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Sustainability Framework SF1.1 Sustainability Framework Design

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Sustainability Framework SF1.1 Sustainability Framework Design

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EXECUTIVE SUMMARY

The purpose of this project is to recommend the key elements of a sustainability framework with the ultimate purpose of facilitating the implementation of sustainability outcomes at the level of 'home'. In developing these recommendations the project team considered the following issues:

- the theoretical basis of different framework designs (i.e., framework structures) and their content
- the appropriateness of a selection of environmental assessment methods for the metric element of the framework
- the needs of different constituents of the framework and the uses these constituencies might make of the framework
- the ability for the addition/deletion of new factors as new information becomes available, or the importance of certain issues changes (i.e. future-proofing)

As a result, this report provides:

- a clear understanding of what sustainability means for the 'residential built environment'
- an evaluation of the elements of good framework design
- recommendations for the elements of a sustainability framework relevant to NZ houses (both new and existing)
- recommendations for a review schedule to update the framework to allow for advances in technology and methodology
- recommendations for further study as a result of issues emerging during the project which are of perceived relevance to SF1.1 or the other projects

The structure and content of the sustainability framework is biased towards best practice and deliberately so. We believe that the proposed framework creates a comprehensive view of sustainability and proposes actions that are strategic and enable a conscious process of decision-making. In saying this, we also believe that the framework is non-judgemental and does not take away people's decision-making power, i.e., there is enough flexibility to seek alternative solutions across stakeholder sector groups. We have sought a framework design that best fits with building and the residential built environment. The proposed framework provides the potential for New Zealanders to live more sustainably through the delivery of more sustainable housing.

As a result, the project team hope to inspire the Beacon programme to continue in its resolve to bring the industry and the built environment sector closer to high performance and efficiencies and towards truly sustainable buildings. To do so, we need to change current thinking and practices; a mindset that needs to be challenged due mainly to the belief that a sustainable approach to design, building and construction is a barrier to growth, stability and livelihoods in this sector. Over time, with our vision in mind, the construction industry will make the transition to sustainability.

The project team recommends the following structure and content (the key elements) of the sustainability framework for housing:

Definition of success
That 90%+ of housing in New Zealand to reaches a high standard of sustainability by 2012. A sustainable house is one where social and cultural needs are met, where resources are (more) equally available to everyone, and where no irreversible damage to the environment is caused during its entire life-cycle. A high standard will be defined by the achievement of a rating as determined by the framework's metric tool (to be finalised).

Level 1: Principles for the constitution of the system
The strong sustainability model and naturalistic approach

Level 2: Principles for sustainability as the desired outcome
The Natural Step and Natural Capitalism

Level 3: Principles for the process to reach the desired outcome
Backcasting

Level 4: Actions and concrete measures
Actions related to achieving 100% sustainability in 7 areas: materials and design, energy, water, air, transport and habitat

Level 5: Tools and metrics to monitor and audit
To be finalised (BREEAM / NOW Home)

Level 6: End-user analysis
To be finalised (consumer view, industry view, central government view and local authority view)

2. THE PROJECT

2.1 Background

Beacon Pathway Ltd (Beacon) is a research consortium funded by shareholders and the Foundation for Research Science and Technology (FRST) to carry out research into the uptake of greater levels of sustainability in the residential built environment. Much of the housing stock in New Zealand is considered to be below par for even basic sustainability issues such as energy and water efficiency and in many cases is below World Health Organisation guidelines for human health requirements. Even houses perceived as higher quality are expected to fall short of future requirements proposed by upcoming national goals for sustainability (e.g., Building Act 2004, Sustainable Development Programme of Action, 2003).

Beacon's goal is to establish a 'sustainability standard' for New Zealand houses, and inform a programme of interventions that will bring about uptake of greater levels of sustainability features such that 90%+ of houses meet the 'standard' by 2012. In addition, Beacon intends to inform the development framework for neighbourhoods, so that as neighbourhoods are developed and/or redeveloped, the principles of sustainability are taken into account.

Beacon has defined a programme of research to be carried out over 2004-2010 to determine the means by which these goals will be achieved. The programme contains nine 'objective areas', each with a varying number of milestones to be met over the 5-year research period. The objective areas are categorised as follows:

- Consumers
- Industry
- New Build Technologies
- NOW Home
- Sustainability Framework
- Retrofit
- Neighbourhoods
- National Scorecard
- Integration

The first stage (July-September, 2004) involves eleven 'programme confirmation phase' projects to ensure the overall programme is well informed and that the structure of the programme is optimal. The projects are:

- SF1.1: Sustainability Framework Design
- INT1: Prioritisation/Optimisation Tool
- CON1: Consumer Research Impacts and Alternatives
- IND1: Industry Research Impacts and Alternatives
- NEW1: New Technology Impacts
- NOW7: Demonstration Home Hypothesis
- FR1: Housing Stock Analysis
- NBH1: Neighbourhood Research Baseline
- NS1: Macroeconomic Models – availability and relevance
- SF1.2: NOW Home vs. REF Home
- NOW1: NOW Home Knowledge and Future Monitoring Recommendations

For more information about the overall programme and the programme confirmation phase projects, refer to the 'Research Programme' (commercial in confidence) and 'Research Project Specification'

(dated 18 May 04) documentation, available from Beacon Pathway Ltd (via Paul Minett, Acting General Manager: paulminett@strategic-lift.com)

This report documents the findings of **SF1.1: Sustainability Framework Design**.

2.2 Project definition

The supporting programme documentation states this project's aim as: "by building on the existing model (NOW Home) and through learning from international experiences, have identified the key elements of a sustainability framework for houses". From here, the project is intended to inform Stage 2 of the Sustainability Framework objective area: SF2.1 "to develop the key metrics for each aspect of the framework and develop a prototype model".

This would tend to suggest that this project (Stage 1) is more about setting the direction for where we are going, rather than being driven by how we are going to get there. However, based on the feedback from Beacon stakeholders, it would appear that both features warrant consideration at this stage of the overall programme.

Therefore, the project team propose that the purpose of this project is to recommend the key elements of a sustainability framework with the ultimate purpose of facilitating the implementation of sustainability outcomes at the level of 'home'. The purpose can be broken down into two parts: the first – 'to recommend the key elements of a sustainability framework' – provides the belief structure for the framework and defines the ultimate state of where we want to be. The second part – 'to facilitate the implementation of sustainability outcomes at the level of home' – provides the tactical aspects for achieving the ultimate state. It is important not to confuse the two parts – the first sets the philosophical base, the second sets the operational base.

While a sustainability framework ultimately provides users with a simple way to assess whether or not sustainability outcomes have been achieved, it is also important to note that a sustainability framework is not a rating scheme. A rating scheme (including metrics/criteria/indicators) is an important element of a framework, but they are not one and the same.

In sum, a framework is a tool for guiding decision-making, one that provides a degree of certainty for where different decisions will lead.

The following section (section 2) considers various sustainability frameworks as potential templates for the SF1.1 sustainability framework structure.

3. SUSTAINABILITY FRAMEWORKS

Sustainability is an immense area of inquiry. 'Sustainability thinking' can be tracked back to the environmentalist movement which emerged in the 1960s, largely in the US. It wasn't until the release of the so-called Brundtland Report (*Our Common Future, 1987*) that the concept of sustainability was launched onto the international agenda[1]. As defined by the Report… "sustainable development is development that meets the needs of the present without compromising the ability of future generations

[1] This influential document framed sustainability in terms of sustainable development.

to meet their own needs" Fundamentally about people, this 'original' definition of sustainability has been equated with a commitment to living within the limits of the biophysical environment and managing resources (especially those constituting economic development) in such a way as to meet the aspirations of society over time (Chiu, 2003).

A definition such as this, while intuitively simple, becomes increasingly complex upon application. This is because of the different ways it can be broken down and interpreted. For example:

- 'A commitment to living': sustained how?
- 'Within the limits of the biophysical environment': sustained where / which parts?
- 'Managing resources': sustained for what / which ones?
- 'Aspirations of society': sustained by and for whom?
- 'Over time': sustained for how long?

Answers to each of these questions vary depending on the philosophical 'worldview' of the person or people undertaking the inquiry. A worldview is a powerful 'filter' that each of us has developed and maintained through our experiences that shapes our values and beliefs in certain ways. It provides the basis for why we think the way we do.

Because we don't all think the same way, there are many different approaches to sustainability. These approaches come in various forms such as, principles, concepts, strategies, policies/legislation, guidelines, specifications, standards, processes, tools, best practice models, case studies, indicators and assessment methods, etc. Some of the more important approaches include:

- New Zealand Sustainable Development Programme of Action (2003)
  'Sustainable cities are healthy, safe and attractive places where business, social and cultural life can flourish'
- Urban Design Protocol (work stream under SDPA)
  '…outline a vision for successful towns and cities in NZ through high quality urban design'
  '…identify high quality urban design principles'
- Building Act (2004)
  '…buildings are designed, constructed and able to be used in ways that promote sustainable development' and inclusion of principles for taking into account of human health, whole of life building costs, energy efficiency/conservation, renewable energy, water efficiency/conservation, and waste reduction

Other examples include:

- TUSC (Tool for Urban Sustainability – Code of Practice)
- LIUDD (Low Impact Urban Design and Development)
- Local Agenda 21 initiatives
- Communities for Climate Protection – New Zealand
- National Energy Efficiency and Conservation Strategy
- New Zealand Waste Strategy
- New Zealand Biodiversity Strategy
- New Zealand Transport Strategy
- Auckland Regional Growth Forum
- Resource Management Act 1991
- Local Government Act 2002
- Maori Sustainable Development
- Sustainable Development Reporting (ICANZ, NZBCSD, MfE, SBN)
- The BRANZ Green Home Scheme

All of these (and others) are about advancing the sustainability agenda in some shape or form. There is a risk that the approaches are perceived to be in competition with, or are contradictory to, one another making it even more difficult to choose which method to go with to achieve the desired sustainability state. So how can we begin to makes sense of it all?

3.1 A Model for Sustainable Development

In considering various approaches, we can see that, while the components of each approach may be different, they tend to be organised or 'framed' in similar ways. In broad terms, there is usually an element that reveals the overarching principles / strategy / vision that the approach aims to achieve, and / or elements that suggest how to operationalise, and measure progress towards, those aims. Indeed, research by Robèrt et al (2002) argues for a 'holistic systems model' for analysing these elements in a useful way. They state that the many tools and approaches, when 'viewed' using this model, can be seen as complimentary to each other and used in parallel in the process of making progress toward sustainable development.

The model is presented as five interdependent levels, categorised as:

Level 1: Principles for the *constitution* of the system

Here the principles that constitute and construct the system under study are defined. The system under study is the global ecosystem or the ecosphere. The three dimensions of the global ecosystem or the ecosphere are economy, society and environment. How these dimensions are defined reveals the principles (worldview or philosophical base) underpinning the approach. There are three main worldviews[2]: rationalistic, naturalistic and humanistic. Each worldview places a slightly different emphasis on each dimension and on the combination/interaction of dimensions, and this is reflected in the various frameworks that follow that particular worldview (as shown below). The order of the listed sustainability dimensions (the 'interaction'), is a measure/indication of the emphasis of the dimensions in relation to that worldview.

