NO102/5

Waitakere NOW Home®: Occupants' experience of the home and implications for future NOW Homes®

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About This Report

Title

Waitakere NOW® Home: Occupants' Experience of the Home and Implications for Future NOW® Homes

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Abstract

This report reviews the research on the Waitakere NOW Home® occupants' experience of living in the home and the impact of their behaviour on the physical performance of the home. It has found that their experience was overwhelmingly positive and had marked impacts on their attitudes, with less clarity on the impacts on their behaviour and how this might unfold. Their experience however has provided valuable insights for the Home*Smart* Homes programme, both for the development of new houses and the monitoring and research associated with them.

Reference

Trotman, Rachael, May 2008, *Waitakere NOW Home®: Occupants Experience of the Home and Implications for Future NOW Homes®*, Report NO102/5 for Beacon Pathway Limited.

Contents

1 Executive Summary

Beacon Pathway Limited is a research consortium with a goal to bring 90% of New Zealand's homes to a high standard of sustainability by 2012. One strand of its research supporting this aim is based on the NOW Home® programme, whereby demonstration sustainable homes are designed, built, lived in and monitored. Two NOW Homes® have been completed to date, in Waitakere City and Rotorua.

These two homes have been subject to a significant level of monitoring of occupants' physical use of the home, plus some research on their experience and behaviour within the home. This report presents the research undertaken on how the occupants found the experience of living in the Waitakere NOW Home®, and how their behaviour impacted on the home's performance.

Methods used were a review of the research carried out with the occupants over the first two years of their occupancy, plus a face to face 'exit interview' in February 2008. Performance monitoring in the first two years included four face to face surveys focusing on how the NOW Home® compared to their previous homes, and a survey in year two based on the survey used in BRANZ's[1] Household Energy End-Use Project. This survey focused on understanding energy use behaviours within the home. The exit interview explored issues arising from previous research and focused on their lived experience of the home and behaviours within the home. Only the two adult occupants of the house were involved in the research, with their two children being considered too young.

The Waitakere NOW Home® occupants arrived in September 2005 and extended the initial two year tenancy period by six months, moving out in mid February 2008 after purchasing their own home. The occupants consisted of a higher than average income family of mixed Māori and Pakeha parents and two young boys. They rated themselves as being only "averagely" eco conscious (five out of ten) and their resource use behaviour did not appear to be significantly affected by knowing that their activity was being monitored and examined. Their average yearly water consumption is comparable with Auckland region figures and their general energy and resource use could be described as "average" or "typical".

The occupants considered their last house to be poor quality and unpleasant to live in, and this is likely to have increased the felt positive impact of the sustainability features of the Waitakere NOW Home®.

Overall the occupants' experience of the house was extremely positive, with the features consistently impacting most positively on their experience of the house being the layout and open plan design, sun and natural light, warmth and temperature, the concrete floor and reduced energy costs. The occupants regularly and consistently referred to significant health and wellbeing benefits from living in the house, including decreased levels of ill health, increased

[1] ***Building Research Association of New Zealand.***

children's confidence, a more active social life, enhanced interfamily relationships, a low noise environment and generally feeling "happier".

Less favourable experiences included some overheating in summer, quality of some build work, stones carried in from outside, lack of privacy and security issues. In terms of the neighbourhood, the proximity of shops, schools and transport was rated highly, and a less positive aspect was security concerns through living on the edge of a public park.

Occupants became more aware of their energy and water use but this did not compel them to use less, in fact their energy use increased in the second year. Areas where behaviour changed most consciously were a reduced need to heat their house in winter and undertaking food composting. The occupants reported an increase in their awareness and understanding of environmental and sustainability issues and living in the NOW house® opened doors to different behaviour for the occupants, such as public transport use and more conscious consumption.

Lessons for future NOW Homes® include an affirmation of the design and layout of this house; continue to use concrete flooring; add window latches, solatube ventilation and extractor fans; ensure quality control of the build work and add a rain gauge to rainwater tanks.

Lessons for future research include a greater focus on benchmarking occupant attitudes, behaviour and expectations when they first move in to the home, plus:

- Exploring the links between experience, awareness and behaviour, and what drives behaviour change.
- Probing reasons behind behaviours, for example in this case more detail on reasons why energy use increased in the second year.
- A stronger focus on the health and wellbeing aspects and impacts of living in the house, including the impact on relationships and mental health.
- Perceptions and interaction with the surrounding neighbourhood.
- Capturing children's views, or those of all occupants.

A baseline survey at the start of the occupancy is indicated, with a further survey or research process at six and twelve months, and possibly six monthly or annually thereafter. The first survey should capture current behaviour, attitudes and expectations, with future surveys exploring changes in these and actual behaviour, plus seeking information to interpret what is coming through in terms of the physical monitoring data.

Overall, a standard comprehensive monitoring and research programme needs to be developed for the NOW Home® 100 Programme that reflects the suggestions above. More creative research methods could also be explored for this programme, including self-assessment, photovoice and story based techniques.

2 Introduction

Beacon Pathway Limited is a research consortium that that aims to bring about a significant improvement in the sustainability of the residential built environment in New Zealand through science-based New Zealand research. Beacon's vision is to 'create homes and neighbourhoods that work well into the future without costing the Earth'. This vision is guided by two goals:

1. To bring 90% of New Zealand homes to a high standard of sustainability by 2012.
2. Every new subdivision and any redeveloped subdivision or neighbourhood will be developed from 2008 onwards with reference to a nationally recognised sustainability framework.

Beacon's research on homes has two strands: retrofit and new build. A major foundation of this research involves the NOW Home® programme, whereby Beacon has designed and built two demonstration sustainable homes, which are being lived in and monitored. Some existing homes are also being retrofitted as part of this programme. These homes are 'live' research projects that aim to show that sustainable, affordable and desirable homes can be built now using available design concepts, materials and products.

The two NOW Homes®[2], one in Waitakere City and one in Rotorua, were designed and built on the principles of maximising the sun's warmth, reducing water use, and providing a dry, healthy indoor environment. These NOW Homes® were designed with the 'average' New Zealander in mind, and to be within reach of the median household income, while recognising that significant savings are needed to reach the 10-20% deposit generally required for a mortgage. Overall the NOW® Homes aim to balance environmental, social and economic gains.

Informed by the experience of the first two NOW Homes®, Beacon's Home*Smart* Homes programme aims to create 100 more sustainable homes in order to strengthen industry capability to deliver sustainable housing, and to increase the visibility and demonstrated value of these homes within the market. These 100 homes will be built by developers, in consultation with Beacon (i.e. they are not being funded or built by Beacon).

