It was recognised that the typology (60s-70s) and the topography of the suburb were factors which were expected to make the retrofits more difficult.

The intention had been to base the retrofits on a series of thermal envelope packages as follows:

- High Thermal (heavy insulation of ceiling, under floor, insulation of walls, double glazing)
- Standard Thermal (heavy ceiling and under floor insulation)
- Basic Thermal (a "typical" thermal retrofit as was funded by EECA at the time).

In addition a range of hot water, heating, water efficiency and IEQ improvements were also trialled in different houses.

When the packages were applied to the different houses a number of factors presented difficulties as follows:

- Aspirations of the home owners differed from the proposed methodology [for example recent redecoration meant a reluctance in some cases for wall insulation and different interventions were sought rather than those proposed – partly as a result of expectations being raised early in the project]
- Difficulties arose with defining the thermal envelope to insulate [this was a particular difficulty with the households – four of the dwellings had householders doing some work from home]
- Cost escalations resulting in cut backs to the packages
- Time delays with the consenting process and getting suitable trades people meaning that some interventions were not included
- One of the houses was sold and the new owners declined to participate in the project
- Wall insulation was discovered in homes where it was not expected

All of these difficulties could be expected to be encountered in many sustainable home retrofits, and therefore are issues which need to be explicitly identified and managed in future projects.

10.4.2 Actual Retrofits Undertaken

The actual retrofits undertaken differed from the original intent of the project as is demonstrated in the following table.

Original Proposed Intervention Packages		Actual Interventions
P01	High Thermal + Pellet Burner	*Standard Thermal + Pellet Burner +* Heavy ceiling insulation and R2 under floor Pellet Burner + Heat Transfer Kit, Worm Farm, Energy Efficient Lighting + HW Cylinder Wrap.
P02	ECAN/MFE + Waste + IEQ	*Better than Basic but not Standard Thermal* HW Cylinder Wrap, R2 under floor, Ceiling insulation top up, Heat transfer kit, worm farm
P03	High Thermal + Solar Hot Water + solid fuel	*High thermal +solar hot water + solid fuel* Wall insulation , Heavy ceiling & under floor insulation, new Al frames & double glazing, solar hot water, low emission wood burner, worm farm, range hood, dual flush toilets, low flow shower head
P04	SOLD	No intervention
P05	Standard Thermal + Gas Hot Water	*Standard Thermal _gas hot water* Ceiling insulation top up, under floor insulation, heat transfer system, bathroom extractor fan, instant gas hot water, low flow shower head, worm farm, energy efficient lighting
P06	No Interventions	*Basic* Ceiling insulation top up
P07	High Thermal	*High insulation* Ceiling insulation top up, wall insulation, under floor insulation, hw cylinder wrap, bathroom ventilation, worm farm
P08	High Thermal + Solar Hot Water	*High thermal + solar hot water* Ceiling, wall, under floor insulation, double glazed window panes, solar hot water, shower dome, worm farm
P09	Standard Thermal	*High Thermal + heat pump* Heavy ceiling, under floor, mid-floor insulation, wall insulation, shower dome, heat pump, HW cylinder wrap, worm farm, energy efficient lighting
P10	High Thermal + Solar + Solid Fuel + Wetback	*High thermal + solar + solid fuel + wetback* Ceiling, under floor, wall insulation, double glazing in new AL windows, solar hot water, low emission wood burner with wetback, bathroom ventilation, worm farm, energy efficient lighting

Table 10 Retrofit Packages Undertaken as Part of the Papakowhai HomeSmart® Renovation

10.4.3 Efficacy of the Retrofits

The most significant results have been the reduction in reticulated energy requirements for water heating due to the solar water heating systems.

The best energy and comfort improvements came from the houses with the most extensive interventions, (Beacon High interventions) including full insulation of the thermal envelope, solar water heating, and new solid fuel burning appliances, although all homes have improved thermal comfort levels, and usually also increased temperatures.

While it is difficult to draw concrete conclusions based on the very short period of monitoring data it appears that the following retrofits in particular were most effective from a resource efficiency and improved indoor environment quality perspective:

- Solar hot water systems – in all of the homes the solar hot water systems have performed well, with significant reticulated energy savings. This is particularly encouraging as the monitoring period was over the winter months (May-September) and indicates that the panels were well oriented for winter sun. It is important to note however that the installations were of a high specification – with panels twice the size of an installation undertaken under the EECA subsidy scheme, and therefore not a common practice installation.
- Heat transfer systems – where heating was undertaken these seemed to make a particular difference to bedroom temperatures, and humidity levels

10.4.3.1 Individual Interventions

Numerous different interventions were applied to the Papakowhai Renovation Project houses. The interventions were designed to generate improvements in four areas, indoor environmental quality (IEQ), energy, water and waste.

The energy savings and temperature differences in the houses with only floor and ceiling insulation are far exceeded by the two houses (P03 and P10) where walls were insulated, and the one house where a lower level of wall insulation already existed (P09). Two of the three of these homes also had double glazing installed. This indicates that the insulation of the full envelope is a synergy that transfers significant benefits. It is expected that these results will be verified by the 2008 analysis, showing higher temperatures, lower humidity, and some energy savings, although it is possible that these will be reduced by comfort take-back as people may use the reduction in power bills to pay for additional heating.

However there is no way to extract the effect of individual interventions from the complete package of 'Basic', 'Standard' and 'High' as multiple interventions interact to alter energy consumption profiles. The intervention packages installed to P03 and P10 in this work were designed to meet a high level of sustainability, cost a significant amount and are unlikely to be able to provide a realistic economic payback period, however the companion report (Saville-Smith, 2008) indicates that the householders were more interested in the comfort and environmental advances.