- **Rationalistic or economy/environment/society interaction.** With an emphasis on the economic dimension, the focus of this worldview is on resource efficiency, resource productivity, eco-efficiency, etc. Conceptual frameworks include Steady State Economy, Natural Resource Accounting, Green GDP, Factor 10, Capital Conservation, Eco-Efficiency, and Energy Accounting.

- **Naturalistic or environment/society/economy interaction.** The focus of this worldview is on the biophysical environment, flows of materials within larger natural systems, working within the limits of the earth, etc. Conceptual frameworks include Carrying Capacity, Biomimicry, Limits to Growth, The Natural Step, Cleaner Production and Natural Capitalism.

- **Humanistic or society/environment/economy interaction.** The focus here is on society, stewardship and responsibility, support and preservation of life, meaning and purpose, etc. Conceptual frameworks include Ecological Footprinting, Ecosystem Health, Resource Management, Agenda 21, Human Development Index, and the Index of Sustainable Economic Welfare.

Another method of conceptualising sustainability philosophy is to characterise approaches as 'weak' or 'strong' (see Figure 1). The 'weak' approach views the three dimensions of sustainability (society, environment and economy) as discrete dimensions, that when selected elements of that dimension are

[2] Adapted from information available online at www.solonline.org (accessed 27/7/04), and www.sustainableliving.org/appen-e.htm (accessed 14/7/04).

integrated (represented as an intersection or cross over point), sustainability is achieved. Implicit is the assumption that trade-offs can be made between the three dimensions to achieve the desired sustainability outcomes.

The 'strong' approach, on the other hand, views the three dimensions as wholly reliant on (and fully integrated with, as opposed to intersecting with) one another. This approach recognises that the economy is a sub-set of society (i.e. it only exists in the context of a society), and that many important aspects of society do not involve economic activity. Similarly, human society and the economic activity within it are totally constrained by the natural systems of our planet. The economy may expand or contract, and society's expectations and values may change overtime, but to function in a sustainable way we must not exceed the capacity of the biosphere to absorb the effects of human activities (PCE, 2002).

It is not that one particular worldview is any better than any other one, or that 'weak' is necessarily any better or worse than 'strong'. Equal and opposing arguments exist for each. Instead, delineating sustainability in these ways gives us a means of understanding the base/core from which decisions are made, provides clarity and transparency of those choices, and provides a degree of certainty for knowing where certain decisions will lead to.

In sum, level 1 defines the philosophical base that a particular approach is aligned to (whether stated explicitly or implicitly). It influences/shapes the content of the remaining 4 levels and is effectively the core from which all remaining decisions are made.

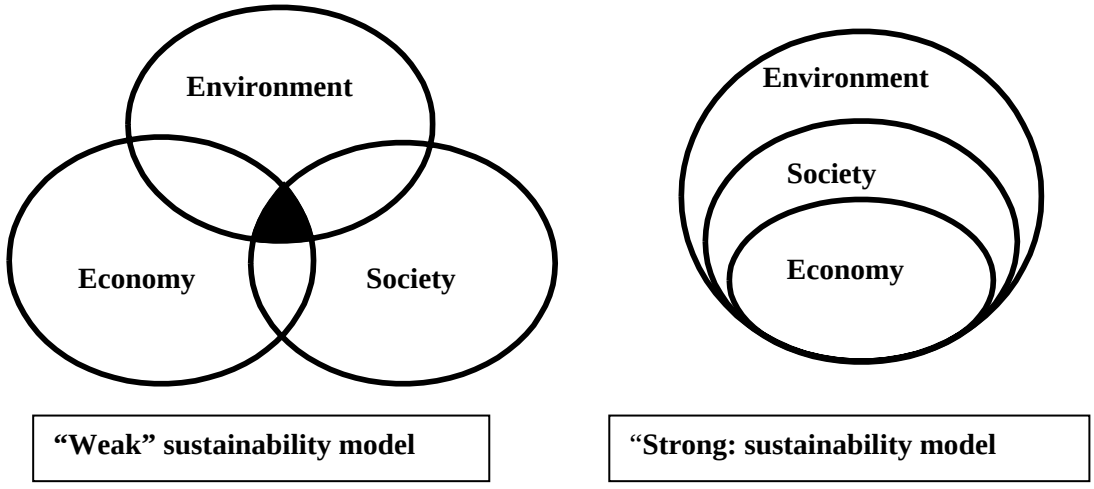

Figure 1: 'Weak' and 'strong' models of sustainability

Level 2: Principles for a favourable *outcome* of planning within the system

Here the desired state of sustainability, or preferred principles to achieve a certain outcome, is stated. Level 2 is a critical stage, as it is this level that sets the **strategic planning** direction for the entire framework.

Robèrt et al use the four system conditions of the Natural Step Framework as an example:

- In the sustainable society, nature is not subject to systematically increasing concentrations of substances extracted form the Earth's crust,
- Concentrations of substances produced by society,
- Degradation by physical means,
- And, in that society human needs are met worldwide. *(http://www.naturalstep.org/)*

In other words, if these four system conditions are met, the desired state of sustainability will be achieved.

Other examples include:

- 12 Principles of Green Engineering (a framework to engage when designing new materials, products, processes and systems that are benign to human health and the environment) *(http://www.ku.edu/~cebc/about/about04.shtml)*
- Ahwahnee Principles (guides the planning and development of urban and suburban communities so they will more successfully serve the needs of those who live and work with them) *(http://user.gru.net/domz/ahwah.htm)*
- Bellagio Principles (guidelines for starting and improving the sustainability of community groups, NGOs, corporations, governments and institutions) *(http://www.iisd.org/measure/principles/1.htm)*
- Ceres Principles (provides an environmental code of conduct for environmental, investor and advocacy groups working together for a sustainable future) *(http://www.bsdglobal.com/tools/principles_ceres.asp)*
- Daly Principles (addresses the regenerative and assimilative capacities of natural capital and the rate of depletion of non-renewable resources) *(http://www.wsu.edu/~susdev/Daly90.html)*
- Earth Charter Principles (promotes respect and care for the community of life, ecological integrity, social and economic justice, and democracy, non-violence and peace) *(http://jnevill.customer.netspace.net.au/Env_principles_EarthCharter.htm)*
- Global Sullivan Principles *(http://globalsullivanprinciples.org)*
- Hannover Principles (priorities for the built environment and promoting an approach to design that meets the needs of the present without compromising the needs of the future) *(http://www.mcdonough.com/principles.pdf)*
- Interface Steps to Sustainability (a system of industrial production that dramatically reduces the burdens placed on living systems) *(http://www.interfacesustainability.com/model.html)*
- Natural Capitalism (refers to the earth's natural resources and the ecological systems that provide vital life-support services to society and all living things). (*http://www.rmi.org/sitepages/pid564.php*)
- The Precautionary Principle (to prevent harm to the environment and to human health) *(http://www.biotech-info.net/precautionary.html)*
- UN Global Compact Principles *(www.unglobalcompact.org)*

Level 3: Principles for the *process* to reach this outcome

Here the principles for the process to achieve the successful outcome are determined (i.e., how do we achieve the desired sustainability state as stated in level 2). Robèrt et al provide a number of examples:

Principles for strategic investments:

- Backcasting
- Flexible platforms
- Good return on investment
- Precautionary principle

Social principles:

- Dialogue and encouragement
- Transparency

Political principles:
- Differentiated taxes
- Subsidies
- International agreements
- International trade and economic development
- Legislation

The process principles that are stated here must reflect the outcome principles stated in level 2. In other words, you would chose the process principles that best fit with achieving whatever the desired state of sustainability is (and this to a certain extent also depends on the stakeholders' sphere of influence / what process methods are available to them).

Level 4: *Actions, i.e., concrete measures* that comply with the principles for the process to reach a favourable outcome in the system

Here practical actions in line with the process principles in order to achieve the outcome within the larger system are outlined. It is important not to confuse concrete actions with the principles that underpin them (level 2). All actions must comply with the process principles (level 3). Examples could include:

- Specify sustainable materials and construction methods
- Identify life cycle costs and benefits
- Manage social and environmental impacts
- Help household and/or community safety and reduce conflict and vandalism
- Be self-sufficient in energy and water
- Use renewable energy sources
- Apply the '5 Rs' to waste management
- Travel sustainably
- Mitigate and adapt for climate change
- Retain indigenous biodiversity

Level 5: *Tools* to monitor and audit

Level 5 is where the monitoring of the whole process is described and should be designed from a total systems perspective. There are two levels to consider: (i) the relevance of actions with reference to principles for the process (e.g., indicators of flows and key-figures to comply with principles for sustainability), and/or monitoring (ii) the status of the system itself, and impacts (e.g., ecotoxicity and on employment), or reduced impacts, as a consequence of strategically planned societal actions. At least 70 building-based rating tools exist. Examples include:

- LEED
- BREAM
- BASIX
- Green Home Scheme
- NOW Home
- SAM (Sustainability Assessment Model)
- NABERS
- CASBEE
- GB Tools

- CRISP
- Global Reporting Initiative

The five levels outlined above make up the 'general model of interrelated and essential elements for sustainable development' and can be visualised as follows (see Figure 2). We note that Robèrt et al further break down level 2 into a number of subparts. They take the four system conditions of the Natural Step Framework and further divide these into two basic mechanisms: dematerialisation (reduction of material flows) and substitution (exchange of type / quality of flows), with a further break down of what those two aspects mean in relation to the system condition.