This report aims to complement and help understand the comprehensive monitoring that has been undertaken of the physical performance of the Waitakere NOW Home® and of the occupants physical use of the home (for example energy and water use). Beacon has a good understanding of how the home performed in relation to physical indices such as temperature, water and energy, but less of how the occupants found the experience of living in the home and how their behaviour impacted on the home's performance.

[2] ***See http://www.nowhome.co.nz/ and Beacon's website http://www.beaconpathway.co.nz/ for further information on NOW homes®.***

As such, this report focuses on the adult occupants' experience of living in the Waitakere NOW Home® and their behaviour within the home. Specifically, it:

- examines the relationships between the behaviour and experience of the Waitakere NOW Home® occupants and the physical monitoring data; and
- presents the results of an 'exit interview' with the occupants which focused on their behaviour and experience of living in the house, alongside other relevant social research undertaken with the occupants over the two and a half years of their occupancy (September 2005 to February 2008).

These findings will inform a case study of the Waitakere NOW® Home experience, plus NOW Home® Procedures and a 'Value Case for Consumers' in relation to new homes.

The method used is described below in section 3.0, followed by key findings under the following themes:

- Description of the Waitakere NOW Home®.
- Tenant household context.
- Key findings relating to the physical performance of the home and occupants' use of the home.
- Key findings from social research in years one and two.
- Key findings from the exit interview.

The report ends with a set of lessons for Beacon's Home*Smart* Homes programme and related research.

3 Method

A review was undertaken of the social research carried out with the Waitakere NOW Home® occupants in the first two years of their occupancy. Occupant interviews and physical monitoring are written up in two reports, the first covering September 2005 to November 2006 (French et al 2007[3]); the second December 2006 to August 2007 (Pollard et al 2007[4]).

Four face to face occupancy surveys were undertaken in year one, which focused on asking the occupants to compare the NOW Home® with their previous homes (see Appendix A for this survey questionnaire). Three of these interviews were taped and the author of this report was able to listen to the tapes. In year two an edited version of the same survey used for BRANZ's ten year Household Energy End-use Project (HEEP)[5] was undertaken with both adult occupants, which focused on understanding energy use behaviours within the home (no taped interview was available).

This research and feedback from discussions with Beacon representatives was then used to construct an interview guide for an in-depth face to face 'exit interview' with the occupants, which occurred on the evening of 7 February 2008. The focus of the interview was on exploring issues and questions raised during the previous research, as well as their behaviour in the home and its impact on home performance, their experience of the home and issues they feel Beacon should consider regarding future NOW Homes®.

The exit interview was undertaken by the author and taped to assist analysis of the feedback. See Appendix B for the exit interview guide. Previous social research was undertaken by other researchers.

[3] ***French, L., M. Heinrich, R. Jaques, C. Kane and A. Pollard (March 2007), NO102 Waitakere NOW Home: First Year of Performance Monitoring.***

[4] ***Pollard, A., L. French, L. Heinrich, R. Jaques and J. Zhao (November 2007), Waitakere NOW Home: Second Year of Performance Monitoring (Draft).***

[5] ***BRANZ's HEEP study had recently been completed and its questionnaire was considered robust and able to provide for some comparison between NOW Home data and HEEP data.***

4 Results

The findings begin by describing the Waitakere NOW Home® and contextual information regarding the occupants, before presenting the research findings.

4.1 The Waitakere NOW Home®

Figure 1.1

The Waitakere Now Home® is based at Olympic Place, next to Olympic Park, New Lynn. It was built in collaboration with Waitakere City Council, who provided the land for the home within its Olympic Park sustainable living cluster. This cluster also houses the Ecomatters Environment Trust and the Sustainable Living Centre (see both at www.ecomatters.org.nz).

The home was designed by architect Greg Burn and constructed by GJ Gardner Ltd. Numerous building manufacturers and suppliers sponsored specific materials and services, in return for the results of the comprehensive monitoring programme of the home's performance and comfort.

The characteristics of the Waitakere NOW Home® are as follows.

- A single storey, three bedroom home of 146 m^2 (including the garage).
- Built at a cost of $218,000 + GST, excluding landscaping and soft furnishings.
- Designed to be affordable to most New Zealanders.
- Designed for a hypothetical, average, young New Zealand family.
- Designed to reduce water, energy and resource use.
- Designed to provide a comfortable, attractive and healthy living environment.
- Built from materials and with practices that are as good as or better than Building Code minimums.

- Built from materials chosen for integrity and durability to maintain capital value and ensure weathertightness.

Figure 1.2 below provides the floor plan of the home.

Figure 1.2

The home aimed to be a physical representation of current best practice within the budget constraints set, including the best use of available building materials and technologies, and practices to support health and wellbeing outcomes for the inhabitants.

The physical data collection occurred through a central data acquisition system, comprising a desktop computer, an Agilent datalogger and a Point 6 radio sensor network. This allowed for data collection of electricity and water use, solar water heating, the hot water cupboard, temperature, humidity and CO_2 levels. The quantity of data this yielded was described as 'considerable' (French et al 2007:49), with each day 80 channels of data being collected at one minute intervals resulting in over 115,000 data points. In the first year the large volume of data challenged software capability until the data was processed into ten minute blocks and a more flexible indexing system was used. Some technical difficulties occurred periodically with the monitoring technology and these are detailed in the monitoring reports.

4.2 Tenant household context

The Waitakere NOW Home®'s first occupants began their occupancy in September 2005, and moved out upon buying their own home, in mid February 2008. The original tenancy was for two years, which was extended for six months. They consist of a married couple in their thirties with two young boys of preschool age when they moved into the house (one of these children started school in 2006). The pseudonyms John and Jess are used in the report for the adult occupants. The children were not interviewed at any stage as they were considered to be too young, and their views and experience are represented by their parents.

Both adults worked full time salaried jobs and often long hours, at times from home, with John working in IT and Jess in human resources. John's ethnic background is New Zealand European or Pakeha and Jess's is New Zealand European/Pakeha and Māori, as are their children. When the family first moved in their combined income was between $80,000 to $100,000, which increased to well over $100,000 in 2007 (in fact their income reportedly doubled in 2006/2007 as Jess went back to full-time work). Thus their household income is significantly higher than average, and the occupants also had a number of computer and entertainment appliances that is higher than average (for example five computers at home in 2007 and a wide screen television).

Rent for the Waitakere NOW Home® was set at the relatively low level of $300 per week, partly to compensate for the inconveniences of monitoring and partly to encourage the tenants to stay for the full term of the project.

The occupants arrived at the tail end of winter 2005 and came from a rented house which they described disparagingly as being cold, dark, damp and a place they didn't like to invite friends and family to. Thus their experience of the previous house was less than positive, including negative health effects for the family in terms of colds and flu (one child is also asthmatic), and on their social life as the house was not suitable for entertaining.

