NO101/1

Peer review of the NOW Home project for the Beacon Consortium

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1. Summary

1.1. Project and Client

The project was to prepare a peer review of the "NOW Home" project at Olympic Place for the Beacon Consortium. Documents provided by the client included the following:

- Detailed Brief for Olympic Place NOW Home", dated May 2003
- Summary sheet of performance specifications targets and measures of success
- Design drawings Sheets A1 to A10 dated 12 December 2004.

1.2. Project Aims

The project aims are to provide a reasoned critique of the NOW Home project, based on the project material provided by the Beacon Consortium. The review will include comments at all levels, from the overall project aims, standards and goals, to the detailed realisation of the design.

2. Comments on the Document 'Detailed Brief for Olympic Place NOW Home' *(reviewer's comments in italics)*

Comments follow on the document 'Detailed Brief for Olympic Place NOW Home', dated May 2003, which has been read in parallel with the design drawings and with an outline material specification. (My comments on the Detailed Brief are in italics).

2.1 The NOW Home project aims to research and encapsulate what we know today about best practice in meeting the needs of the next decade – the 'post-Kyoto'[1] society. Identified should be: preferred design processes, design ideas and also identifiable gaps in the knowledge.

I agree that appropriate design processes and design ideas need to be discussed. For example, did the Beacon team look at how some of the existing successful "Now houses" – i.e. houses that achieve post-Kyoto goals using current technology – from the last, say, 10 years, were designed and constructed elsewhere? However, perhaps more importantly, the statement of Project Aims 1 also assumes there are gaps in the knowledge, but there is no evidence for these gaps. My argument would be that the gaps lie purely in the execution – i.e. we already know how to build the post-Kyoto house, but we seem, as a society, to lack the desire or the will to do it.

2.2 The project aims also to demonstrate this via one possible built solution on a given site.

[1] 'post-Kyoto' refers to the time period after the 2012 reporting period under the terms of the ratified Kyoto protocol. It indicates a time period 10–15 years hence, whereby certain societal changes have been anticipated due to both lifestyle and demographic trends and indicators, as well as the Government regulatory environment that will affect both consumers and industry players.

Yes, this is a good practical and achievable outcome. It is well worth building one example, although it is obviously more useful to build a group so performance monitoring inconsistencies can be evened out, and the builder's economies of scale can be brought into play.

2.3 The built demonstration house will not be a show home, but rather is an attempt to physically represent best practice, in order to assess gaps in meeting the needs and therefore set research priorities for future housing projects.

There is much emphasis on "best practice", which is a worthy goal. However, there is no apparent clarification to show how best practice was arrived at, or why the chosen practices/details/specifications/etc. were assumed to be the best available. From the viewpoint of an experienced external observer, there is very little about the NOW Home that could be considered best practice. It is in many cases slightly better than current New Zealand practice, but that is not the same thing.

2.4 While recognising the limitations of studying a single house in isolation, the project will also install adequate provision for energy, thermal, water and moisture metering (wired-house) for evaluative purposes; and study waste streams and labour processes during the construction process.

Good, this will be useful, even though results are from only a single house.

2.5 All system decisions will be the most appropriate for the situation with regard to the following filter elements (as described in Appendix A: Filter Elements):

- Affordability (capital and running costs)
- Resource use (labour, land, transportation, sustainable and renewable materials)
- Energy efficiency (operating and embodied)
- Desirability (heritage, fashion, comfort and aspiration)
- Performance (durability, seismic, fire, wind-loading) also Future-proof (functional needs, flexible design, maintenance needs)
- Water and Waste management (minimised city-supply water usage, reusability and/or recyclability)
- Personal Health (physiological, safety and security, peace/relaxing (mental))
- Community Health – (social cohesion, neighbourhood etc)

The filtering factors are all quite worthwhile, but this list glosses over the really hard question of prioritising the filters. See comment below for Item 6.

2.6 None of the above filter elements is to be regarded as any more, or any less important than any other filter element.

This idea of no filter element being considered any more important than any other is very much a 'politically correct' comment, but it also tends to ignore the whole 'post-Kyoto' aspect of the project. In a world short of fossil fuels, things like fashion, heritage and aspiration may not seem terribly relevant, particularly when fashion in particular is such a changeable factor. Similarly, how can affordability be judged if current fuels are no longer on

the market? This house is going to be there long after oil and gas are no longer available. Consideration of current affordability may not be a very rational way of dealing with the longer term situation that this house, and all other houses, will face. There is a real need for the filter elements to operate in some sort of hierarchy, for example, the principle might be that all decisions had to demonstrate improved environmental sustainability before any other factor could be brought into play.

The second issue that needs to be raised in connection with the filter elements is that the list is in some ways biased unfairly against environmental sustainability. Most of the items in the filter elements list are things that any house has to deal with. The items in bold below are the ones it could be argued are special to the NOW Home, as opposed to any conventional house.

