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Improving Aboriginal Housing: Culture and Design Strategies

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Improving Aboriginal Housing: Culture and Design Strategies

by

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A THESIS

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Abstract

Aboriginal housing in Canada is in a state of crisis. The status quo is characterized by substandard and culturally inappropriate buildings, and insufficient access to essential services. This reality undermines individual and community health, wellbeing and socioeconomic development. Emerging green building methods and clean technologies have the potential to address key issues and problematic conditions in this context, where occupant health and safety, durability, and reduced operating and maintenance costs are primary concerns. Considerations for Aboriginal cultures are also essential to improved housing design, where their absence has perpetuated a legacy of cultural oppression. Adopting cultural considerations into Aboriginal housing design may increase sense of identity, belonging, ownership and responsibility. This research examines the integration of green building methods, clean technologies, and Aboriginal cultural design considerations as bases for improving Aboriginal housing. Recommendations are based on qualitative case studies within the Seabird Island, Saugeen, and Treaty 7 First Nations.

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Keywords: Aboriginal, First Nations, Métis, Inuit, North American Indian, housing, culture, cultural appropriateness, green building methods, clean technologies, alternative energy, capacity building

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List of Abbreviations

AAND – Aboriginal Affairs and Northern Development
AFN – Assembly of First Nations
CBC – Canadian Broadcasting Corporation
CEAP – Canada Economic Action Plan
CMHC – Canada Mortgage and Housing Corporation
FiT – Feed-in Tariff
HRV – heat recovery ventilator
IAQ – indoor air quality
IHC – International Housing Coalition
INAC – Indian and Northern Affairs Canada
MUP – Maximum Unit Price (CMHC)
NAHA – National Aboriginal Housing Association
O&M – Operations and Maintenance
OFNTSC – Ontario First Nations Technical Services Corporation
RCAP – Royal Commission on Aboriginal Peoples
TRTL – Technological Residence Traditional Living

CHAPTER 1: INTRODUCTION

Aboriginal housing in Canada is in a state of crisis.¹ The status quo is characterized by substandard dwellings, unhealthy and unsafe conditions, shortages, and lack of consideration for Aboriginal cultures (AAND, 2011; AFN, 2006; Auditor General of Canada, 2003, 2011; Beavon 2009; CMHC 2002, 2007, 2010; Curry, 2010; David, 2003; Health Canada, 2005, 2009; IHC, 2006; INAC, 2004; MacMillan, MacMillan, Offord and Dingle, 1996; Maliene, Howe and Malys, 2008; Meissner, 2009; NAHA, 2004; Palmer, Brooks, Izen and Leclerc, 2007; RCAP, 1996; Robson, 2008; Rosenberg, Kendall, Blanchard, Martel, Wakelin and Fast, 1997; Tookenay, 1996).

The housing crisis directly threatens the health, wellbeing and socioeconomic development of Aboriginal individuals and communities across the country, within and beyond reserve lands, in rural and urban settings. Mould, fire and crowding are national epidemics: the Aboriginal population suffers from high rates of chronic illness and disease as a direct result of substandard housing, and the rate of death from fire is ten times higher for First Nations than the per capita rate for the rest of Canada (CMHC, 2007 (d); Health Canada 2005, 2009; MacMillan and MacMillan, 1996; Meissner, 2009;

¹ The term 'Aboriginal' denotes all First Nations, Métis and Inuit peoples. While the case studies herein are all conducted in First Nations communities, literature indicates that these groups share similar housing issues and conditions (as detailed in chapter 3). For purposes of inclusion, the term 'Aboriginal' has been applied throughout the text, except in cases where more specification is deemed appropriate. In no way is the intent to ignore the cultural diversity and distinction of these peoples. Further, while referencing Aboriginal peoples *in Canada*, this research also recognizes that First Nations represent independent states. This language is not intended to overlook such status. Rather, the intent is to provide geographic context that can be easily recognized by the reader. This research may also prove relevant to housing issues faced by Aboriginal communities in other parts of the world.

Robson, 2008; Rosenberg et. al., 1997; Saskatchewan Indian, 1972; Tookenay, 1996). Further, energy, material and water inefficiencies and short building life spans lead to waste of valuable community resources. The high economic costs and negative social, cultural, and environmental outcomes are entirely unsustainable and unacceptable for the ‘developed world’. Strategies for designing and delivering healthy, safe, affordable and culturally appropriate homes are thus of real value and significance.

Green building methods and clean technologies (cleantech) present opportunities to address some of the key issues and problematic conditions that define the Aboriginal housing crisis. Of particular interest are methods and technologies that foster occupant health and safety, increase efficiency and durability, and reduce operating and maintenance costs and environmental impact. Alignment between the environmental orientation of green building and cleantech sectors and the ecological values of Aboriginal cultures is also significant. This alignment provides an important foundation for Aboriginal community support and buy-in, which is consistently viewed as essential to improving outcomes (AAND, 2011; AFN, 2006; McGregor, 2008; RCAP, 1996; Shaw, Stephenson and Optis, 2007; Smith, D., public communication, February 2012²; Smith, 1999).

² Dewey Smith is a Senior Policy Advisor to the Assembly of First Nations. This and subsequent notes refer to his address at the conference on First Nations Sustainable Buildings and Communities in Edmonton, Alberta, in March of 2012.

Simultaneously, green building methods and clean technologies may be accompanied by challenges such as higher initial costs, extended payback periods, or special requirements in design, implementation, operations, maintenance and/or replacement (Proscio, 2008; Shaw et. al., 2007). The feasibility of these strategies may be further influenced by contextual factors specific to Aboriginal communities. For example, vestiges of colonialism include lasting challenges in terms of economic resources and housing related capacities in many Aboriginal communities. Consequently, some local Aboriginal governments struggle to provide for even the most basic needs, let alone implement advanced solutions. As stated by the Auditor General of Canada (2011):

“First Nations members generally face far greater challenges than those confronting Canadian society as a whole, whether they live on or off reserves. The challenges include lower-than-average education levels, higher unemployment, and poorer quality housing and infrastructure,” (pg.9).

Where green building methods and clean technologies are accompanied by both opportunities and challenges, this indicates the need for a well informed approach to their application in Aboriginal housing.

Beyond green building methods and clean technologies, this research explores ‘cultural appropriateness’ in relation to Aboriginal residential design.³ As the place we call ‘home’, housing is more than a physical structure – it reflects and supports culture,

³ Where the term ‘appropriateness’ is somewhat unwieldy, an alternate term such as ‘suitability’ might be preferable. ‘Appropriateness’ has been chosen however, where ‘suitability’ is already used by CMHC as an indicator of core housing need, and so could cause confusion if repeated in this context.

including individual and community identity, lifestyle, values, needs and interests (Boğaç, 2009; Easthope, 2004; Hadjiyanni and Helle, 2009, 2010; Hidalgo and Hernández, 2001). Traditional Aboriginal structures epitomize the potential for connection between home and occupant identity (Crowshoe, R., pers. comm., June 2010 – October, 2011; Lickers, M., pers. comm., December 10th, 2010). The form, function, aesthetics and material choices of traditional buildings are rooted in Aboriginal peoples' spirituality, philosophy, the landscapes they occupy, and the ways of life by which they have historically defined and continue to define themselves.

