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**2010 End-of-contract review of  
Beacon Pathway Research Consortium  
'Housing Advances for Environmental Responsibility  
and Sustainable Living'**

**BCON0401**

*Commissioned by the  
Foundation for Research, Science and Technology*

Expert review panel	Professor Peter Newton (Chair)
	Dr Richard Hawke
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## **Important Notice**

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This document reflects the confidential information provided to the review panel by Beacon Pathway Ltd, the science presentations, specific discussions carried out during the course of the review, and the guidelines.

This report has been prepared by a review panel consisting of Professor Peter Newton and Dr Richard Hawke, at the request of the Foundation for Research, Science and Technology (Foundation). Except where otherwise noted or apparent, all information used in the preparation of the report was supplied by the Foundation and Beacon Pathway Ltd. The review panel was not asked to verify independently the accuracy of the information provided and accordingly provides no guarantees as to information accuracy or sufficiency. In particular, information supplied to the review panel included statements, opinions, estimates, assumptions, projections and analyses made by others that may or may not prove correct. Where information supplied has been inadequate, the review panel has sought further information, but cannot be certain that all pertinent information has been supplied to it.

We have approached this review in good faith, with the objective of providing constructive comment from our combined experiences. Accordingly, while the statements, views, analyses, estimates and projections contained in this report have been developed carefully, no representations are made by the review panel or its respective members as to the accuracy or completeness of such statements, views, analyses, estimates and projections. In particular, no representation is made that the development and commercialisation of projects reviewed will be successful.

## Executive Summary

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### Background

For countries such as New Zealand, a home represents their residents' major lifetime purchase and asset as well as where a significant percentage of their time is spent. The level of sustainability, affordability and quality of environment provided to its occupants is therefore a significant issue. The built environment, of which housing is a major component, is also one of the nation's major assets. At the beginning of the 21st century major challenges face the housing sector that relate to the quality of the stock, its environmental sustainability (e.g. related to energy and water) and affordability. The challenges are for both new and existing housing. Beacon Pathway Research Consortium (hereafter referred to as Beacon) identified issues related to NZ housing and its sustainability performance and created a partnership and a 6-year consortium proposal involving research, development and dissemination directed towards sector transformation. The proposal was successful in receiving \$6.75 million in funding from the Foundation for Research, Science and Technology (Foundation), matched by the consortium, commencing in July 2004 and ending on 30 June 2010. This Review has been commissioned by the Foundation to gain an independent assessment of Beacon's achievements and delivery of outcomes related to the Contract's objectives.

### Achievements

The mid-term re-focusing of Beacon's programme, reflected in the 2008 contract variation and its milestones, outputs and outcomes, has had, despite loss of time and resources, a very positive effect on the ability of the consortium to ultimately deliver on its Contract objectives. Beacon's two aspirational goals were important in setting over-the-horizon sights for the consortium:

- *"To bring 90% of NZ houses to a high standard of sustainability by 2012"*
- *"To ensure that existing or redevelopment subdivisions from 2008 onwards, is executed with reference to a nationally recognized sustainability framework"*

While still some distance from achieving these goals Beacon has been instrumental in moving the housing sector forward. Key outcomes have included: a clear strategy and framework that all parties could align with ('Beacon on a page'); a 'whole of house' focus; a decision for priority focus on articulating a High Sustainability Strategy (HSS®) for housing; an evidence-based focus; a focus on increasing the performance of existing as well as new housing; investment and management strategies aligned to the six key objectives; and formation of highly effective management and research teams.

The outcomes have been significant. They are catalogued in the three key reports prepared by Beacon for the review panel, as well as having being discussed with and demonstrated to the Panel. They are also represented in the comments provided by Beacon's shareholders and stakeholders during an open forum on 4 May. Sections A and B of this Report contain the Review Panel's assessment of these outputs and outcomes. What follows is a high-level perspective on these achievements:

- Developing a successful partnership model involving research, industry and government

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- Establishing a ‘whole of house’ focus, plus linked key performance domains (energy, water, materials, indoor environment quality (IEQ)) capable of underpinning a National Value Case for retrofitting NZ housing to achieve a high level of comfort and sustainability
- Deciding to monitor as well as model, thereby creating unique databases capable of supporting evidence-based approaches to creation of performance benchmarks for housing
- Demonstrations of best practice for new housing (NOW Home®) as well as for retrofitting housing; supporting the creation of an evidence base for policy (government) and investment (industry, consumers)
- Creating IP in the form of the HSS® benchmarks and prototype computer tools that utilise this and other information assembled by the research teams (e.g. Retrofit Assessor and Plan Builder, Neighbourhood Sustainability Framework, NSF)
- Establishing a consortium (Beacon, BRANZ, NZGBC) to develop a national Residential Rating Tool to drive performance improvements in the housing sector
- Encouraging commercial products via Beacon’s industry partners (e.g. Fletcher Home&dry and new products for retrofitting windows).

It was apparent from the Review that ‘sustainable homes’ would not be as high on the agenda of the NZ government, industry and consumers – as demonstrated by level of buy-in across the sector from key stakeholders – without Beacon.

### **Learnings**

After six years of operation, Beacon is now well positioned organisationally (e.g. key personnel, management and QA processes, governance, networks etc) to capitalise on the initial investment and proceed to the ‘next steps’.