10.4.4 HERS Assessments

The nine homes were evaluated using the recently released New Zealand Home Energy Rating Scheme (HERS) using the AccuRate tool. Both a pre-retrofit evaluation and a post-retrofit evaluation were undertaken. At this stage the HERS evaluation only rates the thermal envelope of the home; however it is proposed to be expanded to include hot water and fixed heating in the future.

Table 1 shows the pre and post retrofit results of the HERS Rating. As can be seen from Table 1 there is no apparent relationship between the investment in thermal envelope improvements and the increased star rating under the HERS scheme. In particular it is worth noting that where partial (but inadequate) insulation exists, "topping up" appears to have a low effect on the star rating.

House ID	Thermal Envelope Intervention	Approx Market Value of Retrofit	HERS Star Rating Before Retrofit	HERS Star Rating After Retrofit
P01	Skillion ceiling lowered in 40% of upper level, and R-3.6 insulation installed to achieve R-3.6. R-2 insulation installed underflow (excluding mid-floor) Heavy draught stopping –garage door Polythene laid on ground	$15 900	1	1.5
P02	Relaid and topped up existing R-2.6 ceiling insulation to achieve R-2.6. R-2 insulation installed underflow Cat door replacement (draughts)	$1 450	2.5	2.5
P03	Insulated walls with R-2.4 insulation Skillion ceiling lowered, (in 40% of upper level) and R-3.6 insulation installed, below existing R-1 layer to achieve R-4.6. Original R-2.6 relaid, extra R-2.6 laid over ceiling joists in cavity ceiling to achieve R-5. Old aluminium windows replaced with clear double glazed units in 16 new frames R-2 insulation installed under floor Polythene laid on ground	$62 300	2.5	5
P05	R-1.8 blanket laid over existing R-1.5 insulation to achieve R-3.2. R-2 insulation installed under floor Polythene laid on ground	$4 270	2.5	3.5
P06	Ceiling insulation top-up to achieve R-2.6	$1 380	1.5	1.5

P07	Ceiling insulation topped up over existing macerated paper insulation to R-3.6 in half the ceiling area; top up with R-2.4 over other half bringing insulation to R-5 R-2.4 insulation installed in bedroom walls R-2 insulation installed under floor Polythene laid on ground	$6 130	2	3
P08	Existing ceiling insulation topped-up to R-2.6, additional layer of R-2.6 put over ceiling joists to achieve R-5. R-2.4 insulation added to rear wall of bedroom R-1.2 masonry insulation added to rear wall of gym R-2 insulation installed to 75% of suspended floor R-1.3 to rest. Polythene laid on ground Clear double glazing units inserted into 16 existing aluminium frames.	$14 190	2	3
P09	Layer of R-2.6 put over existing insulation and ceiling joists to achieve R-4.2. R-2 insulation installed under floor Polythene laid on ground R-3.6 insulation installed to ceiling/floor of garage/main bedroom. R-2.4 wall insulation installed into internal garage wall to stairwell, and on under floor side of rumpus. Sliding door to garage draught stopped	$4 010	4.5	5
P10	R-2.6 insulation laid over existing ceiling insulation, then additional layer of R2.6 put over ceiling joists to achieve R-5. R-2 insulation installed under floor Polythene laid on ground in subfloor Flat roof of foyer insulated with R-3.6 insulation R-2.4 wall insulation to all walls except 1ower bedroom Clear double glazing units in 25 new window frames installed throughout house.	$59 060	1.5	4.5

Table 11: Interventions and Effect on HERS Rating

10.5 Household Interviews

The occupants of the homes were interviewed following the retrofits. Key conclusions drawn from analysing the interview data in the context of the dwelling performance monitoring data are as follows:

- None of the dwellings showed performance levels unequivocally consistent with the HSS High Standard of Sustainability® (HSS®).
- The level of renovation (basic, low, medium and high) is not clearly related to:
  - The cost of the renovation, nor
  - The dwelling performance subsequent to renovation.

10.5.1 Householders Get Benefits

What is clear from the research is that, irrespective of the nature of the renovation itself, householders do recognise dwelling performance benefits from retrofitting. Indeed, some householders actively change their behavioural patterns because of those perceived benefits. The most typical changes in behaviour are increased hot water use, and changes in heating patterns. Increased winter warmth and the reduction of damp were consistently identified by householders as expected and important benefits.

Unexpected benefits identified by a number of householders included:

- Noise reduction associated by householders with double glazing and/or increased insulation, and;
- Reduced household stress associated with warmer winter indoor environments and, for those with solar water heating, increased access to hot water.

Three consistent conclusions can be drawn from the analysis of the monitoring data in the context of the householder interviews. They are that the:

- Householders feel changes in indoor comfort even when changes are relatively small.
- Householders do change their behaviours when previous constraints are released. This is most noticeable among those households that have expanded their supply of hot water through solar hot water and instant gas hot water heating. It is not clear whether this generates total increases in water use.
- Changes in performance may be under or over-stated where changes in occupancy are not taken account. Consequently, physical monitoring data in itself is not enough to evaluate the impact of renovation packages.

10.5.2 Householder Motivations

Notably renovation was not motivated primarily by ideas around capital gain or even reduced operating costs, although the latter were appreciated by some householders when they emerged.

The attraction of the renovation programme lay in householders' desire to:

- Improve the performance of their homes in terms of comfort and health
- Upgrade their homes for future use, and
- Get access to expert advice as well as funding for renovation.

10.5.3 The Renovation Packages, Value and Willingness to Pay

It is difficult to identify from the monitoring data what packages are the most cost-effective. However, the householder interviews do provide some learning's that impact on package design, and package installation.

There is considerable variability around the willingness to pay for retrofit. Householders in the case studies ranged from around $3,000 to around $30,000. There is, however, less variation about the priorities of householders. Those may be summarised as winter warmth and the reduction of damp.