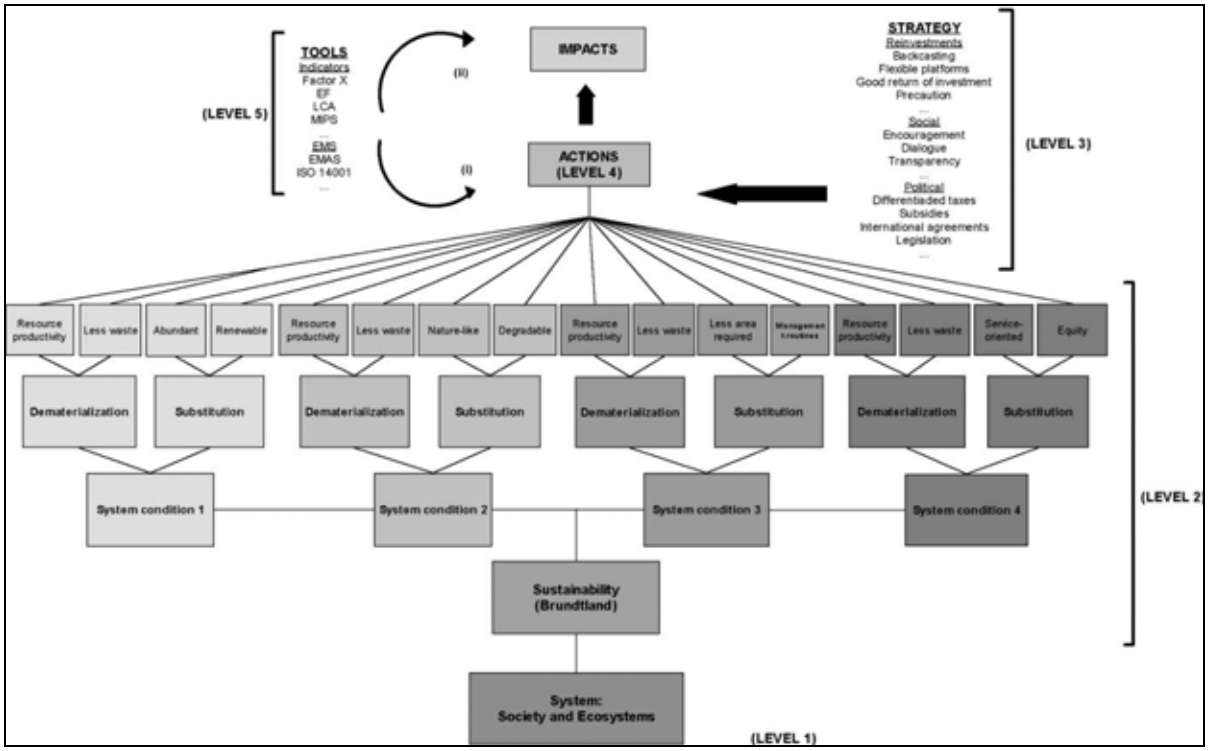

Figure 2: Schematic of the Robèrt et al model

This model provides a useful way of breaking down and untangling various sustainability approaches. In doing this, we are better able to understand the basis for why decisions were made, why different tools were chosen over others etc. In some cases, we may find that a particular approach hasn't had a strategically defined direction in its planning process, there is a lack of clarification regarding the ultimate objectives, and the metrics are often chosen or designed in an unclear way. So, not only does it give us the means to disentangle various approaches, by using the model as a development tool, we can design a sustainability framework that is integrated, comprehensive and robust.

R1: the project team recommend that the Robèrt et al model be used in the development of the sustainability framework for houses.

4. SF1.1 SUSTAINABILITY FRAMEWORK

Before we begin to develop the sustainability framework for houses (based on the Robèrt et al model), what we mean by sustainable housing needs to be established. This is because without first defining a future 'end-point', reaching sustainability is an unlikely outcome of any effort. It is from this 'end-point' that the framework levels will be strategically designed.

Using the Beacon vision, our 'end-point' is defined as "to bring the vast majority (90%+) of New Zealand homes to a high standard of sustainability by 2012".

To do this, we need to know what the ultimate sustainable house is and what a 'high standard' would be in relation to this. Following the basic tenet of the Brundtland Report, the ultimate sustainable house should not only cater for the needs of the present generation, but also for those to come.

4.1 The ultimate sustainable house

To sustain something now and for future generations implies that its presence must not damage the environment in which it is set and which sustains both its initial creation and its subsequent continuation. This seems logical, as life cannot exist if the environment is damaged to the extent of no longer being able to support life. On this basis, a simple definition of a sustainable house would be as follows:

"A sustainable house causes no damage to the environment."

However, the construction of anything is likely to cause some environmental damage. Even the erection of a tent disturbs the soil, flattens plants etc. So, what we mean is that the environment must be safeguarded from deteriorating to such an extent that it diminishes the ability of the environment to recover both in the short and long term (Chiu, 2003). The definition needs to be refined as follows to cover this aspect of reversible damage:

"A sustainable house causes no irreversible damage to the environment."

This definition of the sustainable house so far deals only with the impact of the house on the environment. As housing provides one of the fundamental foundations upon which society exists, develops and survives, we need to add the dimensions of society and the economy into the equation. In keeping with the Brundtland definition, we can include these dimensions by stating that a sustainable house is one where social and cultural needs are met and where resources are (more) equally available to everyone. Incorporating this then:

"A sustainable house is one where social and cultural needs are met, where resources are (more) equally available to everyone, and where no irreversible damage to the environment is caused"

Finally, to be thorough, we are concerned with the entire life-cycle of a house[3] on its site (from construction to operation to demolition), giving the following:

"A sustainable house is one where social and cultural needs are met, where resources are (more) equally available to everyone, and where no irreversible damage to the environment is caused during its entire life-cycle"

Accepting this as our ultimate 'end-point' we can begin to draft the structure and content of the sustainability framework for houses.

R2: the project team recommend that the definition of a sustainable house as described in s.3.1 be accepted.

4.2 SF1.1 Framework Structure

Using the Robèrt et al model, the project team propose the following framework structure (see Figure 3). We recommend starting with a 'definition of success' and also suggest the addition of a further level – level six – to identify how different end users could use the framework and take into account any difference in approach for new vs. existing houses (there have been four user groups identified: consumers, industry, central and local government). An important aspect of level six is to make the limitations of the framework explicit to ensure it is used appropriately in decision making. The indication of feedback between levels 4, 5 and 6, allows for advances in technology and methodology and takes into account the adaptive learning capacity of stakeholders/user groups.

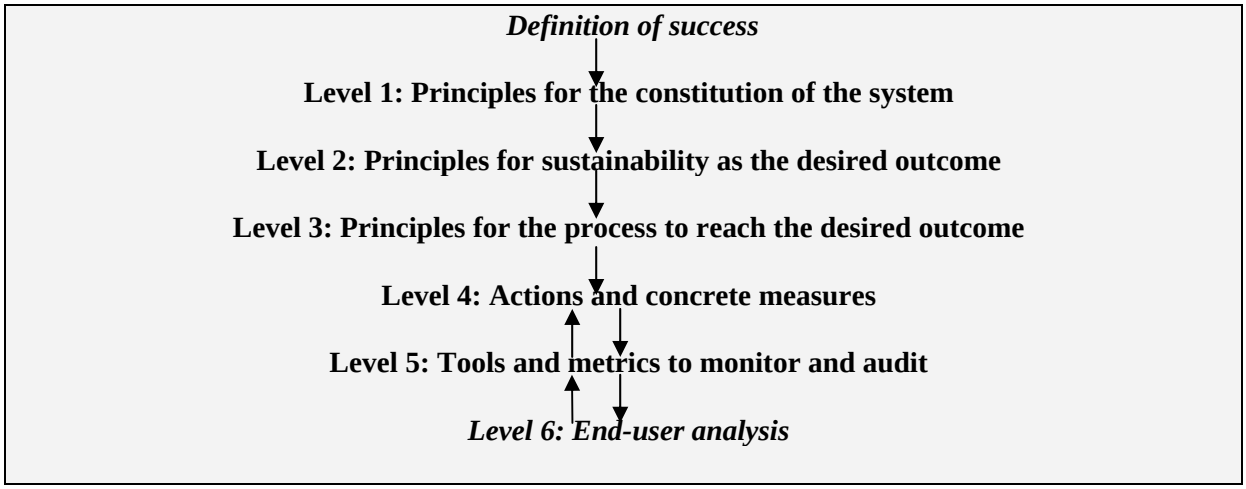

Figure 3: Proposed framework structure (adapted from Robèrt et al, 2002)

R3: the project team recommend that the framework structure as proposed in s 3.2 be adopted.

4.3 SF1.1 Framework Content

The project team recommend the following content for the sustainability framework for housing.

4.3.1 Definition of success

In section 3.1 we defined the ultimate 'end-point' as follows: "a sustainable house is one where social and cultural needs are met, where resources are (more) equally available to everyone, and where no irreversible damage to the environment is caused during its entire life-cycle".

[3] 'House' is taken to mean any form of residential dwelling, e.g., apartment, town house, stand-alone etc.

We have also referred to the Beacon goal which states that 90%+ of housing shall meet a 'high standard' of 'sustainability' (as defined by this end point) by 2012. The next key question therefore is what is a 'high standard'? The answer to this question becomes our *definition of success* and requires careful consideration.

It is likely that the determination of the metric element of the framework (level 5) will assist in this discussion. For example, whatever the metric we choose defines as a 'high standard' should become the default for the definition of success. The NOW home could be the benchmark (or minimum standard) against this. Adapting the Beacon 'sustainability scale', this can be represented as follows (Figure 4):

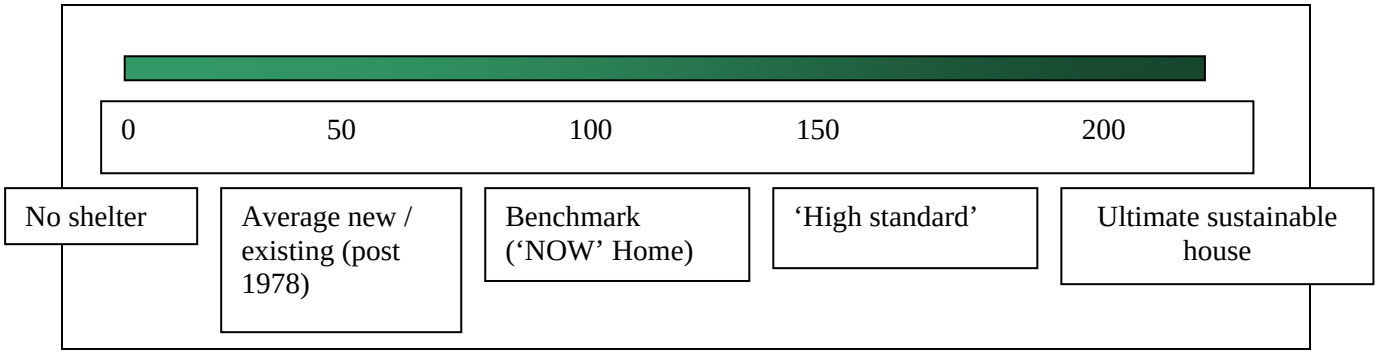

Figure 4: Proposed sustainability scale

4.3.2 Level 1

The programme documentation clearly indicates that this project is about striving for 'a high standard of sustainable housing'. This is an ambitious target and one that imposes a great deal of 'stretch'. Strong leadership will be required and the project team suggest that if Beacon is seriously interested in significantly pushing the boundaries of mainstream practice, then a move away from business as usual to a new business model is required.

What we are therefore looking for is a robust sustainability model that offers significant changes in ways of developing knowledge and solutions that will move the New Zealand housing sector towards sustainability as we have defined it. This being the case, we argue that the economic and social dimensions of sustainable housing should be developed within the context of environmental sustainability. We recommend that a strong model of sustainability be adopted.

A strong sustainability model does not imply that the economy is any less important than society or that society is any less important than the environment (i.e., it is not about relative importance) – rather it indicates the order of interdependence of the three dimensions. For sustainability to be achieved so that the needs of both present and future generations are met, economic impacts cannot diminish the ability of society to maintain or improve its quality, and societal impacts cannot diminish the ability of the environment to maintain or improve its quality.

If we accept the strong sustainability model, the philosophical worldview that best fits with this is the naturalistic approach. Both the strong model and naturalistic approach have been adopted as business strategy and decision making models for a number of organisations, including internationally renowned companies such as Interface Inc. (a leading floor coverings manufacturer), and Alcan Inc. (aluminium

manufacturing and specialty packaging company); both listed as top-100 companies on the Dow Jones Sustainability Index[4].