Significant time and resources have been lost in two key areas associated with the Beacon Consortium:

- The first surrounded the time that elapsed while the shareholders wrestled with the focus for Beacon: whether to be predominantly technology-centred and commercially driven (i.e. seeking to maximise development and capture of IP), versus public good; what were to be the key domains for research and the level of investment to be directed at each. The results of this were a revisiting of original programmes and objectives and a subsequent (positive) refocusing around ‘whole of house’ sustainability – the object of Beacon’s #1 aspirational goal; but less certainty around the role of neighbourhood research – the objective of Beacon’s #2 aspirational goal – and a diminution of focus around materials research.
- The second surrounded the fact that best practice management processes were not immediately available for implementation when Beacon was established.

Both constitute areas where the Foundation could be proactive with newly formed consortia.

As Beacon considers its next phase of operation, issues surrounding focus and partners will clearly loom large. Assuming that focus will continue to be on the housing/built environment, key partners additional to Beacon V1 should be sought from the property development industry, finance and investment, the design professions and urban utilities.

Reference in the Review was also made to need for greater scientific peer review of research proposals and results. Addressing this could provide the basis for significantly increasing levels of low cost engagement with leading academic researchers (either restricted to those roles or engaged more intimately with the research projects).

### The Future: Next Steps

The building, construction and property sectors are among the least research intensive of any sector in the economy, having a relatively low investment in R&D and compared to other industry sectors have a relatively low level of receptivity to innovation. Yet the benefits capable of being generated from this industry as a result of increased innovation and productivity are considerable, both to the economy (percentage increase in GDP) and the population (refer to Beacon's value cases).

While an assessment of possible future research was not part of the terms of reference for this Review, a number of comments are provided as to possible next steps for Beacon V2 (B2):

- Specification of the scientific research required to underpin the key objectives of B2 would appear to be essential to ensure that transformational objectives have prospect of achievement, and that the Foundation's charter of fostering world class research capable of generating significant benefits to NZ is realised.
- *Research gaps* will emerge from the more traditional areas of energy, water IEQ and materials, but new research arenas will need to be engaged if B2 aspires to objectives requiring Research, Development, Dissemination *and* Transition.
- For *Development*, an IT platform related to digital modeling and data interoperability (i.e. for effective access to and integration of multiple databases) would be central to the creation of 21st century performance assessment and rating tools, e.g. the future NZ Residential Rating Tool (see *Technology, Design and Process Innovation in the Built Environment*, Spon Press, 2009); and the Expert Reference Group for the Sustainable Buildings Framework within Department of Environment, Water Heritage and the Arts and the Built Environment Digital Modelling Working Group in the Department of Innovation, Industry, Science and Research; local expert A/Prof. Robert Amor at University of Auckland).
- For *Dissemination*, new media (including social media and information sharing platforms such as Web2.0) constitute important research and application foci.
- For *Transition*, there is now a recognised need to move beyond workshops and other forms of institutional and community engagement to the creation of transition arenas capable of scoping, articulating and validating alternative new and more effective processes that can be substituted for those currently seen to be failing (leaders in this field are the Dutch Research Institute for

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Transitions). There are several candidate areas for application of transition management, such as identifying routes for increasing productivity and sustainability within and across the housing, building, property and construction and building materials industries.



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## Section A. The Consortium as a Whole

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### 1. To what extent has the consortium provided real benefits to New Zealand and progressed towards achieving its vision?

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#### *How have the outcomes of the consortium research impacted upon/affected end-users?*

Tangible benefits from Beacon research, development and dissemination activities are evident at a number of levels, ranging from national to individual homeowner:

#### 1. National

Among the most significant has been *The National Value Case* report which demonstrated the following benefits drawn from Beacon research 2004-09 relating to the direct value of retrofitting homes to the HSS® standard:

- \$2 billion direct benefit to homeowners
- Direct energy savings – 22PJ/year
- Direct water savings – 130 million m<sup>3</sup>/year
- CO<sub>2</sub> emission reduction of 3600kt per year
- Jobs – for every 1,000 homes retrofitted, 392 jobs.

As well as indirect benefits (reduced demand on health services, reduced days off work and school, environmental benefits, productivity benefits).

#### 2. Government

Central government agencies:

DBH, EECA, HNZA, MED have been recipients of Beacon reports and advice; contributed to changes in government policy e.g. Warm Up NZ: 188,500 dwellings in four years – \$347 million in subsidies – est. total \$1 billion costs, up to 3,796 full-time jobs; 40,000 HNZA dwellings in 20 years – \$1 billion costs, up to 784 full-time jobs; 2,000 dwellings targeted by Home&dry in first year – \$57 million and up to 57 full-time jobs; 60,000 of Auckland's dwellings in 10 years in Retrofit the City if rolled out by super city. Beacon also developed the Smarter Homes website (now hosted by DBH).

Local government agencies:

Water demand management (WDM): Slowing the Flow report provided clear evidence that WDM avoids/defers new infrastructure; reduces energy costs; reduces treatment costs; provision of rainwater tanks delays impacts on stormwater detention infrastructure; diversified supply – increases resilience; and overall is likely to increase water availability for agriculture; and delays/avoids disruption to ecosystems. A major series of workshops has engaged NZ local governments in an area where there is potential to significantly reduce per capita demand. Evidence provided in relation to uptake of council specific tools Slowing the Flow and LG Resource Manual.