Operating cost reduction is also valued, but in an unsystematic way. That is, there is no evidence that return on investment in classical economic terms represents the value householders put on certain amenities or performance improvements. Solar water heating is an obvious example of this. Those householders who had solar water heating installed were aware that reductions in energy costs gave relatively low returns on investment. However, those householders valued it so highly that they would prioritise solar water heating immediately after under floor and ceiling insulation and effective heating. The non-monetary value of solar hot water heating lay in improved availability as well as affordability of hot water, satisfaction with using the sun's energy, and a sense of independence and certainty around energy supply.

In short, the issue of affordability is important to householders but the rate of return appears to be less of a consideration. The language of 'return on investment' and 'pay-off periods' when householders do refer to them, appear to be simply a superficial adoption of the language and pre-occupations of public policy and investment decision-makers.

However, householders do want to ensure that they make the 'right' decisions. They want to know what is most effective in relation to the performance outcomes they value. They want to ensure that limited disposable income is used to make the most effective choices. There are three aspects of this that have emerged from the householder interviews:

- Firstly, householders want advice on effective investment at different price levels.
- Secondly, householders want advice on how to assess their needs and the sequencing of product/package installation. That is, given that affordability issues might mean that

retrofit/renovation is likely to take place over time, they want to know what is the most cost effective approach to achieving improved dwelling performance.
- Finally, they want to be assured that necessary standards of workmanship are being adhered to.

Overall the renovation components that tended to be consistently valued were:

- Under floor insulation
- Ceiling insulation, and
- Efficient wood burners or pellet burners.

Alternative hot water heating, either through wet backs or solar water heating, were valued. householders views of double-glazing were more ambivalent. While those that had double-glazing installed appreciated its benefits, double-glazing was not seen as a renovation priority for those householders compared to other retrofit components including solar water heating. Notably, however, those householders that felt that they had 'missed out' on double-glazing tended to see it as a key pathway to improved house performance.

For Beacon the data on willingness to pay, affordability and value means that:

- Packages need to be developed to meet affordability limits. This implies a mix of 'single-point' packages and 'over-time' packages.
- The rationale for packages and package installation processes must be transparent.
- Beacon can support the industry to provide credible assessment and product/package installation processes.

Those findings are consistent with the surveys of householders undertaken in the Energy Research. They are also consistent with the background report on energy and water use. Birchfield (2008) concluded in the latter that:

- Current low standard packages do not achieve sustainable outcomes – need to do more to get energy efficiency AND improved comfort and health [this has now been picked up in EECA programmes]
- Strong link between heating source and insulation – better energy and comfort outcomes result when these are combined [this has also been picked up in EECA programmes]
- Simple water retrofit options (low flow devices, dripping taps) are fairly cheap and easy to install, but not promoted or subsidised in most locations.

The first of these conclusions, however, in the light of the Papakowhai research should not be assumed to suggest that higher expenditure will automatically generate better performance outcomes.

10.6 Implications for Home*Smart* Renovation Pilot Project

There are three sets of implications for the Home*Smart* Renovation Pilot Project that can be drawn from Papakowhai. There are implications for:

- Research methodology
- Retrofit packages
- Management of package installation.

10.6.1 Research Method

One of the major learnings from Papakowhai in relation to method is the importance of differentiating between surveying and case studies. The number of houses involved in the retrofit meant that the dwellings needed to be treated as a set of case studies. Case studies required careful control of some critical parameters to ensure that a robust evaluation of interventions can be made. In hindsight, it would have been useful to specifically select similar houses, as all the houses were very different, and featured a wide range of complex and individual responses to the topography, views and environment.

In addition, while the pre-retrofit monitoring indicated that the 9 homes are relatively ordinary as examples of performance of New Zealand housing stock – that is to say, they are relatively cold, at the upper end of ideal humidity conditions, are energy and water inefficient and do not perform well against high sustainability benchmarks – the homes were chosen on the basis of household makeup, and as a result (and partly because of the topography of the Papakowhai area) the homes are not particularly representative of the range of New Zealand or Porirua's housing stock. All but one of the homes are split level/ 2 storey homes (the single level home has a sunken lounge), and constructed in the period of 1965 – 1979. As such they both represent relatively difficult subjects for standard energy efficiency retrofits, and were expected to be lacking in insulation in the original constructed dwelling.

This has been recognised in the HomeSmart Renovation Pilot Project and will be addressed by:

- Ensuring that monitoring data is sufficient to generate statistically robust analysis.
- Establishing a sample frame that captures the critical primary variables that require control. Those are:
  - Climate zone
  - Household income
  - Market context.

Getting a sample size that allows for statistical tests of significance against the various factors likely to determine outcomes as well as establish performance outcomes means maximising the size of the sample participating in the research. We propose that all dwellings and households participating in the research be subject to some data collection. That is, the full 1000 dwellings.

- Data collection will be limited to the:

- Critical performance outcomes sought by the HSS, and
- Key variables affecting performance:
  - Package type
  - Take-up pattern
  - Household characteristics
  - Installation quality.

With regard to the latter, it is well worth taking detailed photographic records of the retrofits –in terms of demonstrating the quality of retrofit of features such as insulation, for training purposes and also a record of pre-retrofit state of the home.

10.6.2 Retrofit Intervention Development

Papakowhai demonstrated that some packages are easier than others to install and this varies according to both the package and the dwelling itself. This has both cost implications and may affect householder take up.

In terms of physically doing the job, the following retrofits can be regarded as being straightforward to a competent and suitably qualified tradesperson who has had experience with installing this type of feature:

- Ceiling insulation in a cavity ceiling.
- Skillion ceiling lowering and insulating.
- Under floor insulation.
- Wall insulation and replacement of internal linings.
- Mid floor insulation.
- Replacement of non CA rated down lights with CA rated lights.
- Installation of low flow devices (shower head, cistern, taps).
- Installation of bathroom and kitchen ventilation systems (vented to the outside).
- Replacement of solid fuel heating devices.
- Installation of pellet burners.
- Installation of heat pumps.
- Installation of heat transfer systems.
- Replacement of single glazing with IGUs in existing, modern, aluminium frames.
- Worm farms/compost bins/washing lines/recycle bins/Compact Fluorescents/Draught stopping/Shower domes and other minor interventions.
- Rainwater tanks for outdoor use.
- Installing water meters.
- Solar hot water system.