Such cultural considerations have remained largely absent however, from contemporary Aboriginal housing design. Instead, solutions have been externally imposed with little or no input from Aboriginal peoples themselves. Senior Policy Advisor to the Assembly of First Nations Dewey Smith (public comm., March 2012) indicates that:

“The First Nation landscape is littered with substandard housing that was built under the jurisdiction of Indian Affairs, that was designed by Public Works Canada, that was built through a bid procurement process by external contractors that had no social responsibility. They were built to substandard conditions in the first place, never met the minimum requirements of the National Building Code for health, safety, fire protection, structural stability and accessibility.”

This paternalistic approach has perpetuated feelings of marginalization and dispossession that emerged from colonization. Housing's role as a foundation for identity, well-being and development has in turn been undermined within Aboriginal

communities (CMHC, 2010; INAC, 2004). As such, cultural *inappropriateness* is a key factor defining the Aboriginal housing crisis. A gap in the literature surrounds potential strategies for reconciling the divide between traditional and contemporary Aboriginal housing. Exploring how cultural design considerations may foster more culturally appropriate solutions is therefore central to the research purpose.

Purpose

The intent of this research is to identify and understand

- How green building methods, clean technologies, and cultural design considerations may contribute to improvements in Aboriginal housing; and
- The contextual influences that may facilitate or inhibit implementation of these strategies.

Beyond identification and understanding, this thesis provides recommendations for Aboriginal housing design and related policy. The recommendations are intended to capitalize on latent opportunities and potential benefits, and avoid challenges and risks that may be associated with these strategies.

Questions and Objectives

The research questions that guided this investigation are:

- How can green building methods and clean technologies contribute to improvements in contemporary Aboriginal housing?
 - What green building methods and clean technologies have been implemented in Aboriginal housing pilot projects?

- What are the opportunities, limitations and considerations in applying these strategies?
- How can cultural design considerations contribute to the appropriateness of Aboriginal housing?
 - What considerations for Aboriginal culture have informed contemporary building design (both housing and other)? What was the intended outcome? Were they effective? Why or why not?
 - What factors and/or criteria may contribute to a working definition of ‘cultural appropriateness’ in the context of Aboriginal housing?

In accordance with its purpose, the research objectives are to:

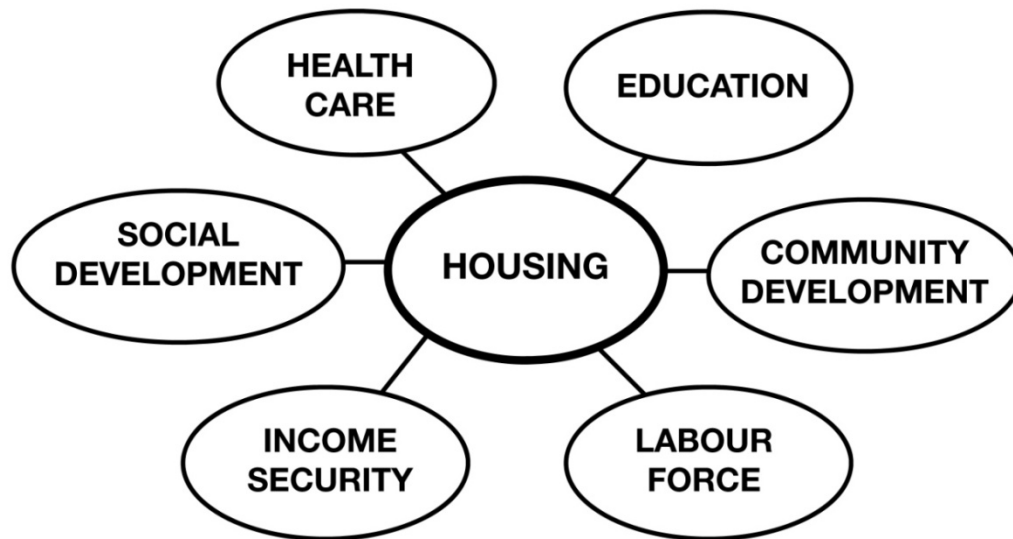
- Provide a systems-oriented account of the drivers influencing Aboriginal housing, including historical and cultural background, contemporary policies, legislation, key issues and problematic conditions;
- Identify green building methods, clean technologies, and cultural design considerations that have been used in Aboriginal housing
- Identify the contextual factors that influenced these methods, technologies and/or design considerations;
- Evaluate the effectiveness of these methods, technologies and design considerations in achieving desired outcomes;
- Provide recommendations to improve Aboriginal housing design; and
- Identify important areas for future research.

Significance and Relevance

Where the Aboriginal housing crisis has persisted for decades, and where housing is recognized as a stabilizer and facilitator for societal outcomes such as health care,

social and community development, income security, labor force and education (CMHC, 2010), (see Figure 1), strategies for delivering positive change are long overdue.

Figure 1. Societal Outcomes of Housing



Source: CMHC (2010)

As this work approached completion in December of 2011, the Attawapiskat First Nation was the subject of national media attention, having declared a state of emergency in relation to its housing conditions (CBC, 2012). Housing in Attawapiskat remains far below National standards, with individuals and families living in temporary structures, mould-contaminated shacks and un-insulated tents. Modular homes that had previously been delivered to the community went unused due to lack of critical infrastructure. Sadly, the circumstances in Attawapiskat are not exceptional: many Aboriginal communities

face similar challenges, which have not been adequately addressed in spite of their grave consequences.

Ideally this research will contribute to the development of strategies for improvement in situations like that of Attawapiskat. Discussion may also prove valuable and timely in the context of the new framework for affordable housing in Canada, which includes an increase in shared responsibility across different levels of government (CMHC, 2011). The findings herein certainly support the role of localized decision-making, and direct response to contextual factors that have historically been overlooked in more centralized models.

Scope and Methodology

Aboriginal housing in Canada is a complex phenomenon. It involves relationships between multiple systems, structures and stakeholders, which occur across different scales in both space and time. As such, the Aboriginal housing crisis can be considered an ‘ill-structured problem’ – one where the problem space is large and ill-defined, with a broad range of sub-contexts and potential solutions that are difficult to enumerate (Dorst, 2005).

In order to adequately understand and respond to the Aboriginal housing crisis, and out of respect for the gravity of the situation, the historic events and forces that have led to the status quo must be acknowledged. Simultaneously, comprehensive recommendations for strategic change at the systemic level are beyond the scope of this

research. I have adopted a pragmatic approach to this breadth and complexity. My research scope is managed by focusing on individual project designs, and the challenges and opportunities to delivering positive change at this level. This allows for the creation of an 'immediate problem space' wherein the breadth of the Aboriginal housing crisis may be meaningfully structured (Dorst, 2005). Identifying how strategies at this scale may be influenced by and/or address issues at larger scales however, is relevant to this research and essential to positive change.