- Affordability (capital and running costs)
- **Resource use (labour, land, transportation, sustainable and renewable materials)**
- **Energy efficiency (operating and embodied)**
- Desirability (heritage, fashion, comfort and aspiration)
- Performance (durability, seismic, fire, wind-loading) also Future-proof (functional needs, flexible design, maintenance needs)
- **Water and waste management (minimised city-supply water usage, reuseability and/or recyclability)**
- Personal Health (physiological, safety and security, peace/relaxing (mental))
- Community Health – (social cohesion, neighbourhood. etc.)

If all the filter elements are of equal value, then the environmentally sustainable parts of the design could easily be outweighed by considerations of the other filter elements. This might not be a useful outcome for the project. It certainly reduces the clarity of the concept. It might have been better if the filter elements had dealt only with those areas in which the NOW Home planned to make measurable improvements.

2.7 The project will reflect the Vision throughout: be inspiring & affordable (appeal), healthy and resource efficient (sustainable), smart, innovative and marketable (education) and fit for purpose for the needs of future 'post-Kyoto' society (performance).

The "Vision" is not given in this document, so it is harder to make comments. However, there seem to be some slightly odd assumptions here. I agree the house needs to be affordable, and this is easy to measure, but how is its inspiring quality to be measured? Who will assess the degree to which the house manages to be inspiring? Similarly, it is possible to measure the resource efficiency in terms of both embodied and operational resources, but how can one measure whether the house is healthy? And is a conventional modern house noticeably unhealthy? Are there any statistics to demonstrate that? I am not here talking of damp, mouldy and cold older houses, but a new house built to the current Building Code standards. Is claiming a house is healthy too much like the spurious health claims made by the purveyors of patent medicines, or of various unproven alternative therapies? There are certain rules governing the claiming of health benefits for foods and dietary supplements – do these rules apply in the case of houses? How is the smartness of the house to be assessed, or its innovative character? And is innovation, per se, of any value? The use of monolithic claddings on untreated timber framing might be said to have been innovative in the housing market, but was it an innovation that had any benefits to society in the longer term? The real

estate industry would probably claim that marketability could be measured, so that is perhaps legitimately included here. The final item, "fit for purpose for the needs of future 'post-Kyoto' society" could also be measured, but the needs of this future society would have to be defined first.

So we have two lists here, one of things that can be measured and that are reasonably objective, where it is possible to say the house achieved such-and-such an improvement in performance, and then a range of things that are very vague and are seen as aspirational for the design team. The trouble with the second set of items is that because they are so hard to quantify, it will be very easy for the design team to claim they have been achieved. One could end up with a house that was "inspiring, healthy, smart and innovative", which would all sound really good, but it could be in terms of overall environmental impact no better than a typical modern house. This would not be a desirable outcome.

2.8 House design will need to provide a 'meaningful' house to reflect NZ character and values.

This idea of meaningfulness is another of the vague areas that it is particularly hard to define. In what way will the NOW Home be any more, or less, meaningful than a conventional house, and who, other than the design team, will be able to demonstrate that the appropriate degree of meaningfulness has been achieved? Is there, in this category, any allowance for the changing of meaning? If, for example, the public were to be offered a "house with no bills" would that change their perception of other meanings or their perception of overall attractiveness of a design? I have experience of this happening in the design of ultra-low-energy social housing, where the meaning of minimal running costs changed people's opinions of the meaning of other less quantifiable factors.

2.9 The house is being designed with the average New Zealand family in mind. The costing is therefore something which is within reach for most (with a 10-20% deposit), but for which they will still need to save and work quite hard towards obtaining.

This is good, and very clear. There could perhaps be some consideration of the idea that lower running costs might permit higher mortgage borrowing (provided of course that there are likely to be any significantly lower running costs).

2.10 The completed construction will be finished with interior chattels such as that of a vacant possession sale, with modest exterior landscaping. Appliances to be included in chattels include an oven, a dishwasher.

This also makes excellent sense, provided the appliances chosen are the most energy-efficient that can be obtained. This is not made clear in the text here. As space and water heating demand are reduced, the energy consumed by 'lights and appliances' becomes of increasing significance. In terms of chattels for example, not mentioned is a refrigerator/freezer. This is one of the larger energy consumers in the home, and the choice of a European A+ or A++ rated appliance could save something like 450 kWh per annum on the annual electricity consumption of the house. Presumably lighting will also be provided, with compact fluorescent lamps at least, if not leds? Also of importance will be appliances with low, or nil, stand-by power consumption – at the very least all items such as tvs, dvd players, computers, etc., need to be EnergyStar compliant. Perhaps the educational value of the house would be

enhanced if it can be shown to the public with a wider range of appliances than just the barest set of chattels in place.