In all these instances the correct specification of the system for a sustainable outcome is still required – under sizing/under specifying seems to be a common theme in almost all instances, with over sizing a common problem with solid fuel burners.

Papakowhai also showed that there are slightly trickier retrofits. Those require a specialised installer who is familiar with the system. They are also slightly trickier because they require several trades to be involved in the installation.

- Replacing windows with Double Glazed IGUs and frames.
- Rainwater tank plumbed to toilet/washing machine.
- Grey water systems.

For the Home*Smart* Renovation Project consideration must be given to simpler options such as:

- Secondary glazing.
- Passive vents in windows.
- Solar tube type systems.
- Heat pump hot water systems.

In terms of package development, both Papakowhai and the energy surveys show that household take-up is likely to be constrained by both willingness to pay and affordability. Consequently, the Home*Smart* Renovation Project will develop a set of interventions that allow households to manage renovations over a period of time and/or to choose what they will take up within the set of options that Beacon would identify as leading to a dwelling performing at a HSS®.

The idea of renovating for HSS® over an extended period will also allow householders to consider the 'natural order' of retrofitting. There is a natural order of retrofits to some extent, in that if plumbing and electrical work is being undertaken in ceilings/under floor, then this should be done *prior* to insulation installation, otherwise trades people are likely to damage the installed insulation. In particular plumbing (e.g. rainwater tank plumbed to toilet/washing machine), heat pump, wetback and solar hot water systems should be installed prior to insulation.

10.6.3 Management of Package Installation

The Papakowhai research found that all the householders that participated in the interviews appreciated the opportunity to be involved in the retrofit project. Most householders identified a number of problems associated with participation, however. The most important of those were:

- uncertainty, and in some case unmet expectations, regarding the nature of the package installed.
- poor specification and sequencing of installation leading to:
  - Extended disruption of the household,
  - Unexpected requirements to provide a 'sweat' contribution, and,
  - Difficulties around managing the quality of work.

In addition there were a number of implementation problems that arose in Papakowhai. Prior to interventions being undertaken all the homes were the subject of a detailed BRANZ House Condition Survey and detailed drawings undertaken in order to provide information for modelling the expected performance of the homes.

These pre-retrofit evaluations identified that the homes were of varying levels of maintenance – with some homes needing urgent maintenance to items such as roofs and windows. In some cases full replacement of rotting materials was required. In addition, it became clear that some of the homes had probably been the subject of unauthorised building work undertaken in the past, by previous owners. In all cases Council plans were inaccurate and incomplete, when the actual built form of the homes was examined. One house had part of the home a mirror image of the plan, and other houses had missing elements (including whole floors) in the plans or in the construction. This is not an uncommon feature in New Zealand's housing stock, with a large proportion of older homes having both poor Council documentation and work not authorised under the Building Code.

While these unauthorised building retrofits (many of which were undertaken prior to the current compliance framework) were not the subject of the Beacon HomeSmart® Renovation Project, they created difficulties for the project when it came to applying for Building Consent for the proposed retrofits. At one point in time it appeared that the Council was considering requiring BRANZ and Beacon to retrospectively consent/legalise all unauthorised building work on the homes (a requirement which would have quickly resulted in the project being cancelled), rather than just the retrofits proposed as part of the project.

Good management of consenting issues and local authorities, then, are critical to implementing Home*Smart* Renovation Project. Several of the sub-industries routinely avoid building consents through claiming like-for-like replacements, maintenance or simply ignoring the requirement. This is not condoned by Beacon. Generally the following installations will require a building consent:

- Window installation.
- Solar hot water installation.
- Solid fuel burners.
- Skylight and roof window industries.

Building consent issues are particularly problematic for retrofitting double glazing. New Zealand homes all have different window typology – there is no standard window size in New Zealand. Therefore replacing frames and/or glass requires one - off products to be made, adding significantly to the cost. Multi level buildings require scaffolding in order to replace windows and it is generally a time consuming and expensive business. There is no Acceptable Solution for replacing windows – therefore compliance issues can arise. It is not a common retrofit, so getting suitably experienced tradespeople is also difficult.

10.7 Conclusions

This report has been prepared to summarise the key points in the series of reports developed as part of the Papakowhai Renovation Project. There are a number of significant learning's to be pulled through into the wider Home*Smart* Renovation Project currently planned. These learning's relate to:

- Methodology for the Research.
- Methodology for Decision Making around Retrofit Options.
- Marketing of Sustainable Home Retrofit to Consumers.
- Project Management of the Retrofits.
- Physical Installation of the Retrofits, including Sequencing.

11 Appendix Three: HomeSmarts Consumer Tool – Example Output of Tool

Energy use

Your Actions

- Keep heaters clean - they'll be more efficient.
- Choose a dishwasher that heats its own water.
- Turn off lights when you leave the room

Get more suggestions

Your Home – Low Cost

- Unflued gas heaters are very unhealthy and are not a good way to heat a home. They contribute 1 litre per hour of moisture - making the home damp and even harder to heat. They also produce a range of pollutants which can affect respiratory health and are particularly bad for people with asthma or respiratory problems, young children and older people. They also are one of the most expensive ways to heat for the output of energy they provide. Get rid of it! A modern wood burner, pellet burner or heat pump, combined with a heat transfer system to move the heat to the bedrooms will provide the most efficient and cost effective heating options. If you can't afford to install this at the moment, then portable electric heaters are a better option to consider.
- The hot water cylinder is an older, inefficient model. Putting a hot water cylinder wrap and pipe lagging on it could save you $100 per year.
- For energy efficiency, choose a smaller LCD TV screen and computer screen in preference to plasma. Buy an Energy Star rated model as these are the most efficient.