The Tauranga evaluation provided opportunity for the application of Beacon's WDM method; results revealed total net benefits to be of the order of \$53m to the community over a 10 year period.

Neighbourhood sustainability research has delivered:

- A neighbourhood sustainability framework
- Prototype sustainability assessment tools to allow stakeholders to work through issues in existing and planned neighbourhoods, including preliminary analysis of neighbourhood value by monetising the NSF.

### 3. Industry

Market benefits are expected to flow from an increased profile of sustainable retrofitting and new homes value propositions being disseminated, e.g.:

- Changed policy settings
- Product and service opportunities and new markets identified
- Fact-based value propositions
- Skills development through training, tools and transformational research.

Residential Rating Tool scheduled for joint development by Beacon, NZGBC and BRANZ – targeting 1 million homes for self assessment and 100,000 homes for certified rating in 10 years.

Emergence of private sector and community based providers offering services and products targeting high performance of homes; monitored NOW Homes® produced evidence that more sustainable and affordable homes can be built using current products.

### 4. Homeowners and occupiers

Direct benefits of Beacon research relate to proof to the public of lower running costs, better health, more comfortable homes, and greater resilience from application of HSS® principles to new home construction and retrofitting. Primarily demonstrated via: NOW Homes® (Waitakare and Rotorua); Papakowhai renovations; Renovation Assessor and Plan Builder (to assist homeowners to determine options for house improvement); HomeSmarts – website for provision of information; and collaboration with Housing New Zealand Corporation on designs for future public housing.

### ***How successfully have the outcomes of the research impacted business best practice and policy?***

Beacon comprises several of NZ's leading companies. Comments below on how outcomes of Beacon's research have impacted business best practice have come directly from feedback from Beacon's industry and government stakeholders at the Review (4/5/2010; see list of names and organisations in Appendix):

- There has been a step change in sustainability credentials e.g. HSS® – provided platform to engage within the consortium and outside; operationalised 'sustainability' – "eight years ago no language, data or tools to have conversation about sustainability" (BRANZ)

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***The Consortium as a Whole***

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- Consortium has assisted in Identifying areas for new product development (Fletcher Home&dry)
- Encouraged system thinking: Beacon's 'whole of house' model central to 'whole of consortium' thinking and project deliverables (NZ Steel)
- Better understanding of value chain, which provided arena for engagement that previously did not occur (Scion)
- Partnering – developing a common language (e.g. support for Residential Rating Tool for assisting market change; BRANZ)
- Policy – challenging government to question who owns the policy space, especially in relation to existing homes (as opposed to new build) – 1.6m buildings. Basis for local government to test/validate some of their policies and programmes prior to implementation. Influencing the changes to the Building Code (DBH)
- Information – independent information for builders and consumers to enable more informed decisions; data on actual housing performance via monitoring programme provides evidence base for policy etc
- Value proposition – warm, dry healthy home and how to communicate via builders to customers as well as direct to customers. NZBCSD credits Beacon with creating a new proposition for the industry from one based on price per square metre and location to one around quality and performance
- Evidence-based advice – identify what is needed to bring NZ housing to a civilised – warm, dry and healthy – level (EECA).

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## **2. Has Beacon delivered value for money for the Foundation and the consortium shareholders?**

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### ***The outcomes delivered within the 6-year term of the contract***

For their Final Review, Beacon provided three volumes of detailed evidence of progress against Contract objectives and deliverables. The reader is referred to Section B for more detailed assessment of deliverables/outcomes across the six research programmes.

There were two high-level aspirational objectives central to guiding Beacon activities – one relating to homes, the other to neighbourhoods. Reflections on key outcomes for each follow.

*Homes* – Beacon goal is “*To bring 90% of NZ houses to a high standard of sustainability by 2012*”. Against this objective there were several significant achievements:

- HSS® created 2006 and is a hallmark output and outcome, encompassing the key sustainability benchmarks for NZ housing. Following exposure and workshopping, the 2008 revision becomes core for NOW Homes® demonstration projects and future Residential Rating Tool. The challenge now is continuing and expanding buy-in to the framework and the underpinning benchmarks.
- NOW Home® projects – demonstrate HSS® and the sustainable-affordable new housing value proposition as well as being monitored for operational performance. The challenge is to ensure/enable/encourage the sustainability features of the NOW Home® projects to become business as usual for the NZ house building industry in a period of economic downturn.
- Significant data on housing performance has been captured, based on Beacon’s monitoring programme and retrofit assessor and plan builder. However, Beacon data is not centralised, raising questions about access post-2010.

*Neighbourhoods* – Beacon’s second aspirational goal is “*To ensure that existing or redevelopment subdivisions from 2008 onwards, is executed with reference to a nationally recognized sustainability framework*”.

- Neighbourhood tool suffered from a hiatus of 12 to 18 months when it was unclear what the implementation pathway was going to be. Consequently it has not been subjected to the extent of development and testing that would enable it to be adopted by government or industry in subdivision planning or redevelopment. The tool’s value lies in its attempt to provide a platform for stakeholders to work collaboratively on a neighbourhood scale planning or redevelopment project. An important and challenging but yet incomplete dimension is its attempt to quantify/monetarise neighbourhood quality. It requires further peer assessment.
- Important work related to assessing the importance of scale in delivering water and energy (e.g dwelling vs neighbourhood scale) appears to have flagged. Outputs would provide important contribution to the strategic planning and future delivery by these key utilities.