2.11 The NOW Home is about building a home requiring whole house considerations in terms of Function, Light, Indoor Air Quality, Safety and Security, Cost, Warmth, Acoustics, Aesthetics, Energy Use, and Environmental friendliness. The benefits of this house will be a home that is: of higher quality, more comfortable, safer, quieter, requiring less maintenance and is more durable incurring lower monthly operating costs to support a state of complete physical mental and social well-being for its occupants.

Many of the things in this list can be measured and demonstrated to be in place, although Function, Safety and Security are difficult, there are at least proxies for these that can be shown to be in place. The durability will not be known until the house has been there for 20 years or so. However, the last part of this statement is somewhat surprising. Can a single house really offer its occupants "complete physical mental and social well-being"? This is an absurd idea. It is, after all, only a house.

2.12 Aim to use the least environmentally-damaging and resource-intensive materials.

Yes, this can be assessed and demonstrated, although this too is an area where there are often a lot of unsubstantiated claims.

Values
There is a strong sense on reading these values and comparing them with the design drawings that the intentions, which are often good, have far exceeded the scope of the final outcome.

- Setting a benchmark for best practice.

Is the final design of the NOW Home really best practice? Against what criteria is best practice being judged? This point is of key importance and does not appear to have been clearly addressed in the NOW Home programme.

- The performance requirements are better than Code minimum.

This is a good aim, but the more important, and unmentioned aspect is "how much better"? Being a little better than the Code is not really best practice.

- Make the best decisions possible given appropriate and reasonable analysis. (Remember the 80:20 rule).

Yes, I agree with this aim. It is never possible to have enough data to make perfect decisions, but it is still possible to make good decisions that can be supported by argument.

- Describe your goal, how will you measure success and how will you confirm success.

This is very important, so that decisions are made in a logical and supportable fashion. This aim seems at odds with some of the highly subjective criteria listed under the Project Aims above. How is success to be confirmed in areas such as smartness, or meaningfulness?

- Behind every decision is a story – ensure your story is in the log.

It would be fascinating to see this log – was such a document ever produced? Is there indeed a record of how and why each decision was made? To an outside observer, some of the decisions seem quite wilful.

- Making a mistake is forgivable, not trying is not forgivable.

Yes, this is good, but somehow this noble statement of values seems totally at odds with the final outcome of the project, which seems very much a case of 'not trying'.

- The best personal ethics – we do not accept personal gifts – any gifts to the project are officially notified and recorded, and included in the budget.

It is important that the presentation of gifts to a project is not allowed to drive the design in any way. This appeared to happen in the case of the Waitakere Ecohouse some years ago, which ended up with a very inappropriate set of appliances apparently because they had been donated.

- All material and system decisions to be run through the decision filter.

This is good in principle, except that the operation of the filter is open to criticism (see above) owing to its lack of prioritisation, leading to lowest common denominator solutions.

- Unless there are strong reasons why not we use New Zealand-based biologically-derived sustainable and renewable resources.

Yes, this is a good sound aim, which will help to improve long-term sustainability.

- It is difficult that's why we have the best team.

If it was the best team, why is the outcome so disappointing? And is it really so difficult to do what has been done in Germany, Holland, Canada, Denmark, UK, Australia, etc., many years ago and many times. This is not, as they say, rocket science. My suspicion is that it may be precisely because of the team approach that the outcome has been far less inspiring than it might have been. Eleven people are listed on the front of the Detailed Brief document – far too many people to design a simple house, because all decisions will tend to come down to the lowest common denominator, to the ones the whole team feels able to approve. This is probably not a good way to achieve innovation. In design, the memorable and successful outcomes are generally the work of one or two people, albeit with input and advice from others, but not with a large team trying to interact over a small project. For example, some of the most successful car designs, (and a car is far more complex than a little wooden house) are basically the work of an individual, such as Alec Issigonis (the Mini, the Morris Minor). Are any really good designs the work of a committee?

- You CAN be SMART and INNOVATIVE within a NOW framework.

Yes I agree completely, but if that is the case, why is the NOW Home apparently neither smart nor innovative (setting aside for the moment the discussion as to whether smartness or innovation are of themselves desirable goals)?

These Values seem very much grander than the design that has resulted from them. It is as if a moon landing has been promised, but the astronauts have ended up landing in Wellington. This can be seen in the useful table (below) that attempts to provide criteria for demonstrating that success has been achieved. Somehow, the NOW Home that has resulted from this process does not seem nearly as good as the table below, the aims and intentions of which are admirable, suggests it is going to be.