As alluded to previously, it is not so much that the various worldviews are 'good' or 'bad' or that choosing one model over another carries significant risks or benefits – more that the choice of philosophical base allows organisations to 'reveal their colours' and provides a robust rationale for decision-making.

As the sustainability agenda advances, it is becoming clearer that more significant changes need to be made to make 'real' progress – and it's only going to get harder as the agenda moves on (a house that is energy efficient, for example, will not be enough). From this basis alone, a strong / naturalistic approach gives us the scope to remain at least level with the leaders in this field. Further advantages include:

Advantages of a strong sustainability / naturalistic approach:
- Strategically robust
- International and national acceptance
- Demonstrated business advantage
- Shows we mean business (not 'greenwashing')
- Supported by ecological economic theory and sustainability indicators

Potential disadvantages of strong sustainability / naturalistic approach include:
- Requires a significant shift in thinking (may face resistance)
- Requires significant changes to business practices which can take time

R4: the project team recommend that a strong model of sustainability / naturalistic approach be adopted as the philosophical base of the sustainability framework.

4.3.3 Level 2

In selecting the 'principles for sustainability as the desired outcome', we have a number to choose from (listed in s.2.1, under 'level 2'). Ones that best fit a naturalistic worldview include the Daly Principles, The Natural Step, Natural Capitalism and the Precautionary Principle. For the purposes of this study, we consider The Natural Step and Natural Capitalism as the better options as they are internationally and nationally recognised and have been demonstrated across a number of different applications.

The Natural Step (TNS)

The Natural Step Framework is a methodology for successful organisational planning[5]. In using the TNS Framework, one proceeds on the basis of a future point in time when society is sustainable. The prerequisite for this is an all-embracing definition of the conditions that must apply in any sustainable society. These conditions, known as the system conditions, are an important part of the TNS Framework. They have been developed by an international network of scientists and are based on scientific consensus. The four system conditions are as follows:

<u>System Condition One: in the sustainable society, nature is not subject to systematically increasing concentration of substances extracted from the Earth's crust</u>

Society mines and brings into use substances from below the Earth's surface. For this system condition to be met, the extraction rate of these substances cannot be greater than the redeposit rate to the earth's crust.

[4] The DJSI is the first global index tracking the financial performance of the leading sustainability-driven companies worldwide.

[5] http://www.naturalstep.org.uk/uk_homepage.html (accessed 3/8/04)

System Condition Two: in the sustainable society, nature is not subject to systematically increasing concentrations of substances produced by society
Society has also been manufacturing synthetic substances (i.e. substances that wouldn't otherwise occur in nature). For this system condition to be met, the production rate of these substances cannot be greater than treatment rate (i.e. return substances to an inert state, prevent pollution, etc).

System Condition Three: in the sustainable society, nature is not subject to systematically increasing degradation by physical means
Society is breaking down natural systems (ecosystems) faster than they can renew themselves. For this system condition to be met, the natural environment must not be impoverished by over-harvesting or other forms of ecosystem manipulation by building and construction processes.

System Condition Four: in the sustainable society, human needs are met worldwide
If people around the world cannot meet their basic human needs, the first three system conditions will not be met. The basic human needs are air, water, food and shelter. It also refers to needs related to people's choice and control, and implies a more equitable distribution of resources between and within nations.

Planning with the help of the TNS Framework focuses on the initial causes of problems rather than reacting to the environmental effects (the 'end-of-pipe' approach). Investments and measures are selected which develop the organisation in a sustainable direction with maximum long-term flexibility and short-term profitability. The TNS Framework is a methodology for all environmental planning. When environmental management systems and key indicators are utilised and lifecycle analysis is undertaken using the TNS Framework, operations are steered in a sustainable direction.

The following case studies are examples of The Natural Step in practice:

Hot Pyjama Productions Limited
Hot Pyjama Production (http://www.hotpj.co.nz) is a small Christchurch graphic communications company offering design, print production and website development services. It was the desire to combine a well-developed business ethic that values social responsibility, the environment and community development that led the company to participate in the first Natural Step programme for small businesses. The Company's approach is to think the whole process through, from designing and choosing a production method that will minimise waste and the use of non-renewable resources, to how the job is packaged and delivered, without compromising on quality or service.

The TNS framework has helped Hot Pyjama Productions to make sense of many of the complex issues that surround environmental concerns and the wider goal of sustainability. The concept of collecting the 'low-hanging fruit' first has helped the Company prioritise its actions. Targeting energy consumption has reduced costs, saving around $500 a year, a significant saving for a small business.

Carbon emissions have reduced through the frugal use of private cars, more efficient lighting and switching off computers at night. A number of new client relationships have been established through the development of the Company's network of environmentally-aware organisations and have allowed the Company to create a platform for further improvement in the supply chain.

Phoenix Organics
Phoenix Organics, an organic beverage company, are actively involved with and support sustainable business initiatives. TNS has been running in this company for over 3 years and continues to provide them with a framework on which to build a comprehensive and progressive environmental management programme.

Some of Phoenix's initiatives, based on TNS System Conditions, include switching from imported glass bottles/ jars from Europe to standard models produced in New Zealand or Australia; commitment to producing an organically certified product range to reduce the chemical use associated with conventional growing practices; utilizing rain water for pasteurisation, toilet system and gardens; and design of new premises to incorporate some sustainable building criteria including water and energy efficiency measures.

Christchurch City Council: South City library

The new library building incorporates the Council's local service centre, and a Ministry of Education funded learning centre using information technology. The Christchurch City Council's (CCC) Project Management Team found the TNS framework provided a shared understanding of sustainability to people involved in the project.

Not all the Project Control Group shared the policy commitment to sustainability features at the outset, but their interest and understanding grew through participation. Lack of knowledge about life-cycle costs of materials was a handicap and it was difficult to find out true information about materials sources and environmental credentials. The difficulty of securing South Island supply of some preferred components and materials was another challenge, but successes included persuading the main contractor to use Duracem cement, manufactured from 75% recycled fly ash produced as a waste product from the smelting of steel. Through the CCC's energy management programme, energy efficiency over periods of several years was accounted for, allowing investment "up front" to secure cost saving in operation.

The completed building's features include roof-rainwater collection for use in toilet-flushing, low-water-use plumbing fittings, exterior swales and ponds to slow stormwater flow to the river, sustainably sourced timber, minimised use of paints, use of building materials with recycled content, low-energy lighting, wool acoustic insulation and minimised toxic materials. On-site trees have been retained. Heating is supplied by means of a heat pump from city water supply pipes below the site.

Case Studies from the UK and US

The Natural Step in the UK has been working with Skanska, the global construction services group, to redevelop the Barts Hospital in London and the London Hospital as exemplars of sustainable development. The Natural Step organisation will work closely with the project teams from the very early stages of the project. Once introductory TNS training and sustainability workshops (for all involved) have been completed, then specific objectives will be drawn up to produce exemplary buildings.

Crest Nicholson (http://www.crestnicholson.com/home/home.html) is also a major developer in the UK, renowned for redefining the boundaries of construction. The CEO, who is passionate about sustainable development, has involved TNS to work on two recent high profile projects. The first is in Bristol and involves the redevelopment of old docks (the Harbourside scheme) in the city, and the second is to redevelop a run down estate in Birmingham with some significant social issues.

Carillion plc has worked with TNS (in a TNS Pathfinder project) to apply sustainability principles from design through to construction at Princess Margaret Hospital in Swindon (http://www.carillionplc.com/sustain-002/documents/pdf/sustainability%20strategy%20paper.pdf)

A sustainability action plan (encompassing ten areas including: waste management, materials selection, community relations, etc) was used to assess impacts and to generate ideas and innovation (Leiper et al, 2003). To demonstrate the business benefits derived from a sustainable development approach, in this

project, a sustainability cost accounting system was developed (Casella Stanger 2002, in Leiper et al, 2003).

The construction of the Nursing and Biomedical Science Building at the University of Houston, Health Sciences Center in Texas offered the opportunity for design of a facility that is a net energy producer; employs state-of-the-art green building techniques and technologies; generates operational savings; increases employee moral; and illustrates wellness and health. For the next hundred years, the building is designed to serve as a space where people walk in and feel they are in a place built for healing, caring, and nurturing (www.naturalstep.org/learn/docs/cs/case_ut_houston.pdf).

TNS will allow the University to provide a building which will: be a non-toxic workspace, include grey water systems, utilise natural daylight, and reclaimed wood flooring. The project team also uses local materials as often as possible.

More case studies of The Natural Step can be viewed from the following web pages:

Private Sector:
Electrolux Eco-Know How - http://www.electrolux.com/node423.asp
Interface - http://www.ifsia.com/us/company/sustainability/frontpage.asp
Collins Companies - http://www.collinswood.com
Gerding/Edlin Development - http://www.ge-dev.com/sustaindev.htm
Nike Environmental Fact sheets - http://nikebiz.com/environ/we_factsheets.shtml
or Nike Sustainability Education Curriculum - http://www.airtoearth.com
Norm Thompson Outfitters - http://www.normthompson.com/content/commitmentmain.jsp
Progressive Investments - http://www.progressiveinvestment.com
Sanga-Saby Conference Center - http://www.sanga-saby.se/miljo/miljoredovisning/1997/eng/index.html

Public Sector:
Oregon Solutions - http://www.oregonsolutions.net
City of Portland Office of Sustainable Development - http://www.sustainableportland.org
and Green Rated - http://www.green-rated.org
City of Santa Monica - http://www.ci.santa-monica.ca.us/environment/policy
APA Policy on Planning for Sustainability - http://www.planning.org/policyguides/
Curitiba, Brazil - http://www.dismantle.org/curitiba.htm
City of Seattle Sustainability Studies - http://www.cityofseattle.net/light/conserve/sustainability

Natural Capitalism

Natural Capitalism (developed by Paul Hawken, Amory and Hunter Lovins) describes a set of fundamental assumptions necessary for the integration of economy, ecology and societal demands. It assumes that future economic growth will be limited by natural capital rather than human-made capital, and that radical increases in resource productivity are necessary. Natural Capitalism synergizes four major elements[6]:

Radically increase the productivity of resource use.
Through fundamental changes in production design and technology, leading organizations are making natural resources stretch five, ten, even 100 times further than before. The resulting savings in

[6] http://www.natcapgroup.org/html/natcap_explained.html (accessed 9/9/04)

operational costs, capital, and time quickly pay for themselves, and in many cases initial capital investments actually decrease.

Shift to biologically inspired production (Biomimicry) with closed loops, no waste, and no toxicity.
Natural Capitalism seeks not merely to reduce waste but also to eliminate the concept altogether. Closed-loop production systems, modelled on nature's designs, return every output harmlessly to the ecosystem or create valuable inputs for other manufacturing processes. Industrial processes that emulate nature's benign chemistry reduce dependence on non-renewable inputs, eliminate waste and toxicity, and often allow more efficient production.

Shift the business model away from the making and selling of "things" to providing the service that the "thing" delivers.
The business model of traditional manufacturing rests on the sporadic sale of goods. The Natural Capitalism model delivers value as a continuous flow of services: leasing and re-deploying carpets rather than selling and disposing of them (an example of the Interface approach as employed at Landcare's new Tamaki building). This shift rewards both provider and consumer for delivering the desired service in ever cheaper, more efficient, and more durable ways. It also reduces inventory and revenue fluctuations and other risks.