Get more suggestions

Your Home – Worthwhile Investment

- Your large household means you would get particular cost saving benefits from an efficient hot water system - either a solar hot water or heat pump hot water system
- If you live in a remote area, consider generating your own electricity.
- The roof shape of this type of house probably provides at least one suitable angle for installation of solar water heating

Get more information

Get more information from www.smarterhomes.org.nz

Water Use

Your Actions

- Have showers instead of baths.
- Run dishwashers and washing machines on a cycle suited to load.
- Scrape plates instead of rinsing before you put them in the dishwasher.

Get more suggestions

Your Actions

- Consider low cost water efficiency measures such as installing flow restrictors on taps and fixing leaky taps.
- Install a low-flow shower head - this will also help save hot water costs, with direct energy savings of up to $100 per year.
- Install a water efficient toilet - ideally 3 /4 1/2 litre flush. As well as saving water, you will find this has a quieter flush.

Get more information from www.smarterhomes.org.nz

Humidity

Your Actions

- Cooking is a major source of moisture into your home which can make it damp, hard to heat and encourage mould. Make sure you always use your rangehood when you cook.
- Bathrooms are a major source of moisture into the home (which cause damp and mould problems and make it harder to heat). It's important to have good quality bathroom ventilation - and make sure the bathroom door is closed when people are showering!
- Many extract fans are poorly sized or don't work properly. Check that yours clears the bathroom of moist air (steam on the mirrors) within 10 min of you finishing your shower. If it doesn't then upgrading to a bigger fan which does the job.

Get more suggestions

Your Home – Low Cost

- Divert storm water so it doesn't run under your home.
- Use secondary glazing systems such as magnetic plastic inserts or heat shrink plastic as a cost effective way of reducing heat loss from your windows. They can be removed over summer if you want.
- While electric heaters are useful for heating one room, they are expensive to operate. A modern wood burner, pellet burner or heat pump, combined with a heat transfer system to move the heat to the bedrooms will provide the most efficient and cost effective heating options.

Get more suggestions

Your Home-– Worthwhile Invesments

- Choose windows with built-in vents, or use louvres, to provide ventilation without draughts.
- Because you also need to do some major maintenance on your house this could be a good time to consider some big changes which will really improve its performance. Things like adding northern windows and reducing southern ones, putting in double glazing, heavy wall insulation, heavy ceiling insulation or an insulated thermal mass could well be worth considering.
  Get more information from www.smarterhomes.org.nz

Air Quality

Your Actions

- Air your home regularly to remove moisture and pollutants.
- Use indoor plants to absorb pollutants and make air fresher.
- Cooking is a major source of moisture into your home which can make it damp, hard to heat and encourage mould. Make sure you always use your rangehood when you cook.

Get more suggestions

Your Home – Low Cost

- Divert stormwater so it doesn't run under your home.
- In older houses like yours, stopping drafts under doors and around windows is an important , low cost action to improve winter warmth.
- Use secondary glazing systems such as magnetic plastic inserts or heat shrink plastic as a cost effective way of reducing heat loss from your windows. They can be removed over summer if you want.

Get more suggestions

Your Home – Worthwhile Invesments

- Install insulation into walls, starting with the southern ones, with eastern and western walls next most important. Try and put as thick as possible insulation in.
- Choose windows with built-in vents, or use louvres, to provide ventilation without draughts.
- Because you also need to do some major maintenance on your house this could be a good time to consider some big changes which will really improve its performance. Things like adding northern windows and reducing southern ones, putting in double glazing, heavy wall insulation, heavy ceiling insulation or an insulated thermal mass could well be worth considering.

Get more suggestions

Get more information from www.smarterhomes.org.nz

12 Appendix Four: Home*Smart* Renovations: Example Renovation Plan

Beacon Report Builder v1.0
Gisb 1

Sustainable Renovation Plan[2]

Prepared by Lois Easton of Beacon Pathway Limited for
Lois Easton of 258 Clifford Street, Gisborne

Assessment Date: 03 November 2008

Your Home*Smart* Renovations Plan is designed to improve the performance of your house, from top to bottom, from comfort to warmth, from savings to sustainability. The key elements of the plan are set out below and this indicates the detail of what is suggested for your house along with an idea of some indicative costs. All costs suggested are approximate. It is difficult to give estimates for installation costs, therefore material costs are given only. Beacon recommends that for any work planned three quotes are organised. As part of the assessment process we have indicated if the recommendation is a high priority as well as indicated the package it is part of. The costs of each package are given at the end. We feel that this would be the most sensible way to approach your renovation - but you may wish to change the order or re-prioritise. The idea is to work through this plan like a checklist - helping to guide you through the process of making your home cosy, warm, healthy, affordable and smart.

[2] ***IMPORTANT NOTICE - Whilst reasonable steps have been taken to ensure that the information contained within this HomeSmart Renovations Plan is correct, you should be aware that the information contained within it may be incomplete, inaccurate or may have become out of date. Accordingly, Beacon Pathway Ltd, its partners, contractors and sub-contractors make no warranties or representations of any kind as to the content of this report or its accuracy and, to the maximum extent permitted by law, accept no liability whatsoever for the same including, without limit, for direct, indirect or consequential loss or anticipated savings. Any person making use of this report does so at their own risk [and it is recommended that they seek professional advice from their own adviser whenever appropriate]. Nothing in this report is intended to be or should be interpreted as an endorsement of, or recommendation for, any supplier, service or product.***

When considering what should be the priorities for renovating your home, there are a number of rules of thumb which are worth taking into account. We think people's top priority should be to get a comfortable and healthy house (installing insulation in particular). Insulation acts in two ways – in winter, it's like a blanket keeping your home warm, and in summer, it's like the walls of a chilly bin, keeping your home cool. Getting your house well insulated means that when you heat (or cool), it's your house that gets the benefit. Heating or cooling an uninsulated house is like trying to fill a bath with water, but not putting in the plug. Once you have your insulation sorted we think it's important that consider other measures to improve your indoor environment quality.