Success	Performance indicators.
A HOUSE that sets a new "benchmark" for understanding sustainability in the framework of affordable and desirable.	▪ Detailed performance criteria with at least 90% of these criteria met. ▪ We break the mould – eco and sustainable are affordable and desirable ▪ National interest in the house is very high ▪ We achieve innovation within a NOW Framework.
A HOUSE that requires significantly less water, energy, resource to operate than a "typical" house.	▪ We achieve 60% of "typical" resource demands.
We will have created a decision framework that we can build into a powerful future tool.	▪ We have developed a baseline decision filter system. ▪ We will have developed a sustainable framework of real and meaningful value.
We will have exposed knowledge gaps.	▪ Created a log of key issues relating to buildings that are otherwise not dealt with.
Created opportunities for the future.	▪ A list of great ideas ready to be tested in retrofit or new build solutions.
We know why we have made ALL decisions.	▪ Every decision and issues affecting those decisions are documented.
We have created a platform that will set precedents for House design.	▪ Developed a system for House design ▪ Set protocols for design focussed on sustainability.
We have captured the attention of the Nation.	▪ Media exposure ▪ Web hits ▪ Demand for information.
We will achieve significant and sustained change in the thoughts, behaviour and uptake of ideas of all people effected throughout the residential value chain.	▪ Code changes and bylaws reflect project aims and outcomes ▪ People come to us as the source of best practice in residential building

3. Comments on the Summary sheet of performance specifications targets and measures of success

Comments are made only were they seem to be relevant, so not all categories are covered. Where there is no comment it is the reviewer's opinion that the category is adequate.

"Operating costs": the question is what is the reason for choosing half the EECA national average figures as the benchmark? The national averages cover houses of all ages and with a wide variety of floor areas. Would it not have been better to make the target for the NOW Home half the energy bills of an equivalent house, of the same floor area, built to the current NZ Building Code? Using the EECA averages makes the target seem rather weak, as the house buyer could probably achieve most of the performance benefit of the NOW Home merely by buying any new house.

The "Thermal" target is good, clearly expressed and to a high standard.

"Water consumption" of around 90 litres per person per day does not seem to have any particular basis. It might have been preferable to make it half the consumption of a typical modern house, using the same analogy as for the operating cost. In addition, it is not clear if this consumption is partly from the public supply and partly from a rainwater tank. It would be clearer if the water consumption target were purely for water from the public reticulated supply; any rainwater use would be part of a design target rather than an operational target.

"Energy consumption" less than 5070 kWh/year does not sound like a very low consumption for a moderately small house that is attempting to be energy-saving. Again, the idea of using national average data is questionable, as it fails to compare like with like. The appropriate basic figure to use would be the consumption of the same house if built to the current Building Code standards.

"CO_2" is pretty high for a post-Kyoto house. A new Building Regulations compliant house in the UK is estimated to emit 4400 kg of CO_2 per year, and this is in a climate that is much colder than NZ, and with full central heating to all rooms running for 7 months of the year. The issue of carbon dioxide also points to the need for NZ generating companies to offer renewably generated 'Green Power' as they do in Australia and the UK. This would be a straightforward way to reduce the emissions associated with electricity supply.

"Materials" are marked TBA. This bears out some of the problems discussed above, in terms of the difficulty of measuring many of the criteria that have been chosen.

"Waste" is good, in terms of both construction waste and household waste.

3.1 Design Constraints

This list is of things that are described as "uncompromiseable Givens". Most of them seem appropriate, but the one headed "Utilise solar water heating circulation system and thermal mass storage for under-floor or preliminary water-heating" seems odd. Why is this a 'given' when it is only one possible design strategy for achieving reduced energy consumption? In

terms of overall energy consumption, underfloor heating might be thought a rather foolish idea. This appears to be sloppy thinking.

The next item mentions a "passive solar panel" for water heating. Is this ruling out a pumped solar hot-water system? If so, this appears to be another example of sloppy thinking. There would need to be a detailed analysis of the advantages and disadvantages of pumped (mains electric compared with direct pv) versus thermosyphon solar water heating, in terms particularly of standing losses from the hot water storage cylinder.

The next part of this Peer Review provides comments on the detailed proposals under a range of headings. The Beacon headings are given in bold text here. Where no comment is provided, the proposal is considered appropriate.

3.2 Site including security and privacy

"Using odd shaped areas and different ceiling heights can create different moods – intimate or public." This is terribly unconvincing; is there any evidence for this statement, or any evidence that the desired moods cannot be created solely with paint colours, furnishings, curtains, etc.? This aim has implications for the cost of the house, as it will always cost more to make more complex shapes in both plan and section. In thermodynamic terms, the more corners there are in the building the greater will be the heat losses. On the other hand, the creation of 'odd shaped areas' in the external spaces has been achieved easily by the diagonal location of the house on the site. This is a simple no-cost option that has been successful.