4.3 Occupants' physical use of the home

This section summarises the key findings of note regarding the physical use of the home by the occupants. Note that technological hitches led to some missing data, primarily affecting the electricity and water use measurements in the first year. These hitches also led to a significant number of visits to the home, which contravened the goal of minimal occupant interruption, but which overall were not considered to have impacted significantly on the occupants' behaviour.

4.3.1 Year One

Key findings in terms of physical use in the first year are as follows. Note that electricity is the only energy type used in the Waitakere NOW Home® (ie no gas or wood burning). Also, the year one and two performance monitoring reports provide accounts of seasonal and other external influences, and further comparison between NOW Home® resource use and that of other types of housing, which are not repeated here.

- The household occupants used an estimated 20.3kWh of energy consumption per day in total, which is equivalent to 7400 kWh per year. The unknown appliance energy use was greater than half the electrical energy use and the year one report recommended additional appliance metering be undertaken (2007:46).
- A reduction in electricity used of 45% from the occupants' previous home. The seasonal variation in energy usage for the NOW home was similar in relative terms to the occupants' previous home.
- Based on HEEP data, the total energy consumption of the home is said to perform well against new houses in the Auckland region and against four person households with preschool age children (French et al 2007:16).
- Again based on HEEP data, the solar hot water system in the NOW Home® saved a significant amount of energy in summer – HEEP houses used on average 3260kWh of their electricity for hot water whilst the Waitakere NOW Home® used half that amount, 1640kWh (including the pump energy). However in winter the solar water heating was less effective.
- Occupants' average water use was 189 litres per person per day in the Waitakere NOW Home®, with the rainwater tank providing for around 47% of the water needs of occupants. The Beacon High Standard of Sustainability (Easton 2006) provides a target of 180 litres per person per day, so the home's reticulated water use of 100 litres per person per day is well below this figure, and only one third of the Ministry of Health's (Easton 2006) estimate of 300 litres per person per day.
- Use of water from both sources (mains and tank) was highest between 5.30am and 8.30am and in the afternoon from 4pm to 8.00pm.
- Showering was the major water use within the house (36% approximately), and in summer 34% of water use was by outdoor taps (note that a portable swimming pool was set up outside during summer for the children).
- Despite the large size of the rainwater tank (13,500L) there were still times when it overflowed.
- The Waitakere NOW Home® had an average evening winter temperature of 19.4°C which was high compared to other HEEP groupings and considered satisfactory by the researchers, despite minimal energy being used for heating during winter in the NOW Home.
- Temperatures in the Waitakere NOW Home® were primarily between 20°C and 25°C, but all rooms experienced some overheating in summer and there is a significant amount of time spent above 25°C over 24 hour periods in January and February, especially in the family

room (60% of the time over summer). French et al's report also notes that it is a concern that Bedroom 3 exceeds 30°C during 34% of the days during January and February.

- In winter some concern about the relative humidity levels was expressed, with French et al's report stating that levels exceeded the maximum acceptable range for health in all rooms (2007:43). Note that Beacon's High Standard of Sustainability states that 20-70% relative humidity is acceptable for human health.
- The CO_2 monitoring data started in March 2006, and the year one report noted that CO_2 levels were less when the occupants were out of the house. It also suggests examining the seasonal influence on CO_2 levels (ibid:44).

4.3.2 Year Two

Changes made to the house in the second year were as follows.

- June 2007 - ventilation extractor fans in the bathroom and ensuite.
- June 2007 – solar powered stack fan in the kitchen.
- July 2007 - installation of a Centameter, which provides a more dynamic reading of electricity usage in a prominent area.
- July 2007 – tank level indicator for the 13,500 litre rainwater tank installed.
- The study was converted to a bedroom to allow the children to have a room each, and the office computer was relocated to the computer nook in the living room.

Key findings in terms of occupants' physical use of the house in year two is as follows.

- In the second year of occupation there was a 15% increase in energy consumption from the first year, from 74000kWh (daily consumption 20.3kWh per day) to 8500kWh (23.3 kWh per day). Much of this increase is due to increased hot water use through showering, and the four highest users of electricity after solar water heating were the computers, lighting, the dishwasher and a large screen TV.
- On average around 80% of the total amount of hot water is used in the shower.
- In the first year the occupants paid $1325 for electricity and in the second year $1640, a 24% increase. The solar energy collected in the second year was 1880kWh, representing a saving of $300; and solar energy represented 45% of the total energy used to heat water.
- Daily energy use data since monitoring began shows a strong seasonal variation and a steadily increasing use trend.
- Total water use in year two decreased by 8% from year one levels, the equivalent of 70 litres per day. Daily water consumption was consistent at around 690 litres per day, or 172 litres per person per day. Around 48% of this water was supplied by the street mains and 52% from the rain tank.
- During the summer a higher proportion of water was taken from the mains (76%) than during winter seasons. In winter 2007 the mains water proportion was around 43% whereas in winter 2006 this proportion was 14.5%. This is likely to be due to the use of the bypass valve, and climatic conditions.

- Average yearly water consumption of the Waitakere NOW home® is around 252,000 litres (63,000 litres per person), which is comparable with Auckland region figures (Pollard et al 2007:27). The highest proportion of use in winter was again the shower (49%), followed by the laundry (19%) and toilet (18%). The water used in the shower gradually increased during year two.

4.4 Key findings from social research in years one and two

Quarterly face to face interviews were undertaken with the occupants in year one to explore the social and qualitative aspects of their occupancy and complement the intense physical monitoring of the home and their physical use of the home. See Appendix A for the interview guide. These interviews occurred with both adults together in December 2006, March 2006 and July 2006, and in November 2006 only John was interviewed as Jess was not available. The author of this report was able to listen to the taped interviews and has added the occasional quote to highlight key points.

4.4.1 Year One – 2005/2006

In the first year the questions focused on how the NOW Home® compared with previous homes they had lived in, in terms of general physical attributes, overall living aspects ('the experience'), and regarding 35 specific features. They were asked to rate their responses from 1 to 10, where 1 meant 'not at all' and 10 meant 'extremely different'.

In the first year "There was an overwhelming vote of confidence for the way the house is performing – in the comfort and utility both it and its surrounding services provide" (French et al 2007:29). Of 35 specific features examined only two were seen as making a negative difference (these were unstated in the report) and three were considered not applicable (again unstated). Agreement between the two adults was high, with their rating scores differing by more than one point only in one case (growing your own vegetables).

The occupants consistently gave a rating of 10 ('extremely different') in terms of the experience of living in the Waitakere NOW Home®, compared to previous homes. A rating of 10 was also given to the question of how much better living in the house was overall compared to previous houses.