Many houses in New Zealand are damp, and damp houses are unhealthy and hard to heat. So we recommend you undertake measures to reduce in particular which will reduce dampness as an early action. Heating is the other side of indoor environment quality. For a healthy, efficient and cost effective house, putting in place effective and efficient heating should be a next priority. The other measures we recommend have been prioritised depending on some of the more specific problems of your house – so in some cases we will recommend water efficiency measures next, and in others it might be hot water heating. Although everyone has their own renovation priorities in this Renovation Plan we have tried to give you the order which we think will make the greatest overall difference to how well your house performs.

Your house has been identified as a type of Bungalow. Bungalows are relatively easy to retrofit to a high standard of sustainability compared to other house types. Provision of additional insulation in the ceiling and under the floor can be achieved relatively easily in most cases and Bungalows are suitable for a wide range of heating types. There may be issues with heritage restrictions in certain neighbourhoods making interventions such as fitting double glazing or providing solar hot water panels slightly more complicated, but overall, providing the 'bones' of your house are sound, a range of retrofit interventions will work well.

THERMAL ENVELOPE

Imagine your house acts as a blanket surrounding you and keeping you cosy. This shell that protects you from the outside world is known as the 'thermal envelope'. It includes your roof, walls, windows, floors and the layers of insulation that these contain. The 'thermal envelope' of your house is critical to keeping you warm in winter and cool in summer. Making changes to improve the thermal envelope of the house is one of the best ways to make your house perform better.

Ceilings

Your ceiling insulation looks OK and it may be better to focus on insulating other parts of your home first before looking to add to your ceiling insulation.

Floors

Install floor insulation to achieve an R2.0 insulation value or better. There is some insulation under your floor, but it is minimal and/or in poor condition meaning that a significant amount of the heat that you are producing is disappearing straight through the floor. As you have wooden floors good levels of underfloor insulation are particularly important as often these are a source of draughts coming in. Having assessed your floor there appears to be sufficient space for adding insulation and we recommend a bulk insulation product with an R value of 1.3 or better. This insulation may cost about $2400. [Packages 1,2,3][HIGH PRIORITY]

Walls

Install wall insulation to achieve an R2.8 insulation value or better. The assessment of your walls indicates that additional insulation could be added by removing the linings and installing building paper and an insulation product. We recommend bulk insulation with an R value of 2.8 or higher. As the process of removing linings is awkward you should consider installing the highest performing R value product available. A rough cost for the insulation is $3800, however the cost of replacing the plasterboard and finishing the internal surface need to be considered. [Packages 1,2,3]

Renovating is the perfect time. As you are planning on renovating over the next 3 years this couldn't be a better time to add additional wall insulation. You may find that removing the existing wall linings, insulating and replacing the linings doesn't cost that much more than removing wallpaper or preparation of surfaces prior to painting - and it should give you a better overall finish.

Windows

You have some single glazed windows in your house. Replacing these with double glazing will be expensive but will make the house more comfortable.

Your windows are draughty which can be a large source of heat loss in your home and may be making the occupants of the house uncomfortable. You should install some basic draught stripping on your problem windows. The assessment has highlighted that you will need approximately 2 metres of window draft stripping at a material cost of about $6. [Packages 1,2,3] [HIGH PRIORITY].

Install more pelmets. Some of your windows did not have pelmets. Full length curtains with pelmets at the top of them are much more effective at trapping the cold air between the curtain and the window therefore reducing heat losses.

HEATING

In a well insulated house heating requirements are reduced so that that first action should be to ensure insulation levels throughout the house are good. Using an efficient heater in a well insulated house will result in warm and comfortable conditions.

From an assessment of your climate, the size of your living room and the amount of windows, once you have added the insulation levels suggested in this report, a heating capacity of approximately 3100W would be required in the living room. Presently a heating capacity of approximately 3700W is required.

Beacon's first preference for a space heater is a wood pellet burner. Pellet burners are an efficient means of heating your home and they use a renewable fuel made from sawdust. The Ministry for the Environment has produced lists of acceptable pellet burners available throughout New Zealand, which do not pollute your local air and which are suitable for New Zealand conditions. Purchase a burner from this approved list and have it professionally installed.

Another option suitable for certain areas is an efficient wood burner. Wood burners are an effective means of heating your home and they use a renewable fuel which is largely carbon neutral because of the CO_2 absorbed by the tree as it grows. The Ministry for the Environment has produced lists of acceptable wood burners available throughout New Zealand, which do not pollute your local air and which are suitable for New Zealand conditions. Purchase a burner from this approved list and have it professionally installed.

Another option is heat pump space heater. Heat pumps warm air inside your home using a process like a refrigerator working in reverse. Heat pumps are controlled using a thermostat, so you can set them to keep your home within a set temperature range. They come in various sizes, from single room heaters to ducted whole-house systems. It is important to get a pump that is the right size for the area to be heated. When talking to your local installer ensure the heat pump being installed has at least a 4 star rating for heating.