3.3 Accommodation

"Total running costs including cleaning materials to be significantly better than the local average for affordability." This is a most problematic aim for several reasons, as set out below:

a) Cost is no measure of environmental impact. Cheap cleaning materials and paints, particularly manufactured ones, are often more environmentally damaging than more expensive ones.

b) One could use very cheap non-manufactured cleaning materials such as bicarbonate of soda and vinegar, which are also relatively environmentally benign, but this then gets into the area of behaviour, and behaviour modification. How is the project going to deal with this?

c) How is it possible to make comparisons between one person's standard of maintenance and cleanliness and another's? It is easy to measure temperature and to compare that with energy consumption, but very hard to measure some of the other items that make up the running cost of a house. For example, the degree of cleaning will have a large impact on the consumption of materials. The cheap but 'green' materials often do not clean as well as the 'chemical' ones, or they take more time to use; how can this be factored into a comparison?

d) Behaviour modification also applies to energy considerations. It is possible to make good use of a solar water heater by choosing to have long showers only when the water is hot, and to manage with short showers or with a wash in the washbasin when there has not been much solar radiation. If the residents of the house decide that they want 15-minute showers at any

time of the day or night, regardless of the temperature of the hw cylinder, they will make much more use of the electric back-up heater.

e) The behavioural aspect also applies to appliance use. Perhaps the largest item is the laundry. A washing machine used only with cold-water detergent and only with a full load is likely to save 500 kWh per year, or roughly 10% of the NOW Home design target. Savings, albeit of a lesser nature, will be made by turning off lights in unoccupied rooms, not leaving the door of the fridge open, etc.

The question is, will the behavioural aspects of the overall operation of the building be measured, and if so, how will they be measured?

"Future-proofing requirement. Anecdotal evidences that older homes do not have adequate room for installing newer, larger items of furniture (esp. entertainment centres, queensize beds and lounge suites) with ease." It would have been very useful for this reviewer to see plans with furniture layouts drawn on them, to demonstrate possible layouts, and to show that real items of furniture (using dimensions from the Freedom Furniture catalogue or similar) will fit into the house.

3.4 Structure and materials

"Roof needs to be supported in such a way as to maximise open plan living space, and also allow all internal walls to be non-loadbearing." This would have been a very good idea, not only does it make the plan much more flexible by allowing future internal changes, but it also substantially reduces the foundation costs. This was not achieved in the final design.

3.5 Waste management

"The design should provide for grey water reuse for garden and flush-toilet uses." I would be very wary of grey water reuse for toilet flushing. It goes wrong very easily and is very likely to create extremely negative responses in residents because of the resulting smells. Better to use rainwater for toilet flushing. Putting grey water on the garden is less of a problem, although it does depend quite considerably on what kind of detergents, cleaners, etc., are used in the house. According to work done by the ATA in Melbourne, many of the available detergents, etc., are not good to put onto garden plants.

3.6 Fire

"A built-in sprinkler system be plumbed in as well as hard wired (and linked) smoke detector system which is properly positioned." The electricity consumption of hard-wired mains-operated smoke detectors can be remarkably high, particularly in the context of a low energy house. They are also, in this reviewer's experience, very hard to stop when they go off accidentally, so householders are more likely to disable them permanently after a couple of 'false alarms'. This then results in overall lower fire safety. What is the perceived problem with battery operated smoke detectors, which are cheap (therefore easy for people to repeat in their own homes) and can be obtained with an override button for false alarms? It seems odd, in a house where cost is of primary importance, that the cheaper and familiar solution has been replaced with an expensive option.

3.7 Air quality

"Any garage detached from house or cross-vented". The inclusion in the final design of an internal garage separated from the house by a single sliding door seems to be a very unfortunate outcome.

In a later section it states that LPG is the preferred cooking option (included here because it is an air quality issue). This seems like a very bad idea. The use of a gas cooker ensures all the products of combustion escape directly into the house, causing major air quality and moisture problems. An extract hood can be provided, but will the residents make use of it? There is a direct comparison here with smoke detectors – hard-wired smoke detectors are called for, presumably because the residents cannot be trusted to change the batteries in conventional smoke detectors, but they are assumed to be able to be trusted to use the extract hood when cooking. In terms of overall risk, the residents will be exposed to harm from the combustion products of gas cooking every day, whereas they may never experience a house fire in their entire lifetime.

4. Peer review of the final design, based on the design drawings Sheets A1 to A10 dated 12 December 2004 *(reviewer's comments in italics)*

The objective of the peer review as stated in the original contract is to:
"Conduct a peer review of the final design (which will include full materials, fittings and colour scheme), providing a more detailed critique with changes and suggestions for enhancement in further designs given a different budget, site and footprint."

For Beacon's purposes, this would entail giving an expert opinion on the following:
a) How well does the final house design (layout, envelope materials and landcscaping) meet the following design specification goals as outlined in the design brief:

4.1 Site

1. Provide a safe and secure area, with residential 'peace of mind', to keep safe the most precious things – family and assets
It is very hard to say if this has been achieved, but certainly the site plan is quite attractive. It is not clear from the drawing whether the lawned areas are in some way separated from the front of the house so that small children can be allowed to play in the garden without going out onto the road. The use of low fencing at the front allows good visibility combined with a sense of enclosure to keep children and pets in and or out. Security of small children is vital, particularly as they delight in running or riding in circles, so are likely to want to go right round the house.