The specific features of the house given the highest rating of 10 were as follows.

Feature type	Specific feature rated highest
Comfort	Temperature, fresh air, lighting, sound insulation
Physical attributes	Concrete floor
Utility	Spaciousness, interior layout and flow
Service provision	Electricity bills, hot water heating, recycling, security,[6] clothes line

The high rating of these features changed little over the first year of monitoring. The features considered most exemplary by the occupants in the first year were:

- The layout of the rooms and good use of space.
- The thermal performance of the house, in terms of stable temperature and almost no need for winter time heating.
- The concrete floor, in terms of being easy to keep clean and heat retention capacity (with occasional scratching a minor drawback). Even in winter the concrete floor was not cold.

The occupants especially liked the open plan nature of the layout, in terms of how open and spacious it felt and the benefit of not having a corridor for transition between areas: "everything seems bigger". They commented that in an open plan design people are not excluded; there is no separation between children and adults and that this helped children take responsibility for keeping things tidy. The occupants remarked on how well the spaces related and on an overall sense of greater freedom of movement. The spaciousness was described as "fantastic", which is notable given the reasonably modest footprint of the house (146m^2 including the garage). The occupants also liked the indoor-outdoor flow as a family and stated that in terms of layout they would not change a thing, and that it was the best house they had ever lived in. They felt that the dining room/lounge area could be slightly bigger however.

The occupants arrived at the tail end of winter but did not use their space heater, drier or dehumidifier, all of which were used continuously at their last house. They also noticed that the internal temperature remained very even; that they didn't need to switch lights on as much due to the natural light in the house; that the warm car engine provided enough warmth in the garage to dry clothes; and that in warm weather good cooling occurred by opening windows and doors. The occupants stated that they loved the solar water heating and that it was very rare that they needed to go on to mains power for hot water heating. Grab rails in the bathroom were seen as being good for the children, but as having low impact for adults.

[6] ***This rating is affected by a private security firm checking the area at regular periods, which would not happen in usual circumstances.***

A regular security patrol was undertaken around their house and surrounding area, and no security problems were reported early on. The occupants reported feeling safe at night. However by March 2006 the local gas station had been held up twice and one of the children's bikes was stolen (later recovered), which made Jess feel nervous at night on her own. The occupants commented that not having residential neighbours had pros and cons, including more privacy but less surveillance (note that the Ecomatters Environment Trust building is located next to the NOW Home® but is not generally occupied in the weekends).

In terms of local transport, the occupants reported taking the children on the local train in November 2005, which everyone enjoyed, and this was the first train trip in three years for the family. The neighbourhood was seen positively in terms of having shops and the older child's school nearby, although they do not walk to the shops or the school, both of which are a five minute drive. Over their occupancy public transport use was very rare for the occupants.

John and Jess noted less sickness for themselves and the children since being in the NOW Home®: "We haven't had to be home with the kids sick since we've been here" (for the three months to December 2005), and reported less use of the nebuliser for the older child's asthma. Jess also suffers from migraines and felt that the double glazing blocked light and sound which was good for migraine situations. Good air flow negated a need to air the house out.

While the adults' gardening started strongly it declined over time, although some vegetables continued to be grown. By March 2006 the garden had become a project with the children and flowers had been put in. John commented that he never used to care about flowers and the garden "But now I do". They commented that having a garden was great for the kids and they had successfully grown vegetables since the last interview.

The first year performance report notes that the occupants felt that the overwhelmingly positive features of the house and its surroundings made a significant positive contribution to their inter-family relationships, but does not provide any detail or description of this (pg30). Interview notes in March 2006 report the occupants stating that relationships were "happier all round" and the indoor and outdoor flow was good for socialising, although a "deck would be nice". In November 2006 the interview notes state that John felt that a good house positively contributes to partner/family relationships, and that if he were to house hunt he would now know what to look for in a house.

Over Christmas in 2005 and summer 2006 the occupants noted that they were more social and invited people round, and that the concrete floors made cleaning easy. A portable swimming pool was set up outside which proved no problem for the concrete floor. The insulation also resulted in noise reduction, for example the occupants didn't hear the rain except for once during a particularly heavy fall.

The occupants felt that the following performance aspects of the house were weaknesses or could have been improved in the first year:

- Tracking of small pathway stones into the house.
- The breakfast bar being too high.
- Lack of privacy from neighbours.
- The quality of some of the build work, for example struts, nails and screws coming up, gib and doorframe moving.
- Condensation on the master-bedroom window in winter[7].
- Drainage of the lawn in winter was an issue, with a "pond" forming due to rain.

They also noted that the house could be uncomfortably warm at times in summer, causing them to have trouble sleeping. Also due to traffic noise and safety reasons they did not open their windows at night or while they were away from the house. The high temperatures achieved indicate a lack of cross ventilation in the house.

While the spaciousness of the house was originally rated 10, over time the occupants felt that an extra metre or two of space on the north wall would have been an improvement. Efforts in the vegetable garden also declined over time, and both adults acknowledged that they did not have 'green fingers'.

The occupants did report having a fear that the water in the water tank would run out, as this did occur when John was in the shower at 5am one morning and was an unpleasant experience. It was impossible to tell the level of the water in the tank until it ran out and this resulted in a tendency to rely on mains supply to avoid running out of water: "If we know it's on tank we are a little bit nervous having a shower". The occupants also remarked on using a lot of water on the garden and lawn, knowing that people would be looking at the garden, but that they were getting more relaxed about this over time (note that regular public open homes were held showcasing this home). In the July 2006 interview the occupants noted that they had mostly been on tank water over the winter, and that lots of rainfall over the winter had supported this.

The house features that reduced their environmental impact as perceived by the occupants were as follows (in no order).

- Less generation of rubbish, mainly due to kitchen waste composting but also due to more recycling (one bag of rubbish used per week).
- More recycling of kitchen waste and reduced vegetable purchases, as kitchen waste composting identified the amount of fruit and vegetables that were being thrown out.
- Reduced heating and water use, leading to reduced electricity and water bills.
- Reduced need for artificial lighting.

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[7] ***The report notes that this could be due in part to user behaviour – not venting the ensuite bathroom properly, drying clothes inside the house and the closure of passive window vents in the bedrooms (pg30). Subsequently it was found that a specified extraction fan had not been installed in the ensuite.***

In the March 2006 the occupants stated: "We can't go back to a normal house now". In November 2006 things that the occupants would change about the house were:

- Increase the number of bedrooms since the adults were working from home more and need a room as a study/office.
- Lower the partition bench in the kitchen, for the social aspect.
- Add bed lamp power points in the master bedroom.
- Have a bigger rainwater tank with a simple visible gauge.