Reinvest in natural and human capital.
A capitalist approach recognises the benefits of reinvesting in productive capital. Businesses are finding a fruitful range of new cost-effective ways to restore and expand the natural capital directly required for operations and indirectly required to sustain the supply system and customer base.

Examples of the application Natural Capitalism include:

Case Study 1 **http://www.natcap.org/images/other/NCchapter5.pdf**
The success of the Village Homes project in Davis, California (completed in 1981), first as a real estate development, and now as a community, can be traced back to its designers' and developers' whole-systems approach that considered end-use/least-cost issues.

The 240 homes in the subdivision are clustered in groups of eight surrounded by common space and connected by pedestrian walkways. The subdivision was laid out so that the small, passive solar homes would have good solar exposure. The original residents were able to decide how their common areas would be landscaped to create diversity among shared spaces.

One example of its unique design philosophy was the use of natural drainage swales instead of costly underground concrete drains. These savings paid for much of the landscaping of the extensive parks and greenbelts, while the swales allow enough water to soak in that the landscaping needs one-third to one-half less irrigation water than normal. The drainage swales are themselves part of the greenways, which not only provide routes for pedestrian and bicycle circulation but are also a focus for community life. Residents' homes are designed to incorporate passive solar technologies in a wide range of architectural styles. Annual household energy bills range from one-third to one-half of those in surrounding neighbourhoods, due to passive heating, natural cooling and solar hot water systems.

Case Study 2 **http://www.natcap.org/images/other/NCchapter5.pdf**
Archetypes of today's most efficient houses, in climates ranging from sub-arctic to fully tropical, have existed since the 1980s, and some much earlier. For example, Rocky Mountain Institute's 370m^2 headquarters stands at an elevation of 2,200m in western Colorado in a climate that occasionally gets as cold as –40°C. The building has no heating system aside from two small woodstoves. Yet its 99% space-heating savings made it cost less than normal to build in 1982–84, because its super-insulation, 'super-windows', and 92% efficient heat-recovering ventilators added less cost than was saved up front by eliminating installation of a furnace and ductwork. Moreover, this structure was able to save half the

water usage, about 99% of the water-heating energy, and 90% of the household electricity. The energy savings repaid all the costs of these efficiency improvements in ten months. Such a building has been shown to also keep its occupants more alert, happy, and healthy.

Comparable results have been achieved in many different climates. In cloudy Darmstadt, Germany, a no-furnace "Passivhaus" uses less than 10% the normal amount of heat (all produced by its water heater) and 25% the normal amount of electricity. It uses about as much energy for all its needs as a typical German house uses just for small appliances. The impressive results of this project have meant that there are now over 3000 units built based on the same principles.

Conversely, in Bangkok, Thailand, where people feel comfortable outdoors for only 15% of the year, an elegant and comfortable three-story, 350m^2 house has been constructed whose super-windows, overhangs, and other design features reduce its air-conditioning requirements by 90%. This house cost no more to build than a standard model.

Case Study 3 **http://www.natcap.org/images/other/NCchapter12.pdf**
The Kyoto Protocol has sent a strategic message to business that by paying attention to carbon reductions, the financial bottom line can be improved. The US's largest producer of chemicals, DuPont, has calculated that reduction in greenhouse gas emissions lead to direct savings - each ton of avoided carbon (or equivalent) emissions has so far saved DuPont over $6 US in net costs. As a result, once the Kyoto trading regime is established, DuPont could become able to earn marketable emissions credits that could someday contribute billions to its net earnings. Moreover, many firms in related businesses are exploring a further business opportunity not directly related to either cutting energy costs or trading emissions – they can see the potential for gaining market share by marketing "climate-safe" products as some electricity providers in the US are already successfully doing.

Case Study 4 **http://www.natcap.org/images/other/NCchapter4.pdf**
Industry is already rising to opportunities of repair, reuse, upgrading, remanufacturing, and recycling as the five main ways to keep the gift of good materials and good work moving on to other users and other uses. Remanufacturing by more than 73,000 U.S. remanufacturing firms, directly employing 480,000 people, generated 1996 revenues of $53 billion, a value greater than the entire consumer durables industry (i.e. appliances, furniture, audio and video, farm and garden equipment) in that country.

The second-biggest U.S. maker of furniture, Herman Miller, has a special day lit factory devoted exclusively to remanufacturing into like-new condition every kind of furniture the company has ever made new. Its larger rival, Steelcase, is one of several large firms battling with independent re-manufacturers to benefit from remaking its own products.

Big benefits flow to both customers and manufacturers when products are 'reborn'. Disposable cameras are affordable because Fuji and Kodak actually salvage them from photo finishers, remanufacture them, reload the film, and sell them again. IBM remanufactures its computers; by profitably recovering (by 1997) 16,000 tonnes of computers and computer parts per year. The Italian firm Bibo shifted in 1993 from making throwaway plastic plates to charging for their use, then recycling them into new ones.

Xerox's worldwide remanufacturing operations boosted earnings by about $200 million US over three recent years. Its latest green-designed photocopier, with every part reusable or recyclable, is expected to save it $1 billion via long-term remanufacturing. For an increasing range of products in Germany, the country which pioneered the concept of "extended product responsibility" (i.e. you make it, you own it forever) —factories producing everything from televisions to cars design them for easy disassembly and disposition, because otherwise the costs of assuming the post-user responsibility are prohibitive. The system, which has spread across Europe and to Japan (and has been introduced in New

Zealand - www.nzbcsd.org.nz/supplychain), raised, for example, the German rate of packaging recycling from 12% in 1992 to 86% in 1997.

Such life-cycle responsibility also creates unexpected benefits: BMW designed the Z-1 sports car's recyclable all-thermoplastic skin to be strippable from the metal chassis in 20 minutes on an "unassembly line" mainly for environmental reasons, but that configuration also made repairs much easier. In another case, the Alpha-Fry Group in Germany were burdened by the cleaning costs of returned jars for its solder paste, so it switched to pure tin containers, which on return are re-melted into new solder—11 cents cheaper per jar. Avoiding dissipation of materials that are costly to buy and toxic when dispersed is smart business. When Dow announced a $1 billion, 10-year environmental investment program, it was not just being socially responsible as it also anticipated a 30–40% annual return.

Case Study 5 http://www.natcap.org/images/other/NCchapter14.pdf
Curitiba is a south-eastern Brazilian city with the population of Houston or Philadelphia. Most cities so challenged by a combination of scant resources plus explosive population have become centres of poverty, unemployment, squalor, disease, illiteracy, inequity, congestion, pollution, corruption, and despair. Yet by combining responsible government with vital entrepreneurship, Curitiba, through the efforts of its former mayor Jaime Lerner, has achieved just the opposite. In nearly three decades the city has achieved measurably better levels of education, health, human welfare, public safety, democratic participation, political integrity, environmental protection, and community spirit than its neighbours, and arguably more than most cities in the United States.

It has done so not by instituting a few economic mega-projects but by implementing hundreds of multipurpose, cheap, straightforward, people-centred initiatives harnessing market mechanisms, common sense, and local skills. It has flourished by treating all its citizens, particularly its children, as its most precious resource and seeing them as creators of the city's future. It has succeeded not by central planning but by combining far-sighted and pragmatic leadership with an integrated design process, strong public and business participation, and a widely shared public vision that transcends partisanship.

As an example of its innovative leadership and successful practical implementation, Curitiba is now widely believed to have one of the best public transportation systems in the world. Bus jams never happen and vandalism is unknown, even to the beautiful but deliberately fragile glass tube stations because of pervasive civic pride. The bus system is entirely self-financing from fares; the city contributes only the streets, stations ($4.5 million US for all 200-odd stops), and lights. The forty-five-U.S.-cent fare covers all other costs, including the $45 million US fleet of buses, plus a profit to the ten private operating firms. The rate structure repays 1% of the operator's fleet investment per month which has been shown to be a strong incentive to reinvest.

The bus system succeeds both financially and socially because it gets the basic incentives right. The division of total fares between the ten bus companies rewards not how many people they carry but how many miles of route they cover, so they have an inducement to be comprehensive, and not to indulge in destructive competition over routes already well served. The flat-rate, unlimited-transfer fare effectively uses shorter commutes by the middle class to subsidize longer commutes by poorer citizens who live further out.

The lessons of Curitiba's transformation hold promise and hope for all cities. To that end, a New Zealand delegation of urban professionals, led by the Parliamentary Commissioner for the Environment, visited Curitiba in 2002 and they have subsequently sought to introduce some of the ideas and innovations into the New Zealand urban policy and planning context (e.g. the Urban Design Protocol - http://www.mfe.govt.nz/publications/urban/draft-protocol-aug04/index.html).

In summary, Natural Capitalism is a new business model that reconciles environmental and economic interests, enabling companies and communities to do well and do 'good' at the same time. Natural Capitalism is attractive to local business people because it offers ways to strengthen competitiveness, while enhancing liveability and reducing environmental impacts. Innovative businesses can lead communities in adopting these principles and setting examples. Natural Capitalism is a powerful strategy for economic development – a route to increased jobs, income, commerce, savings, equity, and community well-being that doesn't necessarily require community growth. Because this kind of development proceeds independent of increases in the size of a community, it is attractive to both booming and declining communities. Unlike conventional expansion schemes that concentrate benefits in one or two places under the theory that benefits will trickle down to everyone, Natural Capitalist development distributes benefits widely across the community.

In considering these two sets of principles (The Natural Step and Natural Capitalism), we can see that both offer real advantages in driving business to be more competitive in the process of moving towards sustainability. The Natural Step introduces a way of thinking about sustainability and serves as both a basic way to understand why current practices need to change, and provides an overarching vision of what the desired sustainability state looks like. Natural Capitalism is a whole systems approach for capturing the benefits of The Natural Step. Natural Capitalism is a ready-made path to sustainability and is highly synergistic with the systems conditions of The Natural Step.

Organisations are increasingly looking increasingly at how to combine the two approaches. The University of Oregon and the Natural Capitalism Group[7] state: "business competitiveness and environmental protection occur through innovation, not regulation. Sustainable businesses and communities are developed by involved employees and involved citizens and neighbourhoods, as well as strong business leaders and local governments. Within the frameworks of the Natural Step and Natural Capitalism, the ingenuity of people in organizations and communities is unleashed to develop sustainable practices that are good for all, including the earth".

Closer to home, the Christchurch City Council actively promote and use both The Natural Step and Natural Capitalism in improving both their own operations and leading the development of a community vision for this city[8].

In sum, the four system conditions of The Natural Step are an integral part of the map to a sustainable future. Elaboration to a more complete business model based on nature is found in the four principles of Natural Capitalism (www.interfacesustainability.com). The project team recommend that both sets of principles be used in the development of the sustainability framework for housing.

R5: the project team recommend The Natural Step and Natural Capitalism be adopted as the 'principles for sustainability as the desired outcome' (level 2).