My research methods are based on systems and design thinking, case study methodology and elements of strategic analysis. Systems thinking allows for a more holistic understanding of the housing crisis based not only on direct causes, but also on identification of indirect and root causes, underlying drivers, and relevant relationships at different spatial and temporal scales (Walker and Salt, 2006). Design thinking and strategic analysis complement this approach, facilitating a reframing of the Aboriginal housing crisis within the larger system, and an exploration of the key contextual factors that determine outcomes. Avoidance of a conventional linear and singular disciplinary approach is an important part of this reframing (Dorst, 2005; Dorst and Cross, 2001; Pacanowski, 1995; Robson, 1993; Yin, 2009). Thus this research revisited problem definition throughout data collection, synthesis and analysis, and includes the perspectives of individuals from a variety of disciplines.

Case study methods are valid given the exploratory and descriptive purposes of this research, and the breadth and complexity of the topic (Yin, 1984, 2009). As Yin (2009) notes, case study methods can be applied when one is seeking “to understand a real-life phenomenon in depth, [and when] such understanding [is] encompassed [by] important contextual conditions... highly pertinent to your phenomenon of study,” (p.18). Yin (2009) further indicates that case study methods are applicable in technically distinctive situations involving a high number of variables, with the need to trace operational links over time – an apt description of both Aboriginal housing phenomena and the intent of this research. Specifically, implementation of Aboriginal housing is heavily influenced by contextual factors, and the line between housing initiatives and the contexts in which they occur is often unclear. Factors such as the individuals and organizations involved and the design strategies employed by a given initiative have a direct impact on project outcomes, and so are integral to adequate study of the phenomenon.

As a foundation for the case studies, background research and preliminary interviews with key informants were used to identify central themes, key issues and problematic conditions defining the Aboriginal housing crisis. Data collected from these sources is used to construct a conceptual framework similar to a logic model, which illustrates the complexity of the crisis, and highlights some of the most pertinent relationships and feedback (see Figures 5, 6, 7 and 8).

A variety of sources account for different perspectives within the background research including journal and media articles, reports on current housing issues and problematic conditions in Aboriginal housing, reports and textbooks on green building and alternative energy solutions, and both fiction and non-fiction literature from prominent Aboriginal authors. Information that I obtained while attending relevant conferences, lectures, and events (with topics including Aboriginal culture and health, and implementation of green building and cleantech solutions within and beyond these communities) also contributed to these findings.⁴

Preliminary key informant interviews were conducted with the Treaty 7 Management Corporation's Director of Housing Arnold Jerry⁵, Architect and Professor of Architecture Tang Lee⁶, Tsuu T'ina Infrastructure Manager Lee Crowchild, and Aboriginal traditional housing expert Michael Lickers. These informants all have experience related to housing within the Treaty 7 First Nations. The preliminary interviews were thus used to inform the design of the case studies while also providing

⁴ Specific events attended include: Pathways to Sustainability (Red Deer, 2011); Aboriginal Health Forum (Calgary, 2011); International Builders Show (Orlando, 2011); World Future Energy Summit (Abu Dhabi, 2009); Canadian Solar Industry Association (Calgary, 2010, 2011); Powering Up Aboriginal Energy (Toronto, 2011); Indigenous Peoples – Vital Partners in Development (Calgary, 2010); Avatar, Oil Sands and the Amazon (Calgary, 2011); Tusaqtuut (Calgary, 2010); and First Nations Sustainable Buildings and Communities (Edmonton, 2012).

⁵ Arnold Jerry is also Chairs the First Nations National Housing Managers Association.

⁶ Tang Lee was not the project architect in the Treaty 7 First Nations case, but has over 2 decades of experience working in these and other Aboriginal communities including the Seabird Island First Nation project. His expertise includes building envelope construction and indoor air quality.

data for the Treaty 7 First Nations case (outlined below). The protocols for all preliminary and case study interviews are included Appendix 1.

The main body of research consists of three case studies. These examine both conventional housing and sustainable housing pilot projects within the Seabird Island First Nation, the Saugeen First Nation and Treaty 7 First Nations. All of the cases were selected on the basis of having implemented pilot projects that adopted one or more green building methods, clean technologies and/or cultural design considerations. Insofar as the pilot projects can be considered experiments in housing innovation, this further validates the use of case study methods, which are appropriate for interpreting successes and failures in experimental contexts (Yin, 2009).

Other cases of clean technology implementation in Aboriginal communities have been identified (Davene, 2012; INAC, 2010). While such precedents offer important insight into the potential value of these technologies in Aboriginal contexts, the scope of this research was managed by restricting the case studies to housing specific initiatives and applications. One additional project that plans to integrate clean technologies into Aboriginal housing was identified. The project's location in the remote community of Sioux Lookout resulted in logistical challenges to conducting research however, and construction was not completed at the time the other case studies were undertaken.

Data for each of the three cases was gathered through site visits and physical observation of the developments, review of documentation such as project drawings,

photographs, reports and promotional materials, and semi-structured interviews with multiple key informants. Key informants were selected for their professional experience related to Aboriginal housing, including but not limited to capacity and resources within the case communities, and/or firsthand knowledge of the pilot projects themselves.

In the Seabird Island First Nation case, interviews were conducted with the Nation's Chief Clement Seymour, Band Manager Daryl McNeil, Band Housing Manager Dwayne McNeil, Band Research Director Jay Hope, and Project Architect Rob Seniuc. Informal discussions also took place with external stakeholders including a project engineer and a government representative.

In the Saugeen First Nation Case, interviews were conducted with the Nation's Chief Randall Kahgee, Housing Manager Ron Root, Project/Construction Manager Derek Laronde, and Aboriginal Architect Bret Cardinal.⁷

As indicated above, preliminary interviews provided data for the Treaty 7 First Nations case, where these key informants have professional experience related to housing in this territory. Data collection for this case was also based on my direct involvement in the sustainable housing pilot project. The initiative featured collaboration between Treaty 7 First Nations community representatives and students at the University of Calgary in the design-build of a fully-functional solar powered home. I was directly involved in this

⁷ Brett Cardinal was not the project architect in this case. He was interviewed however, during a CMHC-sponsored conference specific to the Saugeen First Nation case (Cardinal, 2011). Cardinal's experience includes extensive work in Aboriginal communities across Canada, such as the sustainable community development in the Oujé Bougoumou First Nation (Oujé Bougoumou, n.d.).

initiative, initially as Project Manager for the first year, and subsequently as Aboriginal Relations Manager and Chair of the Aboriginal Advisory Council for one year. This level of involvement offered significant insight into Treaty 7 First Nations culture, as well as invaluable experience of the design and implementation process, detailed further within the case study.