***The outcomes that will continue after the completion of the current 6-year contract***

Feedback from the General Manager and the Knowledge and Science Manager indicated that without future Foundation support it would be expected that:

- Webtools would become quickly out of date unless taken up by a partner
- Residential Rating Tool initiative may lack the necessary partner (Beacon) to achieve realisation or potential
- Neighbourhoods work would likely cease
- Future retrofit initiatives would lack the important contributions the research to date has provided
- It is questionable whether as much would be gained from the monitoring data, e.g. IEQ work. While likely to continue via shareholders it may not be disseminated as widely and extensively
- A trusted source of independent information for consumers would cease, such as stories for Consumer NZ, Eco-design advisors, Certified Builders BiMonthly 'in-house' magazine and BRANZ's BUILD magazine.

***Have the outcomes of the individual research programmes been coordinated in a manner that provided the consortium with the outcomes it targeted?***

Beacon could be characterised as a learning organisation – other Foundation consortiums would benefit from exposure to lessons and learnings of Beacon. Demonstrated lessons learnt and built upon:

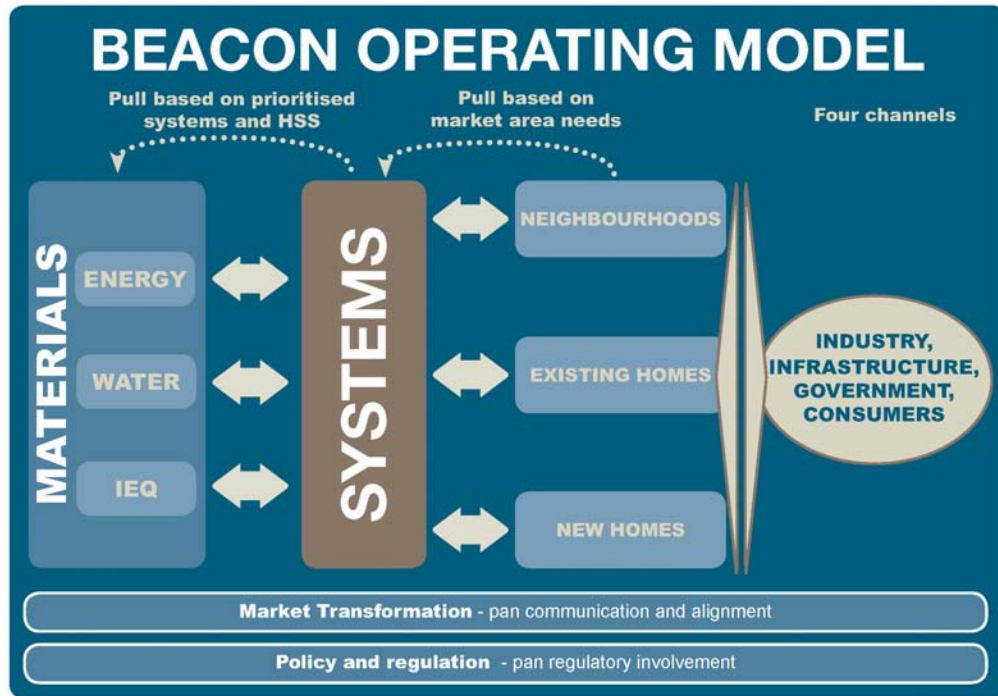
- Project tracking and scorecard developed and implemented to ensure oversight and progress of research against milestones.
- Beacon's framework (refer 'Beacon on a page' – Figure 1) emerged after two years, and provided much needed focus for the consortium and its programme delivery. Conflicting objectives between stakeholders following the establishment of Beacon (primarily relating to preference for commercial vs public good research) provided challenges to management. Beacon's contract variation, agreed in 2008 with a revised set of six objectives and deliverables, proved to be a positive development, but significant time and resources had been 'spent'.
- Operation of the Research Guidance Committee (RGC), IP Committee and Research Team Leaders Committee, and particularly the role of the Knowledge and Science Manager (KSM), have been important for internal coordination. KSM has been instrumental in creating and implementing a sound QA process post-2007. Again, valuable time had been lost in establishing suitable operating processes.
- Development of strategic plan, research information briefs – and how these were 'signed off' – forced coordination. Development of an investment plan by the RGC, then sign-off by the Board, was critical in establishing future directions for programme and consortium activities and funding (see Figure 2 in Section B).
- Locating and managing suitable researchers to deliver on the Beacon goal has been a challenge, in some instances exacerbated by potential providers being

*The Consortium as a Whole*

shareholders. Research Team Leaders have assumed an important role for developing a network of providers.

- Recruitment of Nick Collins proved successful in developing an effective relationship and functioning among the consortium network – more than the sum of its partners (who had distinctive – and often conflicting – ideas/goals for the consortium). Nick also provided a critical interface with key shareholders, industry and government that helped shape the direction and goals for Beacon that were fundamental, given the Beacon goal.