2. Balancing exposure and seclusion to give both inter and intra house privacy
Putting a window down to floor level on the front elevation to the street is perhaps making too much exposure of the interior to the street. A window with sill somewhat higher would still allow good overview of the street from the house, but would avoid internal overlooking, and would increase the possible locations of furniture in the living room.

4.2 Accommodation

1. Meet the needs and key wants and expectations of target population (New Lynn family)
Where are these needs and wants defined? How have the data on these been collected? Certainly the house as designed appears to be very similar in appearance to conventional housing, so perhaps this is enough. Was design discussed with someone from the real estate industry?

2. House should be designed from the outset with approachability, accessibility and useability in mind
The plan certainly manages to avoid passages, and makes the most use of the space. This is good for allowing the overall house area to be lower without losing the sense of spaciousness. It is hard to determine how to assess approachability. Accessibility is covered by various design guidelines and dimensions, so is fairly straightforward. Useability is also a matter of opinion rather than fact, but here there are several issues that can be raised from the drawings under the general heading of useability.

a) Externally: if a car is parked outside the garage – perhaps for washing it – then it is not possible to enter the house because the paved strips on which the car stands also appear to form the front path. In terms of community interaction, having to take the car right into the garage before being able to do anything to it does not encourage chatting with the neighbours as you wait to get into the car, or as you wash it, or change the oil, or whatever.

b) It is hard to be convinced that there is sufficient space for furniture, because there is so much glazing and/or doors in many of the rooms. In many cases the situation is made worse by windows that go down to floor level, making it difficult, for example, to put a desk under the window in Bed 2, or a dressing table or chest of drawers under the window in Bed 1. Where is the television intended to go in either of the spaces labelled Living, and the sofa and/or chairs to sit in when watching it? A plan with furniture drawn to scale would be an invaluable asset, particularly if it could demonstrate alternative layouts.

c) For a smallish house (approx 120 m^2) the bathrooms are poorly designed for efficient use of space. What is the point of having a separate shower cubicle and bath in the family bathroom, when a shower could have been provided over the bath? More efficient use of the space in the en-suite bathroom could have allowed Bedroom 1 to be larger.

d) The secondary Living space has all the bedrooms opening off it. When the children are grown but still at home they may well use this space to play music, computer games, etc., but there is minimal separation between those activities and Bedroom 1. At the very least it would have made sense to put a second door into this bedroom at the end of the wardrobe, to form an acoustic lobby. If not required this door could be left open against the wall where it would not be an obstruction.

e) The fully internal kitchen with a sliding door directly into the garage seems unattractive at first sight, but it may be better in practice because of light coming from the large living room windows. The higher ceiling in this room could make it feel odd, when contrasted with the height of the wall cupboards. It is not easy to comment because there are no drawings showing the kitchen layout in detail as related to the section.

f) It will be hard to seal the sliding door between kitchen and garage against fumes and noise, which is a considerable air quality issue. There is also a fire issue to consider. A separate garage, with some sort of covered link from the house would have been more satisfactory in many ways: less fire and air quality problems; covered outdoor space for drying clothes in wet weather; covered play space; etc. The use of a separate garage might have allowed the kitchen to have a window on an external wall, and could have allowed the positioning of the laundry in the house. There is also the question of whether a garage is necessary at all, or whether a car-port could have been provided (perhaps with a shed/workshop at one end) and the money saved used to improve the performance of the house.

g) The kitchen has been made into a through route to the garage, with conflicts possible in many areas but particularly for the fridge and adjacent cupboards. It might have made more sense to access the garage from the Entry, although this would have reduced the wall space in the Entry for coat hooks.

g) A laundry in the garage never seems like a good idea, the mixing of clean laundry with oil, fumes and old paint tins, although common, is hardly best practice. A bit of rethinking of the main bathroom could have provided enough space for an internal laundry, possibly with access to the garden for drying clothes, within the current plan.