Participation of Treaty 7 First Nations community members in the pilot project included consultation with the Grand Chief of Treaty 7 and Chief of the Blood Tribe Charlie Weasel Head, and cultural orientation provided by Blood Tribe Elder Beverly Hungry Wolf and Blood Tribe Social Worker Arnold Jerry. Additionally, the project's organizational structure included an Aboriginal Advisory Council (AAC) with members Lorna Crowshoe (Aboriginal Strategist, City of Calgary), Lee Crowchild (Infrastructure Manager, Tsuu T'ina First Nation), Monique Kimber (Communications Liaison, Calgary Urban Aboriginal Initiative), Chris Fry (Aboriginal Relations Representative, Esso), Shawna Cunningham (Director, Native Center, University of Calgary), Dr. Jim Frideres (Director, International Indigenous Studies, University of Calgary), Mike Lickers (Director, Ghost River Rediscovery Initiative) and Lori Villebrun (Coordinator, Chinook Lodge, Southern Alberta Institute of Technology). In addition to participation of the AAC, Aboriginal Architect Wanda Dalla-Costa provided invaluable consultation through the design process. Last but not least, former Chief of the Piikani First Nation Dr. Reg Crowshoe and his wife Rose acted as Spiritual-Cultural Advisors to the project. As

detailed in the case description, Dr. Crowshoe's authority on traditional culture, housing and related knowledge, ceremonies and protocols within the Treaty 7 community was absolutely integral to this initiative and my research as a whole.

The case studies act as a rational search and problem solving process wherein the task environment, problem space, solution space and possible solution programs are defined and structured (Dorst, 2005). Case study data is analyzed both individually and comparatively using descriptive word tables that are based on a strategic or SWOT approach (strengths, weaknesses, opportunities and threats), (Business Balls, n.d. (b)). This approach is not strictly adhered to however, where a comprehensive examination of external factors (opportunities and threats) fell beyond the time available for research.⁸

Each case study begins by considering the housing issues and problematic conditions that the community in question faces. Issues include factors such as problematic housing policies, funding arrangements, sufficiency of economic resources available for housing initiatives, and/or housing related capacities. Problematic conditions include the quality and appropriateness of housing and associated outcomes. The issues and conditions within each community provide relevant context for situating their respective pilot housing projects.

⁸ Some external factors do inform analysis. For example, research considers opportunities that are associated with the internet and emerging communications platforms, as well as the challenges surrounding alternative energy regulation, policy and pricing. With these in mind, focus is directed upon internal factors (i.e., strengths and weaknesses).

The individual goals, objectives and strategies of the pilot projects are then identified and detailed. Analysis of each case considers the pre-existing housing issues and conditions, and the outcomes of the pilot projects including the successes, failures, synergies and trade-offs that accompanied various strategies. Analysis thus provides insight into the conventional strengths and weaknesses faced by the case communities in addressing their housing goals, as well as strengths and weaknesses that are specific to the scope and strategies used in the pilot projects. Strengths are factors that enable the communities to address key issues and/or problematic conditions, or to capitalize on opportunities to improve housing outcomes. Weaknesses are tied to failures to address key issues and/or problematic conditions, or to strategies that result in challenges or barriers to doing so.

The strengths and weaknesses are grouped in three categories: (1) political, institutional and regulatory, (2) Socio-cultural and economic, and (3) those related to processes, objectives and strategies.⁹ These categories were not pre-determined, but rather emerged from a broader initial set. Narrowing this set provided a meaningful structure for reframing the problem and solution spaces. This reframing in turn allows for the derivation of key contextual factors affecting outcomes of housing initiatives as identified in Chapter 9 and explored further in Chapter 10. These factors are essential to

⁹ Application of these categories differs for the Treaty 7 First Nations case study, due to differences in the nature of the project as detailed in Chapter 8.

determining potential courses of action that are likely to contribute to positive and meaningful change.

The exploration of key contextual factors in the final chapter is firmly rooted in the rational problem solving process described above – addressing real world situations, defined by goals, strategies and outcomes that must be justified to key stakeholders. This stage of the research also marks a shift – away from the ‘immediate problem space’, towards the ‘overall problem space’ – by way of subjective interpretation (Dorst, 2005). As Dorst (2005) notes, “‘subjective interpretation’ can become very important... where the design problem is ill-structured. In such a case, subjective structuring is the only way to make sense of the problem,” (pg.6). In the context of this research, subjective interpretation bridges the rational problem solving approach and the ‘immediate problem space’ of individual projects with a more reflective approach to potential solutions within the ‘overall problem space’. This subjectivity is particularly important where the housing crisis is defined in part by individuals’ and collective emotive responses to shared histories and environments, and the value and meaning found therein.

Interpretation of the case study data and the key contextual factors identified through the SWOT approach leads me to a set of underlying principles that are expected to contribute to positive change within and beyond Aboriginal housing. The principles are used to guide recommendations for Aboriginal housing design and related policy. The

recommendations are in turn intended to contribute to a framework that supports the principles, by:

- Mitigating existing weaknesses, challenges and/or barriers;
- Avoiding strategies that have introduced or perpetuated the above;
- Maintaining, leveraging and/or optimizing existing strengths and opportunities; and/or
- Introducing new ones based on successful strategies as observed in the case studies (which are particularly valuable to improving policy).

A return to the literature, including identification of additional precedents and testimony from key informants, helps to inform the recommendations. The precedents demonstrate innovative reframing of problems and potential solutions that are directly relevant to the housing crisis. Together, the principles and recommendations provide framework through which future Aboriginal initiatives and programs within and beyond housing can undertake creative and meaningful design. My thesis concludes by identifying important areas for future research.

Ethics Approval

Ethics approval for the involvement of human subjects (i.e., interviews) in this research was granted by the Conjoint Faculties Research Ethics Board (CFREB) at the University of Calgary in September of 2010, based on the CFREB's review of the preliminary interview recruitment script, consent form and interview protocols (see Appendix 1). Consent forms included the right for participants to withdraw from the

research at any time, and indicated that data collected would remain confidentially in my possession indefinitely.

Special permission was also sought and granted, in order to allow for the participants to consent after, rather than preceding interviews. This was important due to sensitivity surrounding the interview process. Specifically, the request for Aboriginal key informants to sign a document at the onset of a meeting (which was in most cases the first interaction with them) was problematic. This had the potential to impede trust and communication, or even prevent this form of data collection altogether. Shifting consent to follow the interviews allowed for the informants to make an informed decision based on the process itself. Consent was granted in all cases.

Limitations, Reliability and External Validity

The methodology adopted by this research has some limitations. For example, it does not allow for a comprehensive audit of the cases, wherein all costs and outcomes are analyzed. Such an audit falls beyond the scope of research, particularly where formal post-occupancy review is outstanding in the Seabird Island First Nation and Treaty 7 First Nations cases, and represents only short term findings in the Saugeen First Nation case. The lack of post-occupancy review further limits the degree to which this research can assess certain design strategies, such as those pertaining to occupant lifestyle and/or comfort. In order to gather this information, additional methods such as occupant surveys and formal building evaluations would be required. While important to future strategy

development, this type of information was not deemed critical to the study, and the required methods fell beyond the time and resources available for this research.