Figure 1. Beacon on a page



**3. Has the research programme scope and cohesion been appropriate in the context of achievements and contributions to science, and end-user uptake?**

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***Has the strategy of the consortium delivered against its goals?***

- The delivery by the consortium primarily relates to the period following the contract revision in 2008. While Beacon's aspirational goals have not changed since its inception (2004), the initial focus (till 2007) was quite different to the present focus (more technical, commercial and new-build) as well as related research programmes (previously nine objectives, now six). Realisation there was no 'silver bullet' to focus research led to a reconsideration of strategy. The subsequent Beacon framework, summarised by 'Beacon on a page', has created a sound basis for organisation and delivery. Delivery is primarily into the public good realm, which may have some implications in relation to support for Beacon v2.
- 2008 revision also clarified what constituted sustainability and pushed the HSS® into the centre. Clarity assisted with focusing the dimensions of performance for the 'whole of house' perspective and the contributing research streams.
- Beacon's goals were aspirational and unlikely to be achieved within a period of six years, but expectations have been that Beacon's life would extend beyond this period. The goal has helped jell and motivate the organisation and attract the attention and interest of stakeholders.
- 'Beacon on a page' framework (2007) identifies four take-up channels. Focus has been primarily in relation to consumers (recognizing that consumers are often reached via local/central government, businesses etc).. Infrastructure seems to have received least attention (other than for water demand management via links to councils) yet will constitute a critical stakeholder for the sector transformation.

***Has the programme management within the consortium contributed to its success?***

- There has been considerable development of appropriate processes to manage the consortium and ensure delivery, e.g. sign-off of strategies to focus the research effort and clarify the roles of Research Information Briefs, the establishment of a Research Guidance Committee, an IP Committee/Manager, the scorecard for the Board, QA processes etc.
- Beacon has assembled a top-rate team led by Nick Collins. The ability to attract, integrate and retain the team leaders is a significant contributor to the overall delivery of the consortium. Vicki Cowan clearly has a range of skills that have been important for ensuring success. Such a team is not easily assembled nor is it easy to make it work.
- The use of contracting has resulted in a delivery focus and the delivery of lots of outputs with a strong sense of value for money. This was not characteristic of the first period of Beacon. The KSM has brought a focus on achievement. Flexible contracting is a critical feature of Beacon.

***Has the balance of effort, cost and focus across the consortium's programmes contributed to its success?***

- The decision by Beacon management and its Board to develop and agree an investment portfolio on homes (40%), neighbourhoods (14%), energy (15%), water (13%), IEQ (5%) and materials (13%) has enabled significant progress to be made in delivering Contract outputs (see Figure 2 and section B). However, it took until 2007 to achieve this level of consensus.
- The actual spend on materials has been 7%, which reflects the decision of the contract variation/consortium to shift focus away from this domain.

***Has there been an appropriate balance of research and implementation during the 6-year programme to deliver on the consortium's goals?***

- The effort and focus on implementation has been large but, given the Beacon goal and the importance of consumers on achieving this goal, this is appropriate and justified.
- Implementation has not just been an add-on, it has been part of the programmes all along. There has been a focus on maximising the impact of the research.
- Andrea Blackmore has proven to be important for taking research and communicating it widely and appropriately (e.g. Consumer NZ articles, trade magazines, community newspapers). NOW Home® video has potential for making a strong impact if distributed to key stakeholders.

***Has the consortium contributed to building science capability and collaborations?***

- Science capability was expected to be built in Scion and BRANZ. This did not occur in Scion but has happened in BRANZ (and BRANZ has acknowledged what it has gained in terms of staff and overall capability).
- Beacon has contributed significantly to cross-disciplinary engagement, which was not common to many of the shareholders.
- The Beacon network has been successful. Capability has been developed via the recruitment of key team leaders, not duplicated, and contracting has been streamlined. Contracting does not seem to have resulted in the loss of the important informal connections.
- Greater use of peer review of science could have resulted in a win-win by enhancing the quality of the research undertaken at Beacon and at the same time developing linkages and potential individual future research providers for the consortium from NZ (or, where need arose, from Australian) universities.
- Stakeholder collaborations have been extensive.

***Panel comments on the attributes that have led to the consortium's success or may have limited its opportunities during the term of the contract***

- Effective Board members and commercial partners provided a strong focus on delivery. Tensions with competing objectives and desires took a while to work through and reconcile.
- Strong Beacon team assembled (see above).



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***The Consortium as a Whole***

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- Beacon would have benefited from access to best practice information to guide Foundation consortia from the outset in relation to governance, investment processes, QA etc. The consortia had to learn by doing.

***How the consortium has addressed challenges and opportunities***

- Beacon have been highly proactive in creating opportunities e.g. the NOW Homes® (more made of these than initially expected), the use of their material for the Job Summit, the future Residential Rating Tool.
- The 2008 contract variation was in recognition of the problems surrounding delivery on initial objectives and the need for a better structure.