The year one report recommended eliminating questions asking occupants to compare the NOW Home® to previous homes after year one, as occupants find it harder to relate to dwellings they occupied longer and longer ago (French et al 2007:46). It also suggested focusing in year two on behavioural questions rather than attitudinal ones, to better link with the physical monitoring results to explore various resource use issues (ibid).

4.4.2 Year Two – 2006

In year two the research approach changed, and it was decided to use the Household Energy End-Use Questionnaire utilised in BRANZ's ten year HEEP project. Consequently, on 23 May 2007 both adult occupants were interviewed, and were asked the bulk of the eighty questions used in the BRANZ HEEP Study over one and a quarter hours, focusing on the house features, household occupants and how they interact with the house day to day. This interview was not taped.

The HEEP Survey focused intensively on the occupants physical use of the house and relevant points not already noted in section 4.3.2 are as follows, based on the survey interview notes.

- Between November 2006 and July 2007 the occupants had used additional heating twice via a fan heater and electric blankets.
- Appliance use was high; on average the TV was on 40-45 hours per week, the stereo 30 hours per week and the home computer/s 50 hours per week.
- The home office was used around 30 hours per week.
- The typical monthly power bill was estimated at $110 in summer and $180 in winter.
- It was noted that if the drapes weren't pulled in winter the house was a lot colder.
- If they could they would change their home computers to laptops and/or have LCD monitors to reduce their energy consumption.

4.5 Key findings from the exit interview

The first part of the interview focused on the context of the household and what this means for how they used it. The interview then progressed along the following structure:

- Perceptions of the house itself.
- Experience of the house.
- Experience of the neighbourhood.
- Description of behaviour/use of the house, including any perceived changes to their behaviour and attitudes over time.
- Impact of monitoring and research undertaken.
- Suggestions for future NOW Homes®.

4.5.1 Context of the household and impact on how they use it

John and Jess were asked their perception of the main factors affecting how they use the house, in terms of the type of household they are. The factors they noted were:

- That both adults work full time and bring work home.
- They have two young children.
- They were quite social and often had people coming round socially (and they noted that they had been more social since living in the NOW Home®).

They commented that living in a quality house aided their sociability, in terms of having good aesthetics, feeling safe and at ease in the home, having a spacious environment, indoor and outdoor flow, and a comfortable and easy to clean house, especially in terms of the concrete floor.

Changes in their circumstances since they had lived in the house were:

- Both adults having more responsibility in their jobs. Jess noted that her career had 'taken off' since living in the house.
- Related to the last point, both boys were now in school.
- Each child now has their own room, with a computer/office being moved into the living area.
- As noted above they considered themselves to be more social, had more friends round and people in their life: "People want to come round". They noted that they didn't invite people to their last house, as it was dark and dingy and that the NOW home® was a 'massive change':

  > "We are happy here, which flows through to everything else. Everything has been better since being here".

4.5.2 The house itself

The occupants were asked whether the features they had most appreciated about the house (layout/design, use of space, indoor/outdoor flow, temperature and the concrete floor) had changed over time, or whether there were other features to add. John and Jess responded that these most liked features had remained consistent over the time of their occupancy.

In terms of least appreciated or liked features, these had also not changed, and were identified as being:

- Stones being brought in from outside and scratching the concrete floor.
- Lack of power points and phone points.

John and Jess noted a desire to add a fourth bedroom as an office. They also mentioned that they were not gardeners and that gardening was a lower priority. They stated that they had adjusted to having people around looking at the house, and that the hedges had grown to twice their original size, providing added privacy over time. Jess noted however feeling less secure in the house since the local service station had been twice held up. Condensation in the bedroom had been addressed once extra ventilation in the ensuite bathroom had been added.

Given that they had recently purchased their own house, the occupants were asked whether their experience of the NOW Home® had influenced their choice in any way and if so, how. They responded that their NOW Home® experience had made a big difference, in terms of ensuring that their new house had sun and light (their major criteria), and that other criteria had included an ensuite bathroom, natural light in the children's rooms, a north facing house, good flow and use of space. They had also had their new house tested for humidity and damp.

In terms of plans to renovate or retrofit their new house, John and Jess noted that the house had double glazing and had just been insulated, and if this hadn't been done they would have had it done. They commented that they bought a house that ticked the boxes of:

- Being a sun trap.
- Good windows.
- Ventilation and insulation.
- No wasted walls (good design and layout).

4.5.3 Experience of the house

The occupants were asked which aspects of the house were most positive and how among a range of domains. Their responses are as follows.

Domain affected	Aspects rated most positive and impacts arising
Children	Having the park next door Having their own space (own rooms) Having their own bathroom gave them a sense of responsibility Children had seen themselves in the paper through living in the NOW Home® John and Jess had noticed a difference in their children's personalities since being in the home: more confident, talk more to people Child's asthma had improved The children liked the solatube in the kitchen "The kids don't want to move, they really like the house"
General comfort	Temperature – comfortable and even Sunlight and natural light
Awareness raising (of their environmental impact and features that made them think most about their behaviour)	Using the compost made Jess realise how much food was previously wasted by being thrown out and led to a reduced food bill and food waste Power bill dropped straight away Amount of water used and the link between rainfall and their water use (based on rainwater tank levels)
Cost savings/household expenditure	Power costs Less rubbish bags used (which cost around $1.65 each in Waitakere City) Having the park next door for the kids meant less entertainment costs
Health	Mental health impacts: "You can't help but be positive, we don't get the winter blues" Healthier in terms of state of mind, feel connected as a family
Safety	The house feels safe but the area feels less safe Kids bike got stolen, no issues otherwise Water tank gets tagged but this gets removed quickly
Interfamily relationships	The change here was referred to as 'huge' in terms of mental health and generally being happier: "The kids were more confident after a week of being here"; "We realised the impact a house could have on the rest of life".

4.5.4 Experience of the neighbourhood

In terms of the local neighbourhood, the features described as being the most positive were having Lynn Mall nearby (local shops), nearby schools, the park, the service station and being able to catch the train. The park also contains a velodrome and the family reported walking more and John and the children used the velodrome. John and Jess noted that it had been good watching progressive changes being made to Olympic Park, including public art and displays, and its increasing levels of use. The family felt comfortable being in the park and socialised there, and had also added a dog to the family in the last six months and took the dog to the park.

The least positive aspects of the park were considered to be local teenagers hanging around causing security concerns and the wind in the area; they mentioned that the wind sometimes took things away such as compost bin lids or washing.

Things they would look for in a neighbourhood in future were more privacy, with no-one being able to look in to the house or yard. While there were positive aspects to living directly next to a local park they would not do this again, mainly for security reasons: "You can't know your noises" living on the edge of a public park.