Further, Aboriginal methodology literature suggests that post-occupancy review may be best conducted from within the community, due to sensitivities surrounding research activity, as well as potential challenges that might emerge through differing interpretations of language and meaning (Battiste and Youngblood Henderson, 2000; Berkes, 1993; RCAP, 1996; Smith, 1999; Wilson and Yellow Bird, 2005). Indeed, the latter may have influenced data collection in the key informant interviews, for example through ambiguity surrounding terminology such as ‘cultural considerations’. Reflecting upon the research, methodological weaknesses related to sensitivity and linguistic challenges may have been countered by developing the case studies in collaboration with the community. That said, I believe the methods adopted here are reliable – that similar results would follow if the same procedure were undertaken by a different researcher. Findings might differ with time however, as conditions change and new outcomes related to performance emerge.

In the context of the current crisis, the phenomenon of Aboriginal housing is by definition contemporary, and key informants who were directly involved in the pilot projects were available for interview. Case studies thus provide a more relevant approach and range of data than a historical approach would have (Yin, 2009). A comprehensive ethnography could be used to complement this research, particularly in developing a still

greater understanding of cultural appropriateness, including Aboriginal systems of knowledge, meaning and tradition. Unfortunately the depth of such an approach fell beyond the time and resources available. Further, as indicated above in relation to surveys, Aboriginal methodologies suggest that this research may be best conducted by the community itself, in order to overcome challenges related to sensitivity, trust, language and access (Battiste and Youngblood Henderson, 2000; Berkes, 1993; RCAP, 1996; Smith, 1999; Wilson and Yellow Bird, 2005).

In each of the case studies, the key informant interviews include community members with housing related experience. This representation, and my personal involvement in the Treaty 7 First Nations pilot project mark strengths of the research, and are also suggestive of a quasi-ethnographic research design. Increased representation of external stakeholders such as policy makers and industry experts may have provided a more holistic understanding of the pilot projects. Unfortunately scope, resources and scheduling provided challenges to such comprehensiveness.

As indicated above, many Aboriginal communities face similar housing challenges. Generalization of the research findings to other communities however, is highly dependent upon contextual factors. That all of the case studies were conducted with First Nations communities for example, may limit the external validity of findings related to phenomena such as on-reserve systems of governance, and to housing funding and ownership on reserve lands. Future research into Aboriginal housing would benefit

from examination of contextual factors that are specific to other Aboriginal groups and geographic contexts, namely Inuit and Métis peoples, and urban and northern settings. That said, the research findings provide some indication of how outcomes might compare or differ in other cases.

Lastly, it is important to note that performance outcomes in emerging sectors often represent moving targets – methods, costs and standards for implementing green building and clean technologies are continually changing, and so must be evaluated by the most recent data available. With these limitations in mind, the research confirms key issues and conditions, direct and root causes, challenges and opportunities in emerging sectors, precedents of Aboriginal cultural considerations, synergies and trade-offs that accompany certain strategies and priorities, and subsequent strategic considerations for improving Aboriginal housing in Canada.

Structure

Chapters two through five present findings from the background research and literature review according to four overlapping thematic areas:

- Historical and cultural context;
- The Aboriginal housing crisis;
- Green building and clean technologies; and
- Examples of Aboriginal cultural considerations, with a focus on those informing housing and other building designs.

Chapters six, seven and eight are dedicated to the three case studies. Chapter nine compares the case study findings. Chapter ten concludes the research by identifying:

- Factors that inform a working definition of cultural appropriateness in the context of Aboriginal housing;
- Recommendations for improving Aboriginal housing design and related policy; and
- Important areas for future research.

CHAPTER 2: HISTORICAL AND CULTURAL CONTEXT

In order to understand the Aboriginal housing crisis, it is essential to properly locate it within the context of broader historical and cultural events. Root causes of the housing crisis can be traced back to Aboriginal peoples' contact with and colonization by European settlers. Problematic policies and legislation that emerged from these events continue to negatively impact Aboriginal housing design and implementation to this day. Yet the evolution of Aboriginal housing extends far beyond this disruption, into the millennia that predate contact. This context is particularly important to developing a sense of how contemporary Aboriginal housing can be improved. Specifically, traditional Aboriginal housing is a physical manifestation of holistic worldviews and lifestyles that integrate spiritual, philosophical, social and political phenomena, as well as tremendous knowledge and wisdom of local natural environments. Strategies to overcome the Aboriginal housing crisis can and should be informed not only by current issues and conditions, but also by pre-contact Aboriginal cultures and the traditional housing practices found therein.

This chapter's discussion on Aboriginal history and culture leads into the third chapter, which examines contemporary Aboriginal housing in terms of key issues, problematic conditions, legislation, policies, models and frameworks. Together chapters two and three provide historical and cultural context that is essential to understanding the root and direct causes of contemporary Aboriginal housing failures, and the role of culture in fostering positive change. Projects and/or programs that overlook this context are less likely to produce meaningful and lasting solutions. Indeed, this is arguably one of

the main reasons why the Aboriginal housing crisis persists – that designs and programs have consistently failed to consider or address the events that have led us to where we are today. This includes disregard for:

- Aboriginal cultures prior to contact;
- Deliberate attempts to assimilate and terminate Aboriginal cultures, and resulting generational disconnects, gaps between traditional and contemporary housing knowledge and practices, cross-cultural inequities, and lasting mistrust of and dependency on the state;
- The degree to which the mandate of assimilation remains embedded in contemporary structures and systems such as policy, legislation, education and housing design and implementation; and/or
- Contemporary Aboriginal demographics, lifestyles, values, needs and interests..

It is difficult to do justice to the diversity and complexity of Aboriginal histories and cultures in a work of this size. There are over 630 distinct Aboriginal groups in Canada, including First Nations, Métis and Inuit peoples. A comprehensive account would detail not only their individual histories spanning the millennia prior to contact with European settlers, but also their differing experiences of contact and colonization, the transformation of the North American continent, and the evolution of Aboriginal cultures that has occurred throughout these events. Where such comprehensiveness falls well beyond this scope of this research, focus is trained on historical events and cultural phenomena that are considered to be of particular relevance to understanding and overcoming the current housing crisis.¹⁰

¹⁰ Here it is important to note that, while common negative outcomes of colonialism have been identified across many Aboriginal communities, each must be recognized as its own unique entity and treated

Before examining Aboriginal cultures prior to contact, it is first necessary to define ‘culture’ itself. For the purposes of this research, ‘culture’ denotes the systems, structures and/or processes in which the members of a given society are collectively engaged, including social, economic, political, environmental, technological, legal, philosophical and spiritual spheres. Culture may therefore be manifest in worldview, language, music, art, tradition, protocol, values, ethics, morals, needs, interests, lifestyles, activities and attitudes. This definition is grounded in anthropological conceptions of culture as explored by Ferraro and Andreatta (2010) and Bailey and Peoples (2011). It is important to adopt a definition of this breadth where traditional Aboriginal housing is intrinsically connected to cultural phenomena across these spheres, as discussed below. Advantages and disadvantages that follow from this breadth of definition are addressed in chapter 10.