4.3.4 Level 3:

Examples of principles for the process to reach the desired outcome are listed in s2.1 under 'level 3'. Again, it is not a matter of which option or options are more risky or more beneficial than others, rather what is more applicable or achievable in terms of this particular programme.

In considering the literature and the case study information involving The Natural Step and Natural Capitalism principles, the process of 'backcasting' is described as a preferred approach. Backcasting is a systems thinking process which determines how to proceed from where we are today to get to the 'end-point' or desired sustainability state. Another way of describing it is as a technique that helps

[7] Refer to http://darkwing.uoregon.edu/~sbs/old/sbs2001/nsf.html (accessed 1/9/04) and http://www.natcapgroup.org/html/newsletter2.html (accessed 9/9/04).

[8] http://www.ccc.govt.nz/SustainableChristchurch/WhatIsSustainableChristchurch/ (accessed 9/9/04)

create a clear vision of a preferred future, and then to devise strategies to make the preferred future. The result: a timeline with specific events / steps / actions that are needed to make the vision a reality.

The process involves four steps:

- Step 1. Create a systems flow chart, or life cycle, of the major activities involved in the creation, operation and demolition of a building.
- Step 2. Identify which of the current flows violate any or all of the four system conditions of The Natural Step.
- Step 3. Visualise a building life cycle that is fully aligned with the four system conditions by modifying the existing flows and processes.
- Step 4. Outline the key steps that can be taken to move from current building practices to ones that meet the four system conditions (becomes part of **level 4** of the framework).

We can apply these steps as follows. This information has been adapted from: http://www.edcmag.com/CDA/ArticleInformation/features/BNP__Features__Item/0,4120,77286,00.html and http://www.ortns.org/docs/TNS%20Construction%20Paper-draft%209.pdf (accessed 1/9/04)

Step 1: system flow chart

Figure 5 shows the typical life cycle of a building beginning with the initial extraction of resources through to the final demolition.

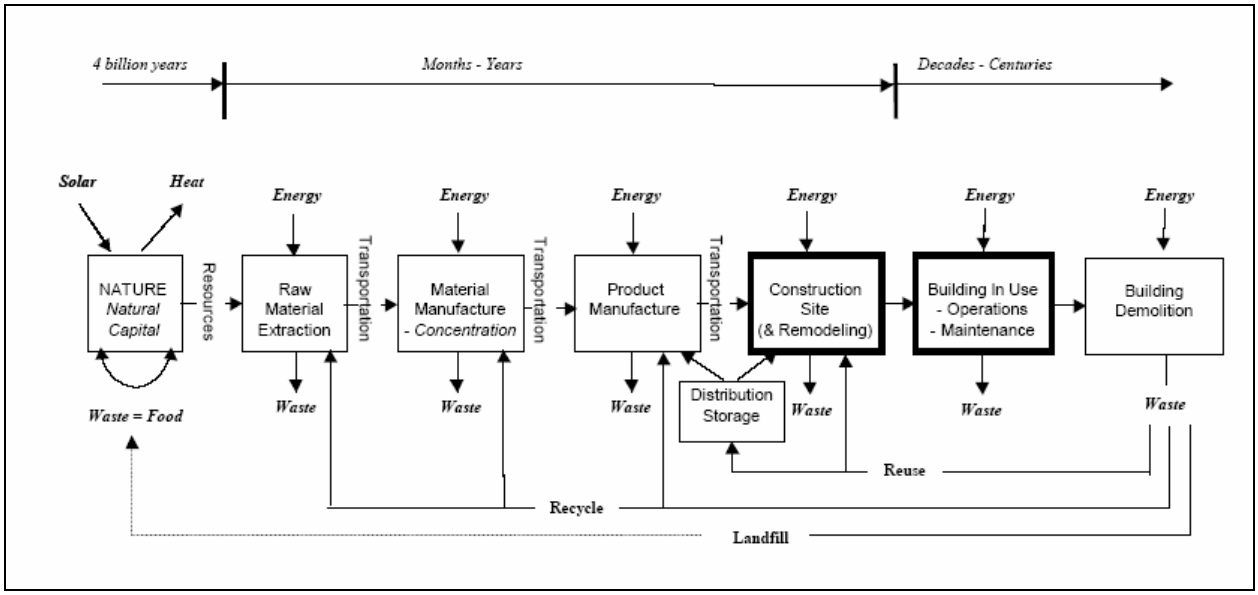

Figure 5: Building life-cycle flow chart

(http://www.ortns.org/docs/TNS%20Construction%20Paper-draft%209.pdf)

Step 2: system condition violations

Identifying all the system violations for all elements of this flow chart is a time-intensive task. At this stage of the SF1.1 project, we have provided an example of the system violations at the construction site phase (see Figure 6) as developed by the Oregon Natural Step Construction Industry Group (reference supplied above). The project team recommend that step 2 be further developed in subsequent phases of the programme.

Area	Item	Violation examples	System Condition 1	2	3	4
Materials	*Durables*	Use of less abundant, virgin mined metals & minerals (copper, chromium, titanium)	X		X	
		Use of heavy metals (mercury, lead, cadmium)	X			
		Use of persistent, synthetic materials (PVC, HCFC, formaldehyde particleboard)		X		
		Wood from rainforests and old growth timber that is harvested unsustainably.			X	
	Consumables	Use of petroleum based products (solvents, oils, plastic film)	X	X	X	X
		Excessive packaging and other disposables		X	X	X
	Solid Waste	Landfill disposal of demolition, remodel or construction scrap and packaging including toxins such as lead, asbestos	X	X	X	X
Energy	*Fossil fuels*	Oil, natural gas, propane, diesel	X			
	Electricity	Non renewable sources (Coal, gas, nuclear, diesel)	X			
		Large scale hydro			X	
Water	*Sourced from wells, rivers*	Sufficient depletion to cause habitat degradation			X	X
		Ground water disruption			X	X
		Contaminated surface water run off	X	X	X	
	Waste	Soil erosion			X	
Transportation	*Energy sources*	Fossil fuels including synthetic additives (MTBE)	X	X	X	X
	Materials	Extensive transport of non-local building material				X
	Infrastructure	Permanent habitat degradation			X	
Air	*Waste*	Use as a pollution sink for dispersion of gases & particulates including VOCs	X	X	X	
Habitat	*Site selection*	Site location & manipulation degrade the local habitat through soil erosion, wet lands destruction or species disruption.			X	X
	Non-native species	The introduction of non-native vegetation that damages native vegetation and other species.			X	

Acronym Glossary

HCFC – hydrochlorofluorocarbons
MTBE – methyl tertiary butyl ether
PVC – polyvinyl chloride
VOC – volatile organic compound

Figure 6: Construction site system condition violations

(http://www.ortns.org/docs/TNS%20Construction%20Paper-draft%209.pdf)

Step 3: visualise the 'full alignment' state

Again, determining this will take more time that than is available at this stage of the programme. This visualisation embodies the definition of success and principles of levels 1 and 2 of the framework adopted thus far. Examples could include:

- all materials are non-persistent, non-toxic and procured either from re-used, recycled, renewable, or abundant (in nature) sources
- all energy sources used are 100% renewable
- water use does not exceed the water that falls on the site
- the quality of the ambient air surrounding the site meets or betters local air quality guidelines
- existing infrastructure is used wherever possible by selecting sites that fit within the current transportation infrastructure
- net degradation of natural systems is zero

Step 4: steps for getting there

This is a critical step in finalising the framework content and we recommend that Beacon spend considerable time ascertaining this. We are working to a timeframe of 2012, where 90% of housing has reached a 'high standard' of sustainability (as defined by the ultimate sustainable home). The emerging critical issues are: what/who is going to make this happen?, who/what might be able to stop it?, what resources will be needed?, etc.

Suggestions for some actions are listed in level 4 of the framework (see 3.3.5).

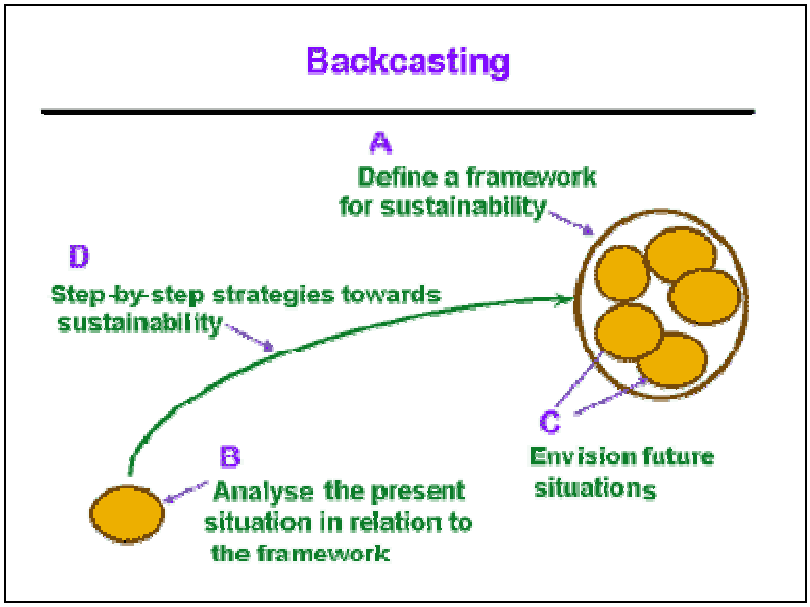

Figure 7: Summary of the backcasting process

(http://au.naturalstep.org/framework/framback.html)

In summary, backcasting (see Figure 7) is a useful process/technique for implementing sustainability. As mentioned, there are other process principles that can be used, although backcasting may be used in these as well. For example, the principle of 'dialogue and encouragement' uses backcasting as a way of avoiding 'frustrating moral conflicts'. Backcasting is also fundamentally a process for successful strategic investments, and includes aspects such as linking to future investments and creating a good return on investment (Robèrt et al, 2002).

R6: the project team recommend the use of backcasting principles as the process for achieving the desired sustainability outcome.

4.3.5 Level 4

The following recommended actions (see Table 1) are derived from the principles endorsed by the preceding sections. Although the list of actions are **not exhaustive or finalised** at this stage of the project, it is felt to be sufficient to provide an indication of the types of actions that will be required to move towards a fully sustainable state. We recommend that these actions be further elucidated in the next phase of the SF programme (they may change over time in any case).