4.5.5 Description of behaviour and use of the house

John and Jess were asked on a scale of one to ten, with ten being extremely eco conscious and one being not at all, how they would rate their level of environmentally friendly behaviour while living in the NOW Home®. John rated this 5 and Jess 4-5, commenting that "Before [living there] it would have been a minus" and that they were "A lot more aware".

When asked if there were things they could have done to reduce their environmental impact they responded not having so many computers in the house (they had five). John commented that their next car would probably be a hybrid, mainly for economic reasons (ie petrol costs).

If they could have done anything differently in hindsight John commented that they would have taken better care of the garden. Jess however felt that "gardens are not us", and that they were too much hard work.

4.5.6 Any changes in behaviour and attitudes

Changes they had noticed in their behaviour in this house were less use of heaters and the drier and that they had started watching their energy use (even though it increased in the second year).

In terms of ongoing impact of living in the house on the attitudes and behaviour of their children, John and Jess hoped that there would be ongoing impacts, and commented that they

would get the children to continue composting and recycling. The children were perceived to have learnt lessons about having respect for people's property from living in the house, and that they had seen and understood the energy, temperature and water monitors.

In terms of any ongoing changes in their own behaviour and attitudes as a result of living in the NOW Home®, they commented that they:

- Would continue to be more conscious of their waste, including not overbuying and wasting food.
- They would buy less 'things' for the house and value open space more.
- They would buy a hybrid car, though cost savings over time rather than living in the NOW house was the main incentive for this (although their experience of living in the house was considered to be a factor).
- Public transport was now more of an option.

Both John and Jess commented that they now "look at things differently". While not being sure if this was due to living in the NOW Home® or being parents, they felt that they were more aware of what they were leaving behind. Jess commented that they now understood the WA$TED programme on television; they could compare themselves to people on this programme and "get it". Jess commented that "I am not conscious anymore it's just how I am – I just do [more environmentally friendly] things I don't think about them".

4.5.7 Impact of monitoring and research

In terms of whether knowing the level of their energy and water use and that this was being monitored made a difference to their behaviour, they commented that it did not after the first few months. They said that Beacon had made it clear that they should not change their normal behaviour; that they should just do what they 'normally' would and try and disregard the monitoring. The occupants reported enjoying their interaction with Beacon, and that Beacon were careful not to intrude and respectful of their privacy: "Everyone has been considerate".

4.5.8 Suggestions for the future

John and Jess were asked what suggestions or advice they had for future NOW Homes® in terms of the house itself, future occupants, research and monitoring and any other area. In terms of the houses themselves they suggested making sure that the builders are aware that they are not show homes; the finishing was not considered to have been done properly in the house, possibly as the builders thought it was a show home. The concrete floor was highly recommended for future homes, and not having stones around the house that can be brought in.

Suggestions for future occupants of NOW Homes® was to "relax and enjoy"; that occupants need to be fairly laidback and understand that things can change (such as monitoring/technology hitches). If occupants are not keen gardeners or "garden people" then they should "speak up at

the beginning". Overall they commented that living in the NOW Home® had "made a huge change to our lives – occupants should embrace it".

In terms of future research and monitoring, they considered that the monitors were easily integrated into their lives, they don't notice the clicking noise they make and that the children had known not to touch them. They had appreciated the Beacon liaison person and that she had always left something behind in the house for the children when she had visited, to let them know she had been there. Beacon was considered to have been responsive to any concerns: "Beacon respected us".

The media aspects of living in the home had also been "fine" for them, and one of the children's day care centres had put a copy of a media article about the home and the family on its wall. One of the children also got to meet Prime Minister Helen Clark through living in the NOW Home®.

5 Discussion

5.1.1 Occupants experience of the Waitakere NOW Home®

The Waitakere NOW Home® occupants consisted of a higher than average income family of mixed Māori and Pakeha parents and two young boys. They rated themselves as being only "averagely" eco conscious (five out of ten) and their resource use behaviour did not appear to be significantly affected by knowing that their activity was being monitored and examined. Their average yearly water consumption is comparable with Auckland region figures and their general energy and resource use could be described as "average" or "typical".

The fact that their last house was considered to be very poor quality and unpleasant to live in possibly is likely to have increased the felt positive impact of the sustainability features of the Waitakere NOW Home®.

Overall the occupants' experience of this house was extremely positive, eliciting comments such as it being the best house they have ever lived in, not being able to go back to a 'normal' house and being extremely different to previous houses. This feedback can be used positively in publicity for future NOW Homes®. The features that consistently impacted most positively on their experience of the house were (in no order):

- Layout and open plan design.
- Sun and natural light.
- Thermal performance, warmth, even temperature and negligible need for winter heating.
- The concrete floor.
- Reduced electricity costs.

Features added in the second year to address issues identified by the tenants were successful, especially the bathroom ventilation and the kitchen Solatube ventilation system.

The occupants regularly and consistently refer to significant health and wellbeing benefits from living in the house, including decreased levels of ill health, increased children's confidence, enhanced interfamily relationships, a supportive environment when health problems occur (such as migraines), a low noise environment and generally feeling "happier". Living in a quality house also supports an active social life and entertaining, with the occupants reporting significant growth in their entertaining and visitors also enjoying being in the house.

The occupants reported becoming more aware of the positive impact a good house can have on individuals and the family as a whole, as well as the negative health and wellbeing effects of living in poor housing (based on their previous house experience). The impact on household relationships and mental health and wellbeing of living in more sustainable housing is a rich area to explore in future NOW Home® research.

Features or experiences that were less favourable were as follows:

- Stones from outside being carried in, which can easily be addressed.
- Overheating in some rooms, which was addressed by installing a Solatube ventilation system.
- Moisture in the main bedroom, which was addressed by putting an extractor fan in the ensuite bathroom.
- Quality of some of the build work.
- Breakfast bar and kitchen partition being too high.
- Lack of privacy from neighbours.
- Security issues due to being located on a public park and lack of surveillance.
- Problems with not knowing when the water in the rainwater tank was running out, which was addressed through adding a rain gauge.
- Not enough power points and phone jacks.

In terms of the neighbourhood, proximity of shops and schools was rated highly, along with having the park nearby and public transport. Less positive aspects were being exposed and lacking in privacy, along with some security concerns related to the adjacent park and local area.

5.1.2 Impact on awareness and behaviour

The occupants became more aware of their energy and water use but this did not necessarily impel them to use less; in fact energy use went up significantly in the second year and there was a general increasing trend of energy use. This reinforces the point that awareness does not necessarily lead to behaviour change. Increasing energy use was due in part to increased working from home by both adults; high use of a big screen TV and entertainment system and a high number of computers. The significant cost of having an electronic office at home was made apparent by the NOW Home® occupants' experience.