INDOOR ENVIRONMENTAL QUALITY (IEQ)

The internal environment (temperature, moisture and pollutants) affect comfort and health (asthma, respiratory problems etc). In New Zealand we have a high level of humidity and it is important to remove moisture from our homes to have a comfortable and healthy environment. The first steps are to remove moisture generating activities from inside (e.g. clothes drying) and remove moisture at their source (e.g. range hoods, extractor fans). An appropriate amount of ventilation is required even in winter to ensure air flow in the house is adequate to remove moist air from the house. Heating is required to increase the air temperature, which in turn increases the air's capacity to hold moisture, the air can then be expelled and fresh dry air can enter the house. Ventilation needs to be higher in wet areas (bathroom and kitchen) however, ventilation is needed throughout the house. A dehumidifier can be used to remove moisture from the air,

but removing moisture sources and improving ventilation in wet areas are suggested to be completed before considering a dehumidifier. If using a dehumidifier, ensure the water collected is empted frequently.

Your kitchen appears to not have a means of mechanically ventilating moisture. It is recommended that you purchase a rangehood or extractor fan. To assist with current moisture build up inside your house it would be helpful to open windows when cooking and to keep internal doors within the house closed while cooking.
Kitchen rangehoods start from about $100. [Packages 2, 3]

While your Bathroom appears to be vented, the system appears to require attention.
Your Bathroom vent appears not to be vented to the outside and may just go into roofspace. While this is removing the moisture from the bathroom it may be causing problems with structures in the roofspace and you should have ducts added to extract the air to the outside of your home

Adding ductwork to your Bathroom extractor fan to take the moisture air outside may have a material cost of about $45. [Packages 2, 3] [HIGH PRIORITY]

LIGHTING

There is an opportunity to install more energy saving bulbs, such as CFLs, throughout your home. CFLs are inexpensive these days and come in a wide variety shapes and colours (including colours similar to standard incandescent bulbs) and save around 80% of the energy as compared with standard incadescent bulbs. CFLs take a while to brighten so many people find that they prefer to use other types of lighting in areas which are lit for only a short time (eg toilets). Dimmable CFLs at the moment are expensive so alternate energy efficient lighting such as new generation halogen lights, which look exactly the same as standard incandescent but are 30% more efficient, would be a better solution in this case.

Replacing 5 standard incandescent bulb(s) at $5 per CFL light will give an overall cost of $25. [Packages 1,2,3]

WATER USE

Water has only recently become an issue in New Zealand, generally in relation to rural allocation and water quality. Demand for water is increasing with population growth in our cities. Delivery water to houses requires water treatment and pipe infrastructure. In New Zealand many of the current water treatment and pipe infrastructure in cities needs upgrading and/or extending. The costs for this will be added to our rates. However, it is possible to push out or eliminate the need for new development through demand management and supply interventions. Only about 3% of water delivered to dwellings is actually used for drinking. Providing water at that standard uses a considerable amount of energy and costs a lot of money. Through using rain water tanks for providing water to the garden or toilets, a significant decrease in potable water use can be achieved. This also has the advantage of having a supply

close to the use, meaning you will be less affected by water restrictions due to weather or other issues. Excess water use results in excess wastewater to be treated. This is both another cost, through the capital and operations cost of wastewater treatment, and/or an ecological problem to receiving waters if wastewater is insufficiently treated. Through grey water recyling and use of low flow fittings this can be reduced.

Shower flows

The flow rate for the Bathroom shower was measured to be more than 9 L per minute.
We recommend a low flow device for restricting the flow for the Bathroom shower down to about 9 L per minute. Lower than 7 L per minute may start to affect shower quality. A low flow shower heat also reduces the amount of hot water needed thus reducing the amount of energy needed to heat water. A low flow showerhead in most instances will pay for itself within a year from the water heating savings. Another option would be to install a flow restriction value in the pipework to the shower.
A low flow showerhead for the Bathroom shower may have a material cost from about $50.
[Packages 1,2,3]

Tap flows

The flow rate for the Bathroom cold tap was measured to be more than 6 L per minute.
We recommend a tap aerator for the Bathroom cold tap be added to reduce the flow down to less the 6 L per minute to reduce the quantity of water required.
The flow rate for the kitchen cold tap was measured to be more than 6 L per minute.
We recommend a tap aerator for the kitchen cold tap be added to reduce the flow down to less the 6 L per minute to reduce the quantity of water required.

Toilets

WATER HEATING

Water heating uses about a third of the energy in a house. Through improving the efficiency of the system and reducing hot water use (see previous section) energy can be saved. This is an area where you can easily make a big impact on your home energy use as well as greenhouse gas emissions.

Water Storage Temperatures

Stored hot water needs to be protected against the growth of Legionella bacteria. Unless there is a specific control regime for Legionella (as may be the case with solar water heating) the water within the cylinder needs to be kept at a temperature of no less than 60°C in order to kill the bacteria. Temperatures over 60°C become wasteful of energy.

Water Delivery Temperatures

Providing for safe tap temperatures to prevent burns is critical for hot water systems. Where children or elderly are present the tap tempertures should be below 45°C or below 55°C

otherwise. In order to store water at high enough temperatures safe for Legionella control but still ensure that it is delivered at appropriately lower temperatures, a tempering (mixing) valve is frequently used on the hot water outlet from the hot water cylinder.

The temperature at the nearest tap to the primary hot water system was measured as 60°C.

The temperature at the nearest tap to the secondary hot water system was measured as 60°C.

Cylinder Insulation

For any type of hot water storage, energy is lost through the walls of the cylinder even if no hot water is being used. This is called 'standing loss'. Increasing the level of insulation around a cylinder will reduce these standing losses and increased levels of insulation are benefical. New cylinders today are made with a level of insulation to reach an 'A' grade, older cylinders identified as energy efficient may also have this insulation level. Less well insulated cylinders made up until the mid 2000's, have greater heat losses and are identfied as having 'B' grade insulation. Those cylinders constructed before the early 1970's which have minimal insulation (perhaps cloth) and high heat losses making them warm to touch, are indentified as insulated to 'D' grade.

Your primary hot water cylinder was identified as a D Grade system.
Your primary hot water cylinder appears to be poorly insulated and you should look to reduce these losses. While adding insulation around the cylinder (loose insulation may help if room is tight) or using a cylinder wrap may reduce some of the heat losses from the system you should also consider replacing the hot water system with a more efficient system.