## Section B. Consortium Objectives

### Research Objectives

Beacon focused on six key objectives following the 2008 contract variation, each of which contributed directly to an attempt to deliver on its two high-level (aspirational) goals:

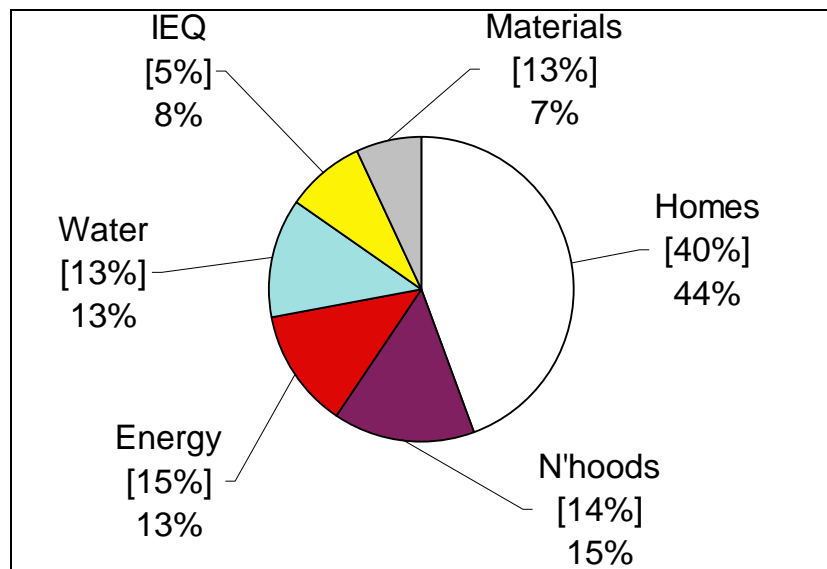
- To bring 90% of NZ houses to a high standard of sustainability by 2012
- To ensure that existing or redevelopment subdivisions from 2008 onwards, is executed with reference to a nationally recognised sustainability framework.

These objectives were:

- More sustainable homes
- More sustainable neighbourhoods
- More efficient energy use
- Conserve water
- Improved indoor environment quality
- Reduced impact of materials.

In the course of undertaking the Review it was clear that responses to many of the Foundation's reporting questions were common across the six objectives. To avoid repetition it was decided to report in full against 'More sustainable homes', given that it consumed almost half of expenditure (see Figure 2 below), and by exception in relation to all others.

Figure 2. Portfolio split



Portfolio splits of Beacon's programme, figures in brackets are the 'ideal' determined by Research Guidance Committee and signed off by the board. Next figure is actual (determined with expenditure from 0708, 0809 and predicted budget for 0910).

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**Consortium Objectives**

**1. How has the objective performed – in terms of quality and productivity of the research?**

***Has the science quality been appropriate to achieve their outcomes?***

- The research undertaken across the six objectives in general has been appropriate to the outputs required as assessed by Beacon itself and the consumers of the research. It is estimated by the Research and Knowledge Manager that less than 10% of reports have been subjected to external peer view. There would have been value in a greater focus on peer review especially in the context of future potential external use of key tools and benchmarks where transparent scientific and industrial validation would be required.
- The monitoring and data collection (quantitative and qualitative) of actual houses to establish appropriate performance metrics for energy, water and IEQ represents an important advance in the field for setting benchmarks and model validation.
- There were no objectives where ‘breakthrough science’ has been required.
- The absence of a mid-term review probably perpetuated an environment where external peer assessment was not seen to be a necessary part of the culture of Beacon. The calibre of the Research and Knowledge Manager and Team Leaders was high as well as the Head of the consortium’s IP assessment, who undertook a significant level of scientific review of reports.

<b>Objective</b>	<b>Comment</b>
1.Homes	With regard to new homes, key scientific objectives were associated with creating HSS® benchmarks for energy, water, and IEQ (where additional validation may be required, given that a couple of the HSS® metrics – such as energy – appear not to have been reflected in the operating statistics of the monitored Waitakere NOW Home®); translating performance objectives into designs for NOW Homes®; and monitoring performance. For retrofitting existing homes, assembly of knowledge necessary for the Renovation Assessor and Plan Builder software prototype represents a good example of applied research
2. Neighbourhoods	An attempt to establish a robust framework to allow stakeholders to engage in discussion on neighbourhood quality; and subsequent (as yet incomplete) attempt to monetarise neighbourhood quality represents a highly innovative project led by Kay Saville-Smith; but lacked continuity of resourcing (linked to internal IP assessment hiatus) and sufficient peer input such that the powerful (draft) statements relating to value of sustainable neighbourhoods are unable to be confidently published
3. Energy	Team led by well-credentialed researcher Verney Ryan with experience at BRE (UK)

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**Consortium Objectives**

4. Water	A single water consumption benchmark for all NZ communities suggests that it may not have been subject to sufficient scientific, industry and community scrutiny (given locational variability in water yields, costs etc)
5.IEQ	Research successfully contracted to experts at Massey University and BRANZ and benefited by involvement of BRANZ scientist Lisa French as Team Leader
6. Materials	The LCA activities needed to be linked to key international scientific groups (e.g. ALCAS, Athena, ISO); area appeared to lack scientific leadership

***Has the research team looked to extend its research within the scope of the objective?***

There are multiple examples in the three volumes of evidence prepared for the Review that provide evidence of successful attempts to extend areas of research e.g.:

- Seeking external collaboration and material contribution to the NOW Homes®
- Revision to HSS® in 2008 (original was 2006)
- Working to form partnerships (NZGBC and BRANZ) to embody Beacon knowledge in the future Residential Rating Tool
- NZ HomeSmarts website
- Developing national value case (beyond the individual value proposition for each stream of research; involved integration with economic modeling).

This is common across all streams. In relation to the Materials objective, IP tends to have been developed by individual industry consortium members 'in house'.