4.3 Structure and materials

1. Preventing loss of value in the physical asset, and protecting people who live in it from natural elements
2. Best structural integrity for LCA of manufactured components, time to construct and use of resources

The considerable complexity of the design does not suggest best use of materials and resources. The use of a very complex roof in particular involves the following problems:

a) Internal loadbearing walls are used to support the roof. These walls add considerable foundation costs, and greatly reduce the future flexibility of the plan. Had a simple trussed roof been used, the only foundations would have been at the perimeter of the house and all walls could have been potentially moveable in the future. Although a simple rectangular plan might be superficially criticised as 'boring' it should be noted that historically NZ houses were simple in plan, so this simplicity could be seen as part of the heritage aspect of the project. Appropriate detailing could have provided an architecturally satsfactory outcome from a simple plan – after all, the Parthenon is a simple rectangle.

b) Cutting of the concrete tiles will be required to form the hips and valleys. There will also be valley flashings to install, which are often a weak point over the years, and a possible place for blockages to occur, leading to leaks and water damage to the house. The most economical roof form would have been a rectangle with gables. Had the roof been made with steel sheet, the waste from cutting could have gone for recycling, but the concrete tile waste is less reusable. However, concrete tiles are long-lived.

c) The many additional corners on the plan all add cost. It would have been worth costing a simple rectangular plan form with bay windows, porches, etc., added as elements that were hung off it rather than as elements with their own foundations.

d) The roof form is not suited to future installation of photovoltaic panels as part of the 'future-proofing' of the design, as such panels are invariably rectangular, and fit poorly on hipped roof forms. This is a known future technology, so it would be reasonable to make provision for it.

4.4 Waste management

1. Minimise liquid and material waste during construction, habitation and demolition stages as much as possible

See comments above on the use of concrete tiles with hip and valley roof. Generally, more complex plan forms are more wasteful of materials. The internal plan is certainly unnecessarily complex, and could result in a lot of wastage of plasterboard.

4.5 Moisture control

1. The provision of a home that excludes external moisture penetration, and manages internal moisture to provide a healthy indoor environment

Not enough detail is provided to check this, but the use of good eaves overhangs, single storey construction to reduce exposed wall area, and wooden cladding should all mean a house that keeps out water.

4.6 Thermal

1. Achieve comfortable ambient living conditions throughout the changing seasons through minimal non-passive means

Looking at the drawings, the underslab insulation and slab edge insulation appear too thin. The cost of using at least 50 mm insulation would have been only the material cost, as labour would have been the same. It is harder to damage the thicker insulation material on site, so it is more likely to get installed as drawn, and it will perform better thermally.

R-values are adequate, given the thermal and energy aims of the project, but no details are given for the double-glazing specification. Adoption of a simpler plan might have saved enough money to afford both low-emissivity glass and thermally broken frames.

4.7 Energy

1. Energy efficiency is a major Post-Kyoto aim – reduce overall non-renewable energy consumption, while increasing benefits from energy use for same units generated

It is not clear how benefits from energy use are increased, but the overall plan and specification looks as if it should be reasonably energy efficient, with appropriate orientation and reasonable concentration of glazing on the north elevation. It would have been good to see detailed specifications of the hot water system and of all the appliances and lighting to

maximise performance for energy used. There is no clear sense that energy consumption has been considered as a whole; rather it seems to have been considered in parts, with some emphasis on the thermal aspect in particular.

4.8 Light

1. Providing effective and efficient lighting to enable functions in specified areas

It is not possible to comment on lighting without a lighting drawing. There appears to be adequate daylight provision, although it is possible the internal kitchen may be dark.

4.9 Acoustics

1. Control noise levels in the home so that internal and external sounds do not impinge on activities

It is not clear how this is achieved. Are there 'trickle vents' on all windows to allow some degree of acoustic control as well as security while maintaining ventilation? There is certainly an internal sound issue between the secondary Living area and Bedroom 1.

4.10 Fire

1. Prevent, minimise risk and contain fires where possible

An integral garage is not good for reducing fire risk. There is an issue here of behaviour as well as of construction. How much is fire prevention a case of assuming people will have fires and so houses should be designed to prevent fire damage, and how much is it a case of persuading people to change their behaviour?

4.11 Air Quality

1. Achieve desirable air change rates with minimal energy and pollutant in ambient air, in recognition that air quality is a vital aspect of good living

It seems particularly bad in terms of air quality to have an integral garage and to have gas cooking in a kitchen with no windows. In addition it is not a good idea to carpet the bedrooms, as these are the places where people will be most exposed to the droppings from the dust mites that will make their homes in the carpet. Admittedly dust mites also live in bedding (which gets washed), but carpet provides a considerably expanded habitat for them.

4.12 Landscaping

1. Provide aesthetic and functional qualities to house design, which improve the value and living ability of the outdoor environment

Provided the garden areas can be closed off securely from the street to prevent small children from wandering, the landscape plan looks good, and creates a series of contrasting spaces around the house. Minimising lawn areas is a good feature as it removes the need for a petrol-powered mower. However, it appears that if the car is washed, the run-off will go to

the stormwater drains in the road, as the area on which the car can be stood for washing is both small and immediately adjacent to the road.

4.13 Aesthetics and decor

1. Provides a modern, desirable, warm and homely atmosphere that reflects our unique New Zealand characteristic and meaning

It is not possible to comment on the atmosphere of the house without seeing the proposed finishes and furnishing. It certainly appears to be very comparable to what the general market is currently providing in terms of construction, materials and overall appearance.

b) Is there evidence that all the design constraints (pp.12–15 of brief) have been met in the design (or if not, an explanation from the designer as to why not)?