Aboriginal Cultures Prior to Contact

Prior to contact with European settlers, Aboriginal peoples sustainably occupied the Americas for millennia. Aboriginal oral histories extend 13,000 years or more, depicting events that are consistent with post-glacial hydrological and geological records, as well as complex accounts of humanity’s physical and spiritual origins (Crowshoe, R., pers. comm., June 2010 – October 2012; King, 2003; Lertzman, D.¹¹, pers. comm.,

accordingly. That is to say, based on personal experience, it is not safe to assume shared experiences or outcomes of the events and forces described below unless this has been explicitly confirmed by the individuals or communities in question.

¹¹ Dr. David Lertzman acted as a committee member for this research, and provided expertise in relation to Aboriginal cultural issues.

2012). The ability of Aboriginal societies to live and thrive in all manner of habitats depended upon their in-depth understanding of local conditions and climate. Evolving over thousands of years, this understanding was experiential, based on direct interaction with natural phenomena including plants, animals, fish, and the local geography throughout all seasons. Beyond the knowledge itself, the wisdom to apply it in order to sustainably provide food, clothing and shelter is a defining characteristic of indigenous subsistence economies (Battiste and Youngblood Henderson, 2000; Morrison and Wilson, 1995; Turner, Ignace and Ignace, 2000). The close relationships with nature that characterize Aboriginal cultures around the world are a logical outcome of this reality (Berkes, 1999; Berkes, Huebert, Fast, Manseau & Diduck, 2005; Feit, 1995; Glenbow Museum, n.d.; RCAP, 1996).

The UNESCO world heritage center at Head-Smashed-In Buffalo Jump elucidates a prime example of the intimate relationships between Aboriginal peoples and their local natural environments. Prior to contact, Native groups occupying the plains co-existed with the buffalo for thousands of years. They learned to move with a herd and to hunt it in a highly coordinated and sustainable manner, taking only as many animals as they needed to survive and using most if not all of each animal. Food was carefully rationed through harsh winters, hides were used for shelter and clothing, and bones were honed into tools and weapons. Vital to their existence, these plentiful offerings were viewed by the people as gifts from the creator (Crowshoe, R., pers. comm., December 2010 – October 2011; Glenbow Museum, n.d.; Head-Smashed-In Buffalo Jump Heritage Center information, n.d.).

Aboriginal housing expert Mike Lickers (pers. comm., 10th December, 2010) provides an additional insight into the principles of community and balance underlying pre-contact societies:

“Where I come from, a longhouse was constructed by the whole community over a period of time, and that whole area would have been utilized for a period of about 15-20 years. So they built the structure from the area. They’d go into a place, a little bit high off of a ridge – for a whole bunch of reasons: you see your enemy, rain, runoff, all those kinds of sanitary things you had to concern yourself with – they built the structure using the trees from that area. Fifteen, twenty years they cultivate the land, they plant, they consume the area for a period of time, and then they completely relocated the village to another area, and that was in a sense to let that homeland rejuvenate itself.”

The term ‘traditional ecological knowledge’ (TEK) has been applied to the interrelated knowledge, wisdom and practices of Aboriginal cultures. Potential misperceptions arise from this wording however: citing Berkes (1993), Battiste and Youngblood Henderson (2000), and Cruikshank (1998), Lertzman (2003) notes that there is no universally accepted definition of traditional ecological knowledge; TEK is not uniform across cultures; and the classification of Aboriginal knowledge by Western academics is inherently colonial, grounded in inappropriate paradigms of categorization and control. McGregor (2008) and Lertzman (2003) also note that what is often categorized as TEK is not static or a thing of the past (as might be inferred from the term ‘traditional’), nor is it necessarily limited to the ecological realm.

A more accurate account of the knowledge, wisdom and practices of Aboriginal cultures will recognize the ongoing evolution of these interrelated phenomena within contemporary Aboriginal societies (McGregor, 2008). It will also recognize the

integration of ecological, spiritual, philosophical, social, economic, political, and technological systems and structures found therein (Battiste and Youngblood Henderson, 2003; Crowshoe, R., pers. comm., June 2010 – October 2011; McGregor, 2008). This research therefore applies the term ‘traditional knowledge’ to the bodies of knowledge, wisdom and practice that originated in pre-contact Aboriginal cultures, which may continue to evolve within contemporary communities, and may relate to a variety of phenomena ecological or otherwise.

As indicated above, traditional knowledge is founded upon an ethic of environmental stewardship, with underlying principles of community and balance (Crowshoe, R., pers. comm., June 2010 – October 2011; King, 2003; Lickers, M., pers. comm., 10th December, 2010). Applications of traditional knowledge in Western science are well referenced in scholarly literature including convergence in forestry, biology, behavioral ecology and numerous other fields (Lertzman 2003, 2010, pers. comm., 2012). It is therefore reasonable to expect that traditional knowledge may prove informative to contemporary Aboriginal housing design. A preliminary search revealed relatively few resources however, on relationships between traditional knowledge and contemporary Aboriginal housing. Potential convergence of these phenomena is explored further below, through the case studies and in the research conclusions.

The Tipi provides an illuminating example of traditional knowledge in the context of Aboriginal housing. This portable tent-like structure was the primary form of dwelling for Aboriginal peoples occupying the plains prior to contact. A traditional Tipi is built by draping buffalo hides around a conical set of pine poles, usually lodge pole pine. The

hide is made supple and pliable by ‘brain tanning’ – applying juices from the buffalo brain to the skin (Glenbow Museum, n.d.). The careful selection of poles is vital to a Tipi’s structural integrity – a wrong choice can lead to premature degradation through lengthwise cracks. Poles are chosen from pine groves in the coldest days of winter, by smacking the trees with a rock. If this results in the consecutive bursts of three or more trunks, then the grove is not suitable for use as the trees are rotting (Manywounds, D., pers. comm., June 28, 2011).

When assembled correctly and from adequate materials, a Tipi is able to weather adverse climatic conditions, providing relatively consistent temperatures year round, and withstanding winds of over 100 kilometers per hour (Crowshoe, R., pers. comm., December 2010 – October 2011 n.d.; Lickers, M., pers. comm., December 10, 2010). The Tipi’s light weight and compact form allowed Bands to relocate as needed, for example to follow herds of buffalo. The innovative structure includes a protective rain screen and passive ventilation, controlled by adjusting the roof’s ‘smoke-flaps’ relative to seasonal wind patterns. Although not typically attributed to traditional design, rain screens and passive ventilation are considered important facets of contemporary building science, providing protection from harsh weather, and reducing energy consumption while promoting indoor air quality respectively.