***Has the research team engaged well with its end-users?***

<b>Objective</b>	<b>Comment</b>
1.Homes	Engagement has been very strong with housing stakeholders and is well documented in the Evidence Portfolio, including those who presented to the Review (see list of stakeholder attendees in Appendix). NOW Homes®, retrofit assessments, publicity and web etc have linked beyond stakeholders to housing customers. Negotiations with key home building players (e.g. Stonewood Homes) to integrate HSS® into housing design performance have stalled due to the change in national economic circumstances from 2008 onwards.
2.Neighbourhood	Stakeholders have been engaged during the development of the Neighbourhood Sustainability Framework and prototype assessment tool . Software prototype has had limited exposure due to shareholder uncertainty around business model to adopt, as well as absence of property developer as member of consortium, hence relied heavily on Waitakere City

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**Consortium Objectives**

3. Energy	The housing typology, which is likely to prove to be a powerful mechanism for engagement with homeowners and landlords, has been used by a number of stakeholder organisations; initial objectives related to distributed generation (neighbourhood vs dwelling) appear not to have been realised. Energy outputs have become core to the wider homes goal
4. Water	Excellent engagement with councils on demand management led by Dorothy Wilson; dissemination of learnings via <i>Slowing the Flow</i> publication; on several advisory committees etc. Opportunity for industry identified (i.e. rainwater tanks)
5. IEQ	Specific studies on unflued gas heaters and forced air ventilation systems likely to have significant impact
6. Materials	Benefits in this area would seem to have been captured by Fletcher, e.g. Home&dry, new aluminium window refit; unclear how Scion sought to engage

***Has the research team worked within the overall strategy of the consortium?***

The housing team has been a leader for the consortium in the context of the 'whole of house' focus and the Beacon goal and the team leader (Lois Easton) should be commended for her role in this (such as integrating inputs from other teams into HSS®).

The housing team has provided the context and platform for the energy, water and indoor environment quality teams to work collaboratively and the Knowledge and Science Manager (Vicki Cowan) has played a key leadership role in ensuring input and engagement across teams.

***Has the research programme been productive in achieving its outcomes?***

The research programme has been productive vis-à-vis the contracted outcomes, and by the time of the Review was operating in a very effective manner. Absence of QA processes at an early stage in the life of the consortium was clearly a brake on progress, but are now clearly operational. High-quality information dissemination has also been instrumental in Beacon achieving an impact, as well as the General Manager's ability to engage effectively at a high level.

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## **2. What has been the progress towards achieving outcomes?**

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### ***Considering end-user engagement, knowledge transfer and delivery of outcomes***

Beacon is on target to deliver virtually all outputs related to research and dissemination (Evidence Portfolio p. 18 lists all contract milestones and progress to June 2010). The Materials area was the one where least progress has been made against contract objectives, but outcomes of benefit to one or more consortium partners may be expected in the longer term.

Shareholders have seen that Beacon's research could be instrumental in changing the conditions in the marketplace to make it possible for the entry of new products and services (refer shareholder comments in Section A).

### ***Considering the success of implementation pathways***

Beacon has successfully utilised several implementation pathways, for example:

- Performance metrics and benchmarks: development of HSS® has enabled more informed discussions and decisions to take place on sustainability and the importance of the quality of housing. Provides key platform for development of Residential Rating Tool.
- New housing: the NOW Homes® have demonstrated the level of improved performance that can be achieved with current knowledge and building products.
- Existing housing and retrofitting process: Beacon has been instrumental in raising the significance of the challenge which poor-performing existing stock makes to resource use and human health. The renovation plan builder is a useful first look at a valuable prototype, but the fact that it has paper-based input will be a limiting factor. Web-based or PDA-based tool to allow wider/automated data entry and feedback represent an important next step.
- HomeSmart etc – vehicle enabling consumers and builders to become better informed.
- Water demand management: engagement with councils to establish the value proposition.

### ***How has the consortium captured value for itself and its end-users and has this been appropriate for its over all strategy?***

- Beacon brand is acknowledged as a trusted source of independent information – an honest broker – a significant achievement in a short space of time.
- Beacon makes effective use of multimedia delivery of research and learnings; as well as more traditional workshops and conferences (refer USB compendium).
- Monitoring of demonstration homes has provided the consortium with a unique and valuable dataset.
- Beacon have pioneered the importance of the retrofit arena. They have focused attention from a wide range of stakeholders on the existing housing stock. Stimulated industry on the opportunity for developing new products (e.g.

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Fletchers windows, Home&dry, NZ Steel) and government on the significance of shifting focus from new-build to retrofit (e.g. DBH, MED, EECA).

- Potential to engage with local government on multiple use consents (e.g. group homes). This has potential for making a substantial contribution to productivity/affordability of housing.