Comments are provided above in the detailed discussion of the design constraints.

c) Are the majority of the following high prioritised performance specifications (those ranked 9, 10 and 10+) present in the final design?

4.14 Performance specifications

1.1: *Yes, the site at Olympic Place New Lynn, has been used.*
1.2: *If the house does not meet local body requirements it will not be allowed to be built, so it is hard to describe this as a high-prioritised performance specification.*
1.3: *The design is quite well sited, given the site area constraints.*
1.4: *This is the same as 1.2.*

2.1: *It is not possible to comment on the cost until the house is finished.*
3.1: *It should meet all NZBC and structural requirements, but the roof is very over-complicated. If it did not meet the NZBC requirements it would not be allowed to be built, so this is hardly an achievement.*

4.8: *A tank is shown on the Landscape plan, but no details are given as to size, percentage of water demand met from the rain, etc., nor any details of how the decisions were made.*
4.9: *These are not described on the drawings or Materials Specification.*

5.1: *This should be achieved by the house as designed.*
5.2: *This may not be achieved; there are issues with the choice of cooking fuel and the use by the residents of the extractor hood. There is also no sign of extracts in the bathrooms, which may add to moisture problems internally.*

6.2: *The specified R-values, slab floor, orientation and glazing should make it likely the house will approach this target. More underslab insulation would probably have been advisable.*
6.6: *Yes, it should manage fairly well without a heating system.*
6.8: *The west-facing window in the Living room seems over-sized. However, the eaves overhangs are appropriate.*

7.2: *No solar water heater is shown on the drawings, but it is on the Materials Specification. The use of a Solahart system will require regular anode replacement for corrosion protection if a glass-lined cylinder is used; this would be avoided by use of an all copper or copper and stainless steel system.*

11.1: *The drawings show no ventilation systems at all. Kitchen and bathroom ventilation are going to be important.*

13.2: *This looks as if it may be achieved, with planting helping to reduce wind and to provide some shade in summer.*
13.3: *There appears to be a clothesline behind the shed to the south of the house. It is not very large, will be screened from the breeze when the planting grows up, and will not receive much sunshine in winter, so may not be used as much as was hoped.*
13.5: *No plan of the existing site features was provided, so it is not possible to comment.*
13.8: *No irrigation is shown on the Landscape plan.*
13.9: *This presumably has been done.*
(These were selected as particularly desired in the New Lynn house)

d) Is there sufficient reasoning behind the choice of materials to be used for the design? (note this is different from "are they the right ones in your opinion?" – we just need to ensure that we have a sound case for choosing them.

There was little information given in the documentation received to allow an assessment of the decision-making process for materials choices. An obvious example is the concrete roof tiles, which are durable but have problems of wastage when cut. Some discussion of this would have been useful.

In general, the materials choices appear to be quite appropriate.

e) If Robert had been the designer, are there obvious differences he might have made to the design (layout, materials and landscaping), yet still met the brief - what would he have done differently to Beacon's final house design (only those things which obviously stand out).

I would have designed a much simpler plan form and roof form to minimise avoidable costs in foundations, corners, loadbearing internal walls, cutting and wastage, and to maximise flexibility. I would have avoided an internal garage, and would have attempted to get the kitchen onto an outside wall.

f) An expert opinion on whether we have achieved success (as per pages 5- 7 of brief), and a comparison of this research home project compared to others that Robert may be aware of – in comparison, what was addressed well, what was addressed poorly, what was unique about this project and Beacon's approach to it?

I think that the house generally will do what its designers intended of it, so it will achieve success in that sense. However, its designers did not appear to intend it to do very much more than a conventional NZBC house would do. I have serious issues with the lack of "endeavour" in the project – it was a chance to do something really good and it seems to have been wasted to a large extent by general timidity.

Comparisons might be made with BedZED near London (2002), Christie Walk in Adelaide, (2001) and Hockerton in Nottinghamshire (1998) for examples of projects that have taken similar aims to the NOW Home (i.e. what can we do now to make the post-Kyoto home at current costs and with current materials). All these projects get much closer to the idea of houses with really advanced environmental performance, (e.g., zero fossil energy use, on-site water and waste treatment, integrated renewable energy systems, more sustainable materials) but they were all built for normal costs and have successfully made their way in the marketplace. Interestingly, they were all designed by individual architects not as research projects but for real clients spending their own money.

5. Conclusions

The NOW Home does not really appear to offer much more than a current NZBC house. It is difficult for house buyers to get excited about it. In general, the NOW Home project had an excellent initial aim (the post-Kyoto home at current costs and with current materials) but has produced a disappointing outcome once that aim was translated into a performance specification by an inappropriately large design team.