The areas where behaviour changed most consciously for the tenants were a reduced need to heat their house in winter and kitchen composting (specifically for Jess), where the strongest driver was primarily to waste less food and secondly to reduce the food bill (economic and environmental drivers).

The occupants reported increasing their understanding and awareness of environmental and sustainability issues through living in the house and that this led to easily assimilated small scale changes in behaviour such as composting and recycling ("I don't think about it I just do it"). Living in the NOW Home® also opened doors to different behaviour, including increased public transport use, buying less for the house, more conscious consumption and considering purchasing a hybrid car.

Economic drivers were a strong lever for this family and will be for others, supporting the need to make a stronger economic case for the benefits of sustainability features.

Their NOW Home® experience also had a significant impact on their choice of future house, with their key criteria being features which impact most on comfort, family interaction and health: sun and natural light, insulation and warmth, lack of damp and moisture, good flow and layout.

6 Conclusions

This report has reviewed the social research relating to the Waitakere NOW Home®, based on occupants' use and experience of the home. It has found that their experience was overwhelmingly positive and had marked impacts on their attitudes, with less clarity on the impacts on their behaviour and how this might unfold. Their experience however has provided valuable insights for the Home*Smart* Homes programme, both for the development of new houses and the monitoring and research associated with them.

The challenge now is to implement the suggested changes and to develop a robust research programme that provides deeper insights and understanding of the complex relationships between attitudes, experience and behaviour to support more sustainable living and action.

Specific lessons for future NOW Homes® and related research are as follows.

6.1.1 Lessons for future NOW Homes®

Key lessons from this research for future NOW Homes® from the point of view of the occupants are as follows.

- Do not have stones or shells outside the house.
- Continue to use concrete flooring.
- Ensure passive ventilation via window security latches or other systems.
- Use extractor fans in bathrooms and solatube ventilation in kitchens.
- Ensure quality control of the build work.
- Lower any breakfast bar and kitchen partition.
- Use screening, permeable fencing and planting to add privacy.
- Add a rain gauge and install larger rainwater tanks and an automatic switch between mains and tank supply.
- Ensure adequate power points and phone jacks.

The Waitakere NOW Home® design was well regarded by these occupants in terms of orientation (north facing), open plan design, good use of space and indoor/outdoor flow. From their point of view a slight increase in the living space area would have been desirable, plus a fourth bedroom or separate study area.

6.1.2 Lessons for future research

The major research emphasis for the Waitakere NOW Home® was on the physical performance and use of the house. In future research more focus is needed on:

- Understanding occupant attitudes and behaviour before they move into the house or as they move in, to benchmark shifts in perceptions and actual behaviour. This involves canvassing expectations of the occupants at the first interview, to gauge their initial expectations, attitudes, behaviours and assumptions and see how these change over time, based on their lived experience in the house. It includes identifying what occupants see as most important to them in a house in the first interview, and seeing if this changes over time.
- Exploring the links between experience, awareness and behaviour, and what drives behaviour change.
- Probing reasons behind behaviours, for example in this case more detail on why energy use increased in the second year.
- A stronger focus on the health and wellbeing aspects and impacts of living in the house, including the impact on relationships and mental health.
- Perceptions and interaction with the surrounding neighbourhood.
- Capturing children's views, or those of all occupants.

The above indicates the desirability of a baseline survey at the very start of the occupancy, and then a further survey or research process at six months and twelve months (and possibly six monthly or annually thereafter). The first survey would focus on capturing current behaviour, attitudes and expectations, with future surveys exploring changes in these and actual behaviour, plus seeking information to interpret what is coming through in terms of the physical monitoring data. All surveys should be undertaken face to face, preferably with the same researcher to develop rapport and build trust, and should be recorded.

It is essential to form a good relationship with occupants to ensure smooth access and operation of the research and monitoring. For example French et al note that good communication with the occupants is essential when 'things go wrong', as they did frequently with the technology to record data from the house (2007:10).

It would be useful to interview John and Jess again in six to twelve months time, to allow reflection on their experience and identify any ongoing impacts regarding their attitudes and behaviour.

Overall, a standard comprehensive monitoring and research programme needs to be developed for the Home*Smart* Homes programme that reflects the suggestions above. More creative research methods could also be explored for this programme, including photovoice techniques, self-assessment and/or story based techniques.

7 References

Easton, Lois (November 2006), PR109 *Defining the Benchmarks for Beacon's High Standard of Sustainability,* prepared for Beacon Pathway Limited.

French, L., M. Heinrich, R. Jaques, C. Kane and A. Pollard (March 2007), *NO102 Waitakere NOW Home: First Year of Performance Monitoring*.

Pollard, A., L. French, L. Heinrich, R. Jaques and J. Zhao (November 2007), *Waitakere NOW Home: Second Year of Performance Monitoring* (Draft).

8 Appendix A: Post Occupancy Evaluation Survey

This survey was used in year one of the occupancy (September 2005 to November 2006).

Questions

Your Household

1. How many people (both adults and children) have lived in your household for **all of** the last 3 months? How many adults (over 18)? How many teenagers (13 – 17)? How many children (under 13)? [NOTE ANY CHANGES ETC]

Your Overall Rating

2. Thinking about the house and living in it overall, on a scale from 1 to 10 (SHOW SCALE), where 1 is 'not at all' and 10 is 'extremely' different, how does **living in this house** compare to other houses you have lived in overall? [ANSWER AS HOUSEHOLD]

3. And on the same scale from 1 to 10, overall how much better or worse is it living in this house? [ANSWER AS HOUSEHOLD]

[IF HOUSE IS RATED '1' or '2' FOR Q. 2 or Q. 3 (I.E. MINIMAL DIFFERENCE), SAY YOU'D LIKE TO ASK SOME QUESTIONS TO EXPLORE ANY DIFFERENCES THEY CAN THINK OF, EVEN VERY SMALL ONES.]

The House

4. Comparing this house to other houses you have lived in: what specifically makes **the house itself** different in any way for you and your household (as a house)?

Living in this House

5. What specifically makes **living in this house** different in any way for you and your household?

6. Thinking about these differences. What are the effects of these differences for you and your household? [PROMPT ON DIFFERENCES MENTIONED IF THIS HELPS]. The effect of having [DIFFERENCE] is ....