If you are considering replacing your hot water system you should consider the installation of a solar water heating system. By harnessing renewable energy from the sun to heat your water, you can reduce your hot water bills dramatically. In summer, it may be possible to heat all the water you need with solar energy. In winter, or on cold cloudy days, solar water heating will meet part of your hot water needs - you'll also need some supplementary heating. The size of your solar water heating system will depend on your demand for hot water.

FIRE SAFETY

In 2007 there were 4,083 house fires. Most fire fatalities occur in homes, mainly while people are sleeping. Fire is quiet and fast. If you're asleep, you can't smell smoke. Sound is the best way to wake a person from a deep sleep – a smoke alarm is the best way to arouse you from your slumber. Smoke alarms detect smoke before you can see or smell it. The smoke particles break a circuit in the smoke detector which triggers a loud warning signal, and keeps sounding until the smoke clears. It is because of this that it is important to place the smoke detectors on the ceiling to get the earliest warning. If you must position it on the wall put it 100mm away from the ceiling to avoid dead air pockets. Smoke alarms need to be in every bedroom plus the lounge and hallways. As a start, the most important areas are the hallways near the bedrooms (leave the doors open), then install in each bedroom, as soon as possible. Don't put them in the

kitchen, garage or bathrooms unless they are specially designed smoke alarms for those areas. Heat detectors are available for the kitchen. Most fire stations in New Zealand will come to your house, advise where to place the smoke alarms, and provide assistance with installation to the elderly and people with disabilities. Call your local fire station for advice on where to install the smoke alarms, and assistance with installation for the elderly and people with disabilities.

Dust and spider webs can affect smoke alarms. Clean with the vacuum cleaner once a month, and while doing so, test the alarm by pushing the test button. Batteries must be changed once a year, time this to recur on a regular date (such as on New Year's day, daylight saving or a family member's birthday). All smoke alarms will sound a short 'beep' every so often indicating that the battery is going flat. Smoke alarms have a life expectancy of 10 years. Smoke alarms that are wired into my electrical system (or burglar alarm) also need to replaced every ten years. If an alarm regularly responds to smoke from cooking, there are several options to handle this problem. One way is to replace the alarm with one that has a button to silence it for a few minutes. You could move the alarm further away, giving the smoke more time to dissipate. If the detector is the ionization type, another option is to replace it with a photoelectric. This detector is less sensitive to the smaller particles so is less affected by cooking smoke. The other option is to use a heat detector rather than smoke alarm. Smoke alarms are available for people with hearing loss. These alarms have extra features such as extra loud alarm sounds, flashing strobe lights, or vibrating devices. Check with your local hardware supplier or fire safety equipment retailer.

Remember:

- Cooking is the number one fire danger in your home
- Never leave cooking unattended
- Keep all matches and lighters up high, out of the sight and reach of children
- Child resistant lighters are not child proof!
- Don't overload power points or multi-boxes
- Use multi-boxes with circuit breakers
- Remember the heater-metre rule – keep furniture, clothes and curtains at least one metre away from heaters and fire-places
- Always turn off your electric blanket at the wall before getting into bed.
- Have electric blankets checked annually by a competent service person.
- Be careful when changing cylinders. Make sure the valve on the empty cylinder is turned off before disconnecting and do not turn on the valve of the full cylinder until it is securely connected.
- When storing, ensure that cylinders are either secured on deck away from hatches so any escaping gas disperses, or are placed in a properly designed and ventilated container above the water line.

The above information has been taken from http://www3.fire.org.nz/fire-safety/ (New Zealand Fire Service). Please see their website for further information.

OTHER

Replacement of white ware

It is suggested any fridge, freezer, dishwasher or washing machine older than 10 years be replaced. Older appliances use a lot more energy than newer appliances due to advances in technology and regulations. For example fridges have increased in efficiency by approximately 50% in the last 10 years. Newer washing machines and dishwashers are more energy efficient as well as being a lot more water efficient and often display a water efficiency and energy rating for ease of comparing between types.

TOTAL COSTS FOR THE PACKAGES

The estimated cost for package 1 was $6,350.00.
The estimated cost for package 2 was $6,500.00.
The estimated cost for package 3 was $11,500.00.

GRANTS AND COUNCIL REGULATIONS

Below is information on available grants in your area and contact information. Information on relevant regulations for rain water collection are also included if your council has any regulations in this area.

An Eco Design Advisor is available through the council in your area. An Eco Design Advisor is a specialist, providing free energy, water and material related advice on home building projects, to ensure better use is made of resources. Their website is www.ecodesignadvisor.org.nz

EECA have subsidised packages available for retrofitting ceiling and underfloor insulation, hot water cylinder wrap, low flow shower head, CFLs, vapour barrier, efficient heating. Contact Energy Options or Terra Lana for more information. Community Service card holders owning pre 2000 houses are eligible for assistance. Middle Income households (less than $100,000 household income for 2 earners or $140,000 household income for 3 or more earners) in pre 2000 homes are eligible for an interest subsidy of $1400 or a grant of a third of the cost of the improvements capped at $1125..

Rental properties are eligible for retrofit package including ceiling and underfloor insulation, hot water cylinder wrap, low flow shower head, CFLs, vapour barrier. To be eligible landlords must have an income of $100,000 or less and the house has be pre 2000. Alternatively pre 2000 rental properties with tenants with a Community Services Card holder tenant are eligable for a 60% subsidy on insulation and other energy efficiency measures. No rent increases are allowed for 6 months after the upgrade. Contact EcoInsulation or EECN (the Energy Efficiency Community Network) for more information.

All households in New Zealand are eligible for an interest free loan ($1000 interest) or a $1000 grant towards a solar hot water system.