<b>Objective</b>	<b>Comment on areas where value captured</b>
1. Homes	HSS®, NOW Homes® and associated data collection; renovation assessor and planmaker and associated data collection; key group involving Beacon to develop Residential Rating Tool; effective dissemination channels with government and industry stakeholders and consumers etc. moving housing sector slowly but positively towards aspirational goal #1
2. Neighbourhoods	Innovative and promising start, but failure of consortium (which had more of a building than planning membership) to decide early on balance between commercialisation and public good focus delayed and limited investment necessary to develop a scientifically validated prototype and value proposition that could be promulgated publicly. Hence, little progress towards aspirational goal # 2
3. Energy	Value captured in a number of areas related to domestic energy use and efficiencies, as well as pathways to enhance energy efficiency of existing homes (renovation plan builder); but initial objectives related to distributed generation options for dwellings and precincts largely unrealised, except for feed-in tariff study – so supply side remains an area for more research
4. Water	Similar to energy, most value captured on demand side of equation – <i>Slowing the Flow</i> etc; supply side limited to desktop research of international practice/options
5. IEQ	Value here relates to key research on unflued gas heaters and forced air ventilation in conjunction with domestic heating options to place Beacon and BRANZ in a position of provider of key advice to both industry and government on pathways for warm and healthy homes
6. Materials	IP that was developed captured primarily by industry partners in-house; little or no evidence of a joint collaborative commercial project in this space; considerable comment however of positive benefit derived from networking, multidisciplinary and value chain discussions



### 3. Has the objective had an impact?

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#### *Within the timeframe of the 6-year contract?*

- Yes (see Evidence Portfolio and above). Section A also outlines the high-level impacts that have been delivered under the set of Beacon research objectives.
- Stakeholders who presented at the Review commented on the fact that 'sustainable houses' is now an important public policy and industry issue and there are solutions and research to inform the discussions. Beacon has made an important contribution to this development.

#### *Beyond the 6-year contract?*

- Most reports and deliverables are in the public domain and will be accessible beyond 2010; a small number (e.g. HSS® and prototype tools for Neighbourhood Sustainability Framework (NSF) renovation assessor and planmaker) remain as proprietary to Beacon and subject to further development/commercial development
- Some shareholders and stakeholders have expressed desire for Beacon v2 (obviously a range of views on what this might be and/or mean). Industry also indicated they were developing their own next steps to grasp opportunities.
- Research providers have developed capabilities and programmes that will extend beyond 2010 on the back of Beacon e.g. BRANZ and IEQ – wave Foundation programme.
- A basis has been established for instituting new building practices linked to shifts in homeowner behaviour (Fletcher's Home&dry initiative)
- A body of research and data assembled in the Sustainable Homes objective can be extended e.g. Residential Rating Tool, subject to ongoing collaborative agreements.

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## Appendices

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### Appendix-1 Questions asked of Stakeholders & Shareholders

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During the review presentation day – Tuesday May 4, the panel posed the following questions of the shareholder and stakeholder representatives that attended the Beacon Pathway review.

1. What has been the impact of Beacon Pathway's research on business best practice and policy?
2. Can this impact be quantified (value statement)?
3. What is the nature of the Beacon Pathway end-user interface?
4. What has been the impact of Beacon Pathway – 'one-step-on' from the stakeholders and shareholders?
5. What will be Beacon Pathway's future impact?
6. What would you favour/see/recommend for Beacon Pathways future direction?

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**Appendices**

**Appendix-2 Attendees at Review Meetings**

The following personnel, shareholders and stakeholder representatives of Beacon Pathway Ltd attended some or all of the review meetings held in Auckland on 3-5 May 2010.

<b>Beacon Pathway</b>	
Nick Collins	General Manager
Vicki Cowan	Knowledge and Science Manager
Lois Easton	Research Team Leader (RTL) – Existing and New Homes (Lois Easton Consulting)
Kay Saville-Smith	RTL – Neighbourhoods (Research Director of CRESA)
Verney Ryan	RTL - Energy (Element Consulting)
Dorothy Wilson	RTL – Water (P.R.I.S.M.)
Lisa French	RTL – Indoor Environment Quality (Building Scientist at BRANZ)
Andrea Blackmore	Communications Liason
<b>Beacon Board members – shareholder representatives</b>	
David Thomas	Board chair – Fletcher Building
Lesley Jenkins	Board deputy chair – Deputy Director Strategic Planning, Watakere City Council
Scott Fuller	Vice President of Sales and Marketing, New Zealand Steel
Trevor Stuthridge	Group Manager, Sustainable Design, Scion
<b>Shareholder and Stakeholder representatives</b>	
Derek Baxter	CEO, Certified Builders
Adrian Bennett	Research Manager, Manager Building Science and Research, Department of Building and Housing
Pieter Burghout	CEO, BRANZ
Terry Foster	Manager, NZ Housing Foundation
Peter Neilson	CEO, NZ Business Council for Sustainable Development
Mike Underhill	CEO, Energy, Efficiency and Conservation Authority
<b>Foundation for Research, Science and Technology</b>	
Vanessa Allen	Investment Manager – Infrastructure and Energy sector team
Paul Sanders	Review Convenor – Delivery Services

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## **Appendix-3 Documents and Source Information**

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Documents provided by Beacon Pathway Ltd and the Foundation and considered in this review included:

### **From Beacon Pathway Ltd**

- Evidence Portfolio
  - Introduction
  - Performance of Beacon Pathway
  - Objective 1 More sustainable homes
  - Objective 2 More sustainable neighbourhoods
  - Objective 3 More efficient energy use
  - Objective 4 Conserve water
  - Objective 5 Improved IEQ
  - Objective 6 Reduce impact of materials
  - Conclusions
- Appendix-1 Glossary
- Appendix-2 Response to review questions by objective (A3 page format)
- Memory Stick of Beacon Pathway reports
- Presentations – May4

### **From the Foundation**

- Terms of Reference – question-set for panel
- Agenda
- Current contract
- 2005 and 2008 governance review reports
- 2008/9 Contract Achievement report