Inside the Tipi, a central hearth acts as a focal point for cooking and eating, which are socially and culturally significant activities that bring family and community together (Crowshoe, R., pers. comm., June 2010 – October 2011; Fox, A. and Hungry Wolf, B., pers. comm., January 2010). Although overall the interior space of the Tipi is flexible,

specific functions may be associated with certain areas. The door of the Tipi traditionally faces east, paying homage to the sun as the creator of all energy and life on earth (Crowshoe, R., pers. comm., December 2010 – October 2011 n.d.; Fox, A. and Hungry Wolf, B., pers. comm., February 5th, 2010). To this day rights to Tipi ownership are governed by strict protocols. Exterior visual designs convey ownership, and are imbued with meaning. Transferred through elaborate ceremonies, ownership is itself considered an honor, and typically results in respect for and careful maintenance of the structure (Crowshoe, R., pers. comm., December 2010 – October 2011).

The design of the Tipi clearly integrates different spheres of knowledge including that of local climate, natural resources, building science and spirituality. Other traditional Aboriginal structures exhibit similar levels of technical innovation consistent with the holistic and environmental values of their designers. For example, pit houses – known as *Sheesh'kan* or *Kukuli* by their creators, the interior Salish and Ktunaxa First Nations – are also built with all natural materials, include partially subterranean construction, the function of which can be likened to contemporary ground source heat pumps. Consistent temperatures below the earth's surface are used to passively moderate internal temperature year round (Perzel, 2004; Seymour, C., pers. comm., March 16, 2011).¹²

As illustrated above, significant wisdom, resourcefulness and innovation emerged from Aboriginal peoples' close relationships with nature. Respect for the natural environment as the support system of all life has allowed Aboriginal peoples to adapt to

¹² For further discussion on traditional knowledge of building science outside of North American Aboriginal contexts, see Fathy's *Natural Energy and Vernacular Architecture* (1986).

some of the harshest conditions on the planet.¹³ Worldviews that have followed from this reality naturally tend towards holism and collaboration. This has been expressed in the belief that all things in the universe are connected, that all things come from and should return to Mother Earth, and that humankind's role in the natural order is one of creativity and cooperation – it is only through collaboration with natural phenomena including plants, animals and other people that humanity is able to survive (Crowshoe, R., pers. comm., December 2010 – October 2011; King, 2003; Perzel, 2004; Seymour, C., pers. comm., March 16, 2011).

Contact and Impacts of Colonialism

Divergence between Aboriginal peoples' worldviews and the now dominant paradigms of their European colonizers has contributed to lasting cross-cultural misunderstandings and conflicts. King (2003) identifies the religious and ideological origins of this divide in these societies' differing views of creation:

“...the elements in Genesis create a particular universe governed by a series of hierarchies... that celebrate law, order and good government, while in our Native story, the universe is governed by a series of co-operations... that celebrate equality and balance...,” (p.23). And later,

“The post-garden world we inherit is decidedly martial in nature... or to put things in corporate parlance, competitive. In the Native story... the pivotal concern is not with the ascendancy of good over evil but with the issue of balance,” (p.24).

¹³ Consider for example the Inuit peoples' capacity to endure in the Arctic, or the Native tribes that occupy the Amazonian jungle.

Following contact, initial relationships between Aboriginal and non-Aboriginal peoples were characterized by mutual respect and cooperation. This was manifest in extensive trade, military alliances, and peace treaties that did not involve the cession of land (Lertzman and Vredenburg, 2005; RCAP, 1996). It did not take long for the situation to devolve however, as a result of population dynamics, changing economic and strategic priorities, and the aforementioned spiritual and ideological differences.

Confederation marked a shift where, as the foundations for settlement and development, land and resources became primary policy drivers (Lertzman and Vredenburg, 2005; RCAP 1996). Under this expansionist framework, Aboriginal peoples represented a barrier to ‘civilization’, and to the uninhibited settlement of and dominion over the new world (Berkes, 1993; Castellano, Archibald and DeGagné, 2008; IHC, 2006; Lertzman and Vredenburg, 2005; Morrison and Wilson, 1995; RCAP, 1996; Reilly, 2010; Smith, 1999; Vaillant, 2006; Younging et. al., 2009). The Royal Commission on Aboriginal Peoples (1996) indicates that colonization was founded on the (fallacious) belief that Aboriginal people were inferior, and that their ways of living were barbaric relative to those of European settlers:

“Our Indian legislation generally rests on the principle that the Aborigines are to be kept in a condition of tutelage and treated as wards or children of the state.... It is clearly our wisdom and our duty, through education and other means, to prepare him for a higher civilization by encouraging him to assume the privileges and responsibilities of full citizenship,” (Looking back, looking forward – policies of domination and assimilation, paragraph six; citing the Annual Report of the Department of the Interior (1876)).

Policies of assimilation and termination emerged, including deliberate undermining of the systems and structures that supported pre-contact Aboriginal societies (Lertzman and Vredenburg, 2005; RCAP, 1996). From the early 1800's to the present day, such policies have contributed to:

- The destruction of Aboriginal social, political, economic, environmental and cultural systems and structures;
- The repression of cultural practices such as language and ceremony;
- The appropriation of Aboriginal land and resources;
- External control of individual and collective legal and financial status;
- The imposition of foreign occidental governance systems fundamentally at odds with traditional governance structures;
- The forced removal of children from their homes and communities; and
- Dependency on the federal government for housing, infrastructure and social welfare.¹⁴

The decimation of the buffalo in North America is a prime example of the destruction of Aboriginal cultures that followed contact and colonization. The slaughter was driven by excessive hunting in Canada and the United States, as well as the intentional suppression of Aboriginal resistance south of the Canada-United States border (Davis, 2009; Roe, 1934; Taylor, 2011). Davis (2009) notes that General Sheridan led the American military strategy, and “advised the U.S. Congress to mint a commemorative medal, with a dead buffalo on one side, and a dead Indian on the other,” (p.169). While Canada did not partake in this particular form of intentional suppression, it is

¹⁴ Specific policy-based and legislative documents contributing to this legacy include the British North American Act, the Royal Proclamation, the Constitution Act and the Indian Act (RCAP, 1996).

symptomatic of an attitude underlying cross-cultural relations in both countries during the nineteenth and early twentieth centuries (Weaver, 1981). Further, Roe (1934) discusses how the strategic suppression prevented the buffalo's migration northward, thereby affecting Aboriginal peoples within Canada.

As we have seen, the buffalo was of particular importance to Aboriginal peoples occupying the plains, who had sustainably co-existed with the animal for millennia, and depended on it for food, clothing and shelter. The eradication of 10-15 million buffalo in a “punctuated slaughter” lasting a mere 10 years (Taylor, 2011) thus had an immeasurable impact on these peoples. This could never be experienced solely as a depletion of a natural resource (itself not an insignificant occurrence, especially at this scale and rate). Rather, it represented the destruction of a principal foundation for their spirituality and way of life (Crowshoe, R., pers. comm., June 2010 – October 2011; Glenbow Museum, n.d.; Head-Smashed-In Buffalo Jump Heritage center resources, n.d.).