The Natural Step Guiding Principles				
Housing element	**Principle 1** *eliminates fossil fuel, metal and mineral use*	**Principle 2** *eliminates use of toxic and synthetic substances*	**Principle 3** *eliminates encroachment upon nature*	**Principle 4** *meets human needs fairly and efficiently*
Materials and Design	Material selection and design favour deconstruction, reuse, and durability appropriate to the service life of the structure	All materials are non-persistent, non-toxic and procured either from reused, recycled, renewable, or abundant (in nature) sources	Solid waste is eliminated by being as efficient as possible, or a) Where waste does occur, reuses are found for it on-site, or b) For what is left, reuses are found off-site. c) Any solid waste that cannot be reused is recycled or composted	Source materials and labour locally and where appropriate support local economies Material selection and design meets social and cultural needs House is affordable for a diversity of residents
Energy	All energy sources used are 100% renewable and are:	a) created without rare metals or persistent or toxic materials, e.g., photovoltaics b) not systematically degrading the water table nor releasing toxic substances, e.g., geothermal	c) "fish friendly" hydro (fish flows are not systematically degraded) d) "bird friendly" wind (bird migration patterns are not systematically degraded)	Design favours excellent levels of thermal comfort (minimise the amount of purchased energy required)
Water	Pumping systems powered by 100% renewable energy	The quality, temperature and rate of flow of the water both on-site and leaving the site have no damaging impact on the natural systems of the watershed (i.e., does not need chemical treatment before release)	The water budget does not exceed the water that falls on or flows through the site: (stormwater control methods, greywater / blackwater systems, etc).	House design favours source control for run-off and allows for community based waste water treatment systems
Air	Indoor air quality maintained by passive means	The purity of ambient air surrounding and flowing off-site is as pure as or purer than the air flowing into the site. This means that air is not a waste sink for harmful particulates or gasses that may contain heavy metals, fossil fuel	Changes to airflow or air temperature do not systematically degrade natural systems	Indoor air quality maintains or improves health of occupants

		by-products, or hazardous or persistent compounds		
Transport	Transportation energy sources (related to construction, operation and demolition of the house) are renewable	Transportation energy sources have no synthetic or toxic additives Transportation infrastructure uses no synthetic or toxic substances	If changes to the infrastructure occur, any degradation of natural systems resulting from paving land and increased driving is repaired or restored	Existing infrastructure is used wherever possible by selecting building sites that fit within the current transportation infrastructure
Habitat	No requirement for petrochemical based fertilisers	No requirement for synthetic pesticides or herbicides	Restore enough of the same habitat within the local area to replace the natural systems that have been disrupted by the construction of the building and its site. Whatever disruption does occur does not extend beyond the boundary of the construction-site development. This means that wetlands, soil or stream habitat downstream of the site are not disturbed. Any vegetation used is compatible with the local natural systems.	Design for on site or community-based food production
NB: depending on the finalised metric (level 5), other elements and subsequent actions may be included or excluded from this table.				

Table 1: Proposed actions for reaching the desired sustainability state

Notes:
a) Reused means reused or remanufactured in the same form, such as re-milled lumber, in a sustainable way.
b) Recycled means the product is 100% recycled and can be recycled again in a closed loop in a sustainable way.
c) Renewable means able to regenerate in the same form at a rate greater than the rate of consumption.
d) Abundant means human flows are small compared to natural flows, i.e., aluminium, silica, iron, etc. Additionally, the extraction of renewable or abundant materials has been accomplished in a sustainable way, efficiently using renewable energy and protecting the productivity of nature and the diversity of species.
e) If the needs exceed site water limits, the difference may be purchased from sites that have excess water to sell as long as this process has no damaging impact on the natural systems.
f) Habitat refers to the living space and systems required by any species to support its existence. Since buildings always impact habitat, the goal is to not systematically degrade the services provided by nature that are necessary to sustain life.

g) The philosophy regarding habitat is the same as that used with water and energy budgets, namely that the net degradation on the natural systems is zero.
(http://www.ortns.org/docs/TNS%20Construction%20Paper-draft%209.pdf)

The next step is to construct a timeline working back from 2012 to enable 90%+ of houses to have reached a 'high standard' of sustainability by then. As discussed in s.3.3.1, defining what a 'high standard' is (and therefore what is practical) is a critical issue. It may be that even reaching this 'high standard' is not practical by 2012, but this process enables us to decide what is achievable by then and to determine what needs to happen to progress faster. It would be a shame to dilute the definition of a 'high standard' so the 2012 target is met.

The most important thing to keep in mind is that the journey to sustainability of the residential built environment is a long one, one that is achieved one decision, one choice or one action at a time. Based on the high level stance Beacon has indicated it wants to take, it is better to retain a high standard and accept a lower percentage of uptake (in the short term), than to lower the standard so the percentage is achieved.

Note: there would appear to be some concern about the difference between what is truly sustainable and what is practical (and therefore achievable). As the project team see it, we have the examples of Bedzed and Hockerton in the UK, and Christie Walk and the Sydney Sustainable house in Australia (to name but a few), which are projects that have been built within the real world, without additional research funding, and are therefore eminently achievable and practical. So there is no convincing argument not to aim as high as they have aimed.

R7: the project team recommend that the actions stated in s.3.3.5 be adopted as the means of achieving the desired sustainability state.

4.3.6 Level 5

There are many different assessment methods available for determining the sustainability of houses and it can be difficult to decide which method is most appropriate for different uses. Comparisons of the most widely used tools have been undertaken by Reijnders and van Roekel (1999) and Forsberg and von Malmborg (2004). They describe a method for analysing the different tools which is useful for this stage of the project. They consider:

Contextual aspects:

- Type of decision-maker

The specification of the decision-maker or stakeholder is a key issue in the context of sustainable buildings. Stakeholders include home owners, architects, building industry, controlling authorities as well as policy makers.

- Overall purpose

Most tools act as strategic decision support tools and aid in communication with third parties.

- Specific objective

Some tools may have been developed for a very specific project, e.g. the Now Home Scheme, or for a specific country, e.g. BASIX for Australia. In order to evaluate the relevance of a tool for Beacon, this aspect deserves special attention.

- Primary type of building

The distinction here is not only between residential buildings and commercial or industrial buildings but also between new and existing buildings. Given the goals of Beacon looking at new build and retrofit, the tool should allow an assessment of new as well as of existing buildings.

Methodological aspects:

- Investigated dimensions

All three dimensions of sustainability, environment, society and economy need to be considered for the purposes of Beacon. As mentioned above, many of the currently available tools tend to have a strong focus on environmental issues.

- Basis of comparisons

Since the primary aim of Beacon is not a comparison of different homes, "basis for assessment" would be more appropriate. In LCA terms this would be called functional unit. With regard to houses this could be the floor surface area or a house with a specified number of bedrooms.

- Spatial and temporal system boundaries

The spatial system boundaries describe just the building itself, or the area and activities around it are taken into account as well, e.g., connection to public transport. Temporal system boundaries simply specify the timeframe of the analysis. This could be an arbitrary time like 50 or 100 years or the average lifetime of a New Zealand house of around 80 years.

- Type of environmental parameters investigated

Although Forsberg and von Malmborg suggest 'environmental' parameters, this does not reflect the aim of Beacon to look at all three dimensions of sustainability. Examples for parameters are resource use, global warming, ozone depletion, ground-level ozone or health effects.

- Presentation of results and top level aggregation of results

Transparency in the presentation of results is a key parameter for the analysis of assessment tools. A transparent presentation would show the results for each parameter separately. However, some tools may include a weighting step and provide highly aggregated results, i.e. give one score for environment, one for social and one for economical parameters. This would mean that, for example, resource use, global warming and ozone depletion would be summarised.

For the development of a framework for sustainable housing in New Zealand five tools will be analysed following the criteria detailed above. The tools were selected due to their relevance for New Zealand and their actual application in practice.

a) LEED

LEED (Leadership in Energy and Environmental Design) was developed by the U.S. Building Council. The LEED Green Building Rating System is a design guideline that 'aims to improve occupant well-being, environmental performance and economic returns of buildings'. The mission statement includes the following principles (LEED, 2004):

- use energy resources efficiently
- use water resources efficiently
- use building construction resources efficiently (through improved design, material selection and utilisation, and construction practices)
- use land resources efficiently
- use materials and practices designed to safeguard occupants' and workers' health

The LEED version for homes LEED-H is still under development and a working pilot draft will be available for public review in December 2004 (LEED, 2004). As a result, we are unable to state categorically what elements it will consider or how it will measure them.

b) BREEAM

The Building Research Establishment (BRE) is based in the UK and provides research-based consultancy, testing and certification services with regard to buildings. In 1990 BRE developed an

Environmental Assessment Method (BREEAM) which is used to review and improve the environmental performance of buildings. Since 1990 some 600 major office buildings have been assessed. The homes version of BREEAM is called EcoHomes. It provides an authoritative rating for new and converted or renovated homes, and covers houses, apartments and sheltered accommodation (BRE, 2004).

c) BASIX

In late 2002, a new planning tool was being developed in Australia (www.duap.nsw.gov.au). It is a sustainable planning and building tool (the Building Sustainability Index - BASIX) and is designed to help architects, builders and developers 'demystify and standardise better urban development practices'. Uniquely, this planning tool is being launched as a web-only tool, which will be applicable to all common residential dwelling types. It has two key parts, the building and context components. The building component assesses the response of a building proposal to the opportunities presented by the context of the site and its infrastructure. It encourages developers to address environmentally appropriate energy, water efficiency, building materials and landscaping. The context component factors in land-use, transport, storm-water systems, water supply and energy infrastructure issues.

The tool was developed in association with Councils and environmental organisations such as the NSW Environmental Protection Authority, Sydney Water, Resource NSW, the Sustainable Energy Development Authority, the Department of Public Works and Services and Energy Australia.

d) Green Home Scheme

Developed after much consultation with industry, the BRANZ Green Home Scheme was launched in late 1997. It is based on BREEAM's (Home) assessment tool (1993), but adapted for NZ building and social norms. As such, it incorporates mainly environmental, but also some social and health issues. The focus was to have a paper based practical tool, which went beyond the requirements of the NZ Building Code and 'greenwash'. It has been updated (in 2004), in line with the new code requirements and generally fine-tuned according to accredited assessors who have applied the scheme over the intervening years.

e) NOW Home

The NOW Home project is a collaborative venture between Forest Research, BRANZ Ltd, Winstone Wallboards, and Waitakere City Council. It is the first step of a multi-staged, multi-faceted, multi-year programme. The NOW House has the objective of meeting the requirements of a 'post-Kyoto' (2012-2015) market environment, whilst being constrained by materials/ technologies which are currently available or able to be achieved in today's technological environment. A 'post-Kyoto' building is defined as: a building 'that enhances the whole of life and quality of life of the inhabitants and the natural environment which nurtures it' (Bayne, 2003).

The NOW House aimed to demonstrate one possible solution through the actual building of a 'demonstration-type' house on a site in Waitakere City. This house has (compared to typical houses currently being built) enhanced features in terms of: affordability, resource use, desirability, overall performance, water and waste management, and health. For more details, refer to the NOW 1 report being produced parallel to this project.

The two assessment tools which were developed as a result of the NOW House collaboration were the Filtering Frameworks and Targets and Benchmarks Tool. The former tool provides a simple scoring scale for each sustainability issue examined, using a qualitative approach. The latter tool provides more quantitative measures on a range of sustainability issues, and establishes targets based on standards and guidelines. These two tools are currently being further refined and amalgamated in a parallel project (SF1.2 NOW versus REF Homes) to a more practical and immediate sustainability assessment tool that can (for now) be applied to new house designs at building consent stage. This composite tool can be used to compare similar building typologies on a wide range of key sustainability issues.