7. So what do you gain by living in this house? What do you lose by living in this house?

Specific Features of This House

8. Which of these features (SHOW CARD) are making a difference for you?

9. Of those you chose, what difference does each make – what are the positives and negatives?

10. On the same scale, how much difference is this? [ONLY RATE ONES THAT ARE MAKING A DIFFERENCE]

Data

Your Household

1.	Total people _____	Adults _____	Teenagers _____	Children _____

Your Overall Rating

2.	Different _____	3.	Better _____	Worse _____

The House

4. Differences in the house itself

Living in this House

5. Differences in living in house	6. Effects	7. Gain	7. Lose

Specific Features of Living in this House

Aesthetics

1. The looks from the outside
2. The look from the inside

Space

3. The spaciousness
4. The interior layout
5. The indoor-outdoor flow

Privacy

6. Privacy from neighbours and people outside
7. Privacy and personal times and places within the house

Comfort

8. Cool in summer
9. Warm in winter
10. Heating needs

Airy

11. Fresh, airy feel
12. Easy to get good air flow

Lighting

13. Natural light (day time)
14. Lighting (night time)

Noise

15. Road noise
16. Noise from people inside the house
17. Noise from appliances

Security

18. Feeling safe and secure

Running Costs

19. Water bills
20. Electricity bills
21. Phone bills

Water

22. Solar water heating
23. Tank water

Ways of dealing with rubbish

24. Recycling
25. Composting

Other Features

26. Grab rails
27. Wide doorways
28. No-step shower tray
29. Extractor fans
30. Concrete floor

Things the Household Does

31. Using the clothesline
32. Using public transport for shops, schools or work etc
33. Walking to shops, schools or work etc
34. Cycling to shops, schools or work etc
35. Growing your own veges

Features	Positives	Negatives	Score
1. The looks of the outside			
2. The looks of the inside			
3. The spaciousness			
4. The interior layout			
5. The indoor-outdoor flow			
6. Privacy from neighbours and people outside			
7. Privacy and personal times and places within the house			
8. Cool in summer			
9. Warm in winter			
10. Any other heating or cooling needed			
11. Fresh, airy feel			
12. Easy to get good air flow			
13. Natural light (day time)			
14. Lighting (night time)			
15. Road noise			
16. Noise from people inside the house			
17. Noise from appliances			
18. Feeling safe and secure			
19. Water bills			
20. Electricity bills			
21. Phone bills			
22. Solar water heating			
23. Tank water			
24. Recycling			
25. Composting			
26. Grab rails			
27. Wide doorways			
28. No-step shower tray			
29. Extractor fans			
30. Concrete floor			
31. Using the clothesline			
32. Using public transport for shops, schools or work etc			
33. Walking to shops, schools or work etc			
34. Cycling to shops, schools or work etc			
35. Growing your own veges			

Not at all									Extremely
1	2	3	4	5	6	7	8	9	10

9 Appendix B: Exit interview guide

Waitakere NOW Home – exit interview with occupants
Question schedule

February 2008

Introduction

Thank you for meeting with me, this is an 'exit' interview and you are encouraged to be frank. The focus of past research with you has been on physical performance of the house and your use of its features. This interview is more about exploring your experience of living here, including whether living here has affected your attitudes and behaviours and how the NOW Home experience can be improved in future. This is a chance to say what has been meaningful about being here and to reflect on how it has affected the way you think and act.

Context of household and impact on how you use it

Start by looking at type of household you are and how that affects your use of the house.

1. What for you are the main factors affecting how you use the house (eg children, work life, priorities, lifestyle, income etc)?

2. Have any of these key factors changed over the time you have been here (any work changes etc)? Probe when moved computer desk into living space. Impact of home office, impact of security concerns on use of outdoor area.

House itself

3. The features you have most appreciated include layout of the house, use of space, indoor/outdoor flow, temperature and the concrete floor – any changes/additions want to make to this? Probe: still happy with the concrete floor?

4. The features you have least appreciated include pathway stones coming into the house, quality of some build work eg lack of phone/Internet points, breakfast bar too high, lack of privacy from neighbours, condensation on master bedroom window - any changes/additions want to make?

5. You have just bought a new house, did your experience of the NOW house influence your choice in any way? If so, how?

6. Do you have plans to retrofit or renovate your new house, and if so what is the priority/ies?

Experience of the house

7. What features would you rate most significant and positive for:
   - Children
   - General comfort
   - Awareness raising (of environmental impact, what made them think the most)
   - Cost savings/household expenditure

- Health
- Safety
- Interfamily relationships

8. Probe here particular issues of interest to Beacon:
   - Did the overheating situation improve with the changes made or did it remain an issue?
   - Was the house too hot over December/January?
   - Did you use your heater, drier and electric blankets last winter? What led you to buy a drier and electric blankets in the second year?
   - Did the passive ventilation work?
   - Any improvement from the Solatube ventilation?
   - Any issues with internal layout of house? Did the second living area remain useful or would you have preferred a different arrangement?
   - Did having a gauge on the rainwater tank telling you how full it was make any difference?
   - Also having the solar hot water controller, did that make any difference, better or worse?

Experience of the neighbourhood

9. Can you describe your relationship with the surrounding neighbourhood in the area (eg Ecomatters, local park, transport etc)?

10. What have been the most positive aspects of the neighbourhood/living in this area?

11. What have been the least positive aspects of the neighbourhood/living in this area?

12. What will you look for in your local neighbourhood in future?

How describe your behaviour/use of the house

The next few questions are about how your own choices and behaviours relate to the features in the house.

13. On a scale of 1 to 10, with 10 being extremely eco conscious and 1 being not at all, how would you rate your level of environmentally friendly behaviour while in this house?

14. Are there any things you could have done to further reduce your environmental impact?

15. Is there anything that you would have done differently in hindsight?

Any changes noticed in terms of your behaviour and attitudes

16. Did you notice any changes in your behaviour <u>in this house</u> to previous houses (eg water and energy use)? Did you do anything differently?

17. Do you feel that living in this house will have any ongoing impact on the attitudes and behaviour of your children?

18. Do you feel that there may be any ongoing changes in your own behaviour from living here?

19. Has living in this house made any difference to your attitude towards:
    - What you buy/consume
    - Transport
    - The environment
    - Other

Impact of monitoring and research

We are interested as to whether the fact that people know their use of the house is being monitored makes any difference, and how this feels for people. Beacon is also very aware of how helpful your family have been, with open days, allowing people access to equipment and people like me to ask you questions (much appreciated!).

20. Did knowing the level of your energy and resource use make any difference to your behaviour? For example, did the Centameter change your behaviour (eg turning things off) and how long did changes last?

21. What difference did knowing you were being monitored make to your to behaviour (if any)?

22. Is there anything Beacon could have done to make the experience of living in the house better or more rewarding (eg education, training, ways to make process smoother, reduce impact)?

Recommendations for the future (house itself and research/monitoring)

23. Do you have any suggestions or advice for future NOW homes in terms of:

- Houses themselves (things to change etc)
- Occupants or potential occupants in these houses
- Research, monitoring, questions, issues to cover?
- Anything else you would have done differently?

24. Any further/final comments? Any issues you feel have not been covered?