Sadly these events do not represent an isolated experience in the course of Aboriginal history, or human history as a whole. Throughout the nineteenth and twentieth centuries, foundations of Aboriginal cultures were threatened or annihilated as modern industry and resource extraction swept across the continent. The logging of old growth forests, overfishing on both Pacific and Atlantic coasts, and extensive whaling, mining and drilling have forever changed the face of the land, sea, and the peoples who lived and evolved within these environments.¹⁵

¹⁵ John Vaillant's *The Golden Spruce* (2006) offers a fascinating and terrifying account of problematic forestry practices that have shaped Canada's west coast.

The Treaties between Aboriginal peoples and the Canadian government are definitive facet of both past and present cross-cultural relationships. Early Treaties provide important precedents for future agreements, where they were based on respect, successfully achieved cooperative peace, and did not capitalize on a weakened population in order to seize land and resources (RCAP, 1996). In contrast, later Treaties were frequently signed under dubious or coercive circumstances. Many remain subject to differing interpretations by the parties involved, resulting in ambiguity, mistrust, and conflict (Hildebrandt, Carter and First Rider, 1996). Indeed, the most intense conflicts between Aboriginal and non-Aboriginal peoples frequently involve the Treaties, and related issues of land and resources as the essential substructure of political, economic and social development (RCAP, 1996). It is hardly surprising that such disparity might emerge from attempts to inhibit Aboriginal peoples' relationships with the land given the latter's significance to Aboriginal worldviews, spirituality and ways of life.

One is hard pressed to find specific mention of the responsibility for housing provision within the Treaties (Smith, D., public comm., February 2012). In certain cases however, Treaty terms included education, health care, comfort and tools to implement housing (Hildebrandt et. al., 1996; Talbot, 2009). Thus some Treaties may themselves provide bases for current claims by First Nations' as to the Federal government's fiduciary responsibility for housing in their communities. As discussed throughout this research, the issue of responsibility for housing is central to the current crisis, with complex implications for housing adequacy and associated economic resources. In some cases, the reluctance of First Nations people and governments to abandon the issue may

have emerged from the potential for such a path to erode other Treaty-based rights and freedoms. The indirect impacts of the Treaties on contemporary Aboriginal housing – for example in the limiting of land base – are examined further in the following chapter.

In addition to the Treaties, the Indian Act of 1876 is a key piece of legislation used in the colonization of Aboriginal peoples, which continues to define cross-cultural relations today (Indian Act, 1985). While a comprehensive examination of the Act and its affect on Aboriginal peoples is beyond the scope of this research, it must be acknowledged for its historic contribution to cross-cultural misunderstandings, conflict and mistrust. These sentiments follow directly from the Act's role in establishing the external control of individual and community rights and freedoms, including but not limited to the determination of Indian status, freedom to leave a reserve, the right to vote, the right to legal counsel, and the right to conduct traditional spiritual and social practices. The Act's ongoing influence upon housing in First Nations communities is explored further in the next section and the following chapter.

The residential school system is perhaps the foremost example of the deliberate destruction of Aboriginal cultures. A comprehensive account of the residential schools is again far beyond the scope of this research. That said it is important to acknowledge the grave losses that followed from their implementation, and the central role which the federal government and the church played in this atrocity. As noted in the Royal Commission on Aboriginal Peoples (RCAP, 1996):

“Church and government leaders had come to the conclusion that the problem (as they saw it) of Aboriginal independence and 'savagery' could be solved by taking children from their families at an early age and instilling

the ways of the dominant society during eight or nine years of residential schooling far from home,” (Looking forward, looking back – policies of domination and assimilation, paragraph 7, bullet 3).

The overarching agenda of cultural assimilation and termination was in many cases pursued through child abduction and abuse (Castellano, Archibald and DeGagné, 2008; Highway, 1998; Puxley, 2012; Smith, 1999). Puxley (2012) quotes Justice Murray Sinclair, Chairman of Canada’s Truth and Reconciliation Act: “the reality is that to take children away and to place them with another group in society for the purpose of racial indoctrination was – and is – an act of cultural genocide...,” (p.A14). As such, the schools are considered among the most damaging actions inflicted upon Aboriginal peoples, with survivors continuing the cycle of abuse with their own children (Puxley, 2012).

While the connection between the residential schools and the current housing crisis is indirect, it is reasonable to conclude that the emotional, physical, spiritual, and mental impacts on Aboriginal people have in turn affected individual and community capacities related to housing. For example, the suppression of traditional language and cultural protocols for knowledge transfer would necessarily have impeded individuals’ ability to interpret both old and new systems of ownership and responsibility (Nettle and Romaine, 2002). Chief Clement Seymour (pers. comm., March 16th, 2011) explains:

“A lot of it goes back generations, when things were taken... away from them [Aboriginal peoples], and saying ‘well now we’re going to look after it for you.’ Then all of a sudden they [the government] don’t want any [responsibility] on them and say ‘well now you’ve got to go take care of this....’ The teachings of how to look after things was taken away from them and so a lot of these

people have the concept like somebody owes them something now.... This was way back in the 1910, 1920, 1930, and after that residential school stuff and everything else right across Canada.”

Outcomes of the residential schools include lasting mistrust towards the government, as well as generational and knowledge gaps, and issues of identity, dispossession, marginalization, and related social ills (Castellano, Archibald and DeGagné, 2008; RCAP 1996).

The Myth of Post-Colonialism

The above events may fallaciously be interpreted as belonging to a distant past. In reality the impacts of colonization continue to affect many Aboriginal peoples and communities today, including facets of housing and related resources and capacities. Labels such as ‘post-colonialism’ contribute to the belief that cross-cultural relations have undergone fundamental change since colonization began (Smith, 1999). This assumption must be questioned however, where the economic and strategic priorities that spawned initial cross-cultural conflicts remain fully intact, where legislative and policy tools initially designed for assimilation still exist, and where systemic biases against Aboriginal culture are prevalent.

As we have seen, European expansionism and subsequent colonial policy on the North American continent was driven by strategic interest in land and resources. These remain central forces in Canada’s political, economic and cross-cultural dynamics to this day. The Northern Gateway pipeline is a prime example of friction and conflict between the interests of non-Aboriginal public and private entities as compared to those of

Aboriginal communities (Hoekstra, 2012; Hermann, 2012).¹⁶ The federal government's attitude towards outstanding land claims on Canada's west coast further highlights tension in cross-cultural relations, and associated problems surrounding political structures, processes and continuing imbalance of power (O'Neil, 2012).

Considering tools for assimilation, the last of the residential schools closed in 1996. This is very recent history, the impacts of which are still felt in these communities today (Castellano, M.B., Archibald, L. and DeGagné, M., 2008; Highway, 1