In the original Beacon programme documentation, there was an assumption that the NOW Home tool may be used as the basis of the SF1.1 framework. However, based on the analysis provided, it is clear that the NOW Home project is a 'level 5' approach and thus not suitable as the basis of the overall framework. As mentioned, the metric elements of the NOW home are also not finalised but are in the process of being so (through project SF1.2). In an ideal world, these projects would have occurred in series, with SF1.1 following SF1.2. However, as they are being undertaken in parallel, the project team is as yet unsure as to the relevance of the NOW Home metrics for this framework. We recommend that links be made with the results of SF1.2 and NOW1 before the SF1.1 level 5 is finalised.

f) Summary

The following table (Table 2) summarises the analysis of theses five tools based on the analytical method proposed:

Feature	BASIX	BREEAM	LEED	GHS	Now Home (to be confirmed)
Overall purpose	Web-based planning tool designed to assess the potential performance of new homes against a range of sustainability indices	Assessment of environmental performance of buildings	Definition of a "green" building	Practical, achievable assessment tool based on the BREEAM system, but New Zealand specific.	A benchmarking tool developed specifically for the NOW House, used to compare similar building typologies on a wide range of key sustainability issues
Specific objective	Mandatory component of development approval Australian focus	Developed in the UK, but applied worldwide	Voluntary, consensus-based national standard for developing sustainable buildings US focus	Voluntary scheme which recognizes houses significantly better than that required by the NZBC.	A sustainability-based tool to compare the NOW House with more standard current-builds.
Stakeholder	Architects Builders Developers	Developers Designers	Home owners	Designers Homeowners	Homeowners, Builders
Type of building	New homes	Offices, retail, industry and homes, including apartments new, converted and renovated	Commercial construction (new and renovation) Commercial interior projects Core and shell projects Homes	New Homes	New Homes only
Investigated dimensions	Landscape, Stormwater, Water, Thermal Comfort Energy	Energy use Health and well-being, Pollution Transport, Ecology, Materials Water		Energy use health and well-being, pollution transport, ecology materials, water design excellence	Affordability Desirability Landscape Performance Community Personal health Resource use
Basis of assessment	A home – not further specified	Whole development, rather than just the house		A home and section (with the exception of transport).	Individual homes only
System boundaries	Spatial: house and garden Temporal: Not clearly defined	Spatial: house and garden but also availability of public transport		Spatial: house and garden but also availability of public transport	Spatial: house and garden but also availability of public transport
Parameters investigated	Energy Water	CO_2-emissions Energy, Access to public transport		Thermal envelope energy efficiency, major appliance	Thermal envelope energy efficiency, CO_2-emissions

		HCFC emissions NOx emissions Surface runoff Materials, Water use, Ecological value of site, Daylighting Sound insulation Private space		efficiency, transport energy use, sustainable materials, water economy, indoor air quality, safety, design excellence.	major appliance efficiency, transport energy use, sustainable materials, water economy, indoor air quality, safety, noise, indoor air quality.
Presentation of results	Water: litres/person/ Day, CO2 emissions/ person/day Results are also given as % of target for water and energy consumption	Points are given for different criteria. Total for each category (e.g. Energy, Pollution) and grand total is given		Descriptive mainly, with the exception of the energy use calculations	Quantitative mainly.

Table 2: Summary of analysis of selected tools

Taking all of these features into account, the tool which appears to be the most relevant and useful for the SF1.1 framework is the BREEAM method. It is building focused, is applicable to both new and retrofit houses, is widely used, is internationally accepted and adopted, its investigated dimensions fit well with the proposed actions, and the presentation of results as a 'number' could be used for benchmarking progress towards our 'high standard'. Adjusting BREEAM for New Zealand houses is also not overly difficult.

As mentioned previously, the timeline of the SF1.1 and SF1.2 projects makes it difficult to include the SF1.2 composite tool in the analysis for this project being, in effect, a moving target. Given the nature in which these tools are being developed (i.e. with very compressed timelines), there should be recognition that that there may be some lack of fit between the recommended approach here and the SF1.2 composite tool.

However, we do not want to dismiss the NOW Home tool at this stage of the project. It is likely that some kind of combination of the BREEAM scheme and the NOW Home metric would be most suited as the level 5 in this framework. We recognise that the finalised tool must:

- meet the analytical parameters as stated above
- be building focussed
- be applicable to both new and retrofit dwellings
- be in alignment with the proposed actions (level 4)
- distinguish the project as rigorous and ideally be able to be internationally validated

R8: the project team recommend an adapted tool (taking into account BREEAM and the NOW Home) be developed as the metric element for the sustainability framework.

4.3.7 Level 6

Level six will need to be developed after the detailed content of levels 1-5 has been further defined through the later phases of the SF programme. Only once the actions and tools have been defined will it be possible to establish exactly how different end users would utilise the framework and what the framework's limitations are.

However the following issues should be addressed as part of level 6:

- appropriate use of the framework by the different user groups
- potential use of the framework as a legislative vs. voluntary tool

- description of the limitations of the framework, such as uncertainties in the measurements applied at level 5 and the need to consider issues that may not be measurable as part of the framework
- a process for transparent decision making, applying the framework as a tool (highlighting that the framework is only a tool, but that it will lead to more informed decision making if used appropriately)
- the appropriateness or otherwise of tradeoffs between different platforms within the metric tool chosen (assuming that there will be various platforms)
- how to practically consider all levels of the framework (it is likely that the practical application will concentrate on levels 4 and 5, however levels 1 to 3 need to also be considered in decision making, i.e. checking that the numbers in level 5 are consistent with the overall aims)

The project team sees a need for level 6 to avoid inappropriate use of the framework. Anecdotally, there are examples (especially in Australia) of where sustainability frameworks and more specifically level 5 type tools have been used without acknowledging their limitations or initial purpose (e.g. a home energy rating which includes thermal efficiency but neglects inclusion of efficiency for water heating). This practice has lead to sub-optimum outcomes that sometimes are inconsistent with the overall aims of sustainability.

5. SUMMARY

5.1 Conclusions

The purpose of this project is to recommend the key elements of a sustainability framework with the ultimate purpose of facilitating the implementation of sustainability outcomes at the level of 'home'. In developing these recommendations the project team considered the following issues:

- the theoretical basis of different framework designs (i.e., framework structures) and their content
- the appropriateness of a selection of environmental assessment methods for the metric element of the framework
- the needs of different constituents of the framework and the uses these constituencies might make of the framework
- the ability for the addition/deletion of new factors as new information becomes available, or the importance of certain issues changes (i.e. future-proofing).

As a result, this report provides:

- a clear understanding of what sustainability means for the 'residential built environment'
- an evaluation of the elements of good framework design
- recommendations for the elements of a sustainability framework relevant to NZ houses (both new and existing)
- recommendations for a review schedule to update the framework to allow for advances in technology and methodology (see below)
- recommendations for further study as a result of issues emerging during the project which are of perceived relevance to SF1.1 or the other projects (see below)

We also hope to have inspired the Beacon programme to continue in its resolve to bring the industry and the built environment sector closer to high performance and efficiencies and towards truly sustainable buildings. To do so, we need to change current thinking and practices. Over time, with our vision in mind, the construction industry will make the transition to sustainability.

5.2 Recommendations

A summary of the recommendations proposed throughout the report are as follows:

- R1: the project team recommend that the Robèrt et al model be used in the development of the sustainability framework for houses
- R2: the project team recommend that the definition of a sustainable house as described in s.3.1 be accepted
- R3: the project team recommend that the framework structure as proposed in s3.2 be adopted
- R4: the project team recommend that a strong model of sustainability / naturalistic approach be adopted as the philosophical base of the sustainability framework (*level 1*)
- R5: the project team recommend The Natural Step and Natural Capitalism be adopted as the 'principles for sustainability as the desired outcome' (*level 2*)
- R6: the project team recommend the use of backcasting principles as the process for achieving the desired sustainability outcome (*level 3*)
- R7: the project team recommend that the actions stated in s.3.3.5 be adopted as the means of achieving the desired sustainability state (*level 4*)
- R8: the project team recommend an adapted tool (taking into account BREEAM and the NOW Home) be developed as the metric element for the sustainability framework (*level 5*).

Based on the acceptance of these recommendations, the project team subsequently recommends the following structure and content of the sustainability framework for housing:

Definition of success
That 90%+ of housing in New Zealand reaches a high standard of sustainability by 2012. A sustainable house is one where social and cultural needs are met, where resources are (more) equally available to everyone, and where no irreversible damage to the environment is caused during its entire life-cycle. A high standard is defined by the achievement of a rating as determined by the sustainability framework metric (to be finalised).

Level 1: Principles for the constitution of the system
The strong sustainability model and naturalistic approach

Level 2: Principles for sustainability as the desired outcome
The Natural Step and Natural Capitalism

Level 3: Principles for the process to reach the desired outcome
Backcasting

Level 4: Actions and concrete measures
Actions related to achieving 100% sustainability in 7 areas: materials and design, energy, water, air, transport and habitat

Level 5: Tools and metrics to monitor and audit
To be finalised (BREEAM / NOW Home)

Level 6: End-user analysis
To be finalised (consumer view, industry view, central government view and local authority view)

The structure and content of the sustainability framework as recommended by the project team is biased towards best practice and deliberately so. We believe that the proposed framework creates a comprehensive view of sustainability and proposes actions that are strategic and enable a conscious

process of decision-making. In saying this, we also believe that the framework is non-judgemental and doesn't take away people's decision-making power, i.e., there is enough flexibility to seek alternative solutions across stakeholder sector groups. We have sought a framework design that best fits with building and the residential built environment. In sum, the proposed framework provides the potential for New Zealanders to live sustainably through the delivery of sustainable housing.

5.3 Review schedule

In drafting a review schedule, it is helpful to review the overall programme's goals and milestones (as below):

Sustainability Framework Outcome Statement:
Through development of a user-friendly sustainability metric we will put tools in the hands of the key stakeholders in the residential built environment that will facilitate measurable implementation of sustainability outcomes at both a home and community level. Measurable outcomes will occur by June 2009.

Sustainability Framework Objective Statement:
Develop a framework for measuring sustainability outcomes in a way relevant to and of value to all stakeholders – homeowners, industry, local and national Government.

Milestones:

1. 09/04 - Sustainability Framework developed for new build and retrofit
2. 02/05 - Key metrics and prototype model developed (aka. finalisation of framework content)
3. 06/05 - Model tested with end user groups
4. 06/06 - Model customised for stakeholders
5. 12/06 - Readiness for national implementation.

Once the framework structure and content are finalised, we will be able to determine the review schedule. At this stage of the project, we recommend that any review schedule be tied in with the backcasting timeline and resource allocation schedule. As this will not be fully determined until 02/05, we recommend that the review schedule be finalised between 02/05 and 06/05 (between milestones 2 and 3).

5.4 Further study

In finalising the framework content, the following aspects warrant further investigation:

- Finalisation of the metric for this framework. Links should be made with SF1.2 and NOW1 projects
- Finalisation of what is meant by a 'high standard' in relation to our 'end-point'
- The details for the backcasting steps, plus timeline and resource allocation finalisation
- Completion of 'actions' table and a determination of who does what and when.

The project team would also recommend the preparation of a graphic showing the framework (in summary) visually. An example of what we mean is provided:
http://www.sustainability.dpc.wa.gov.au/docs/Final%20Strategy/Poster.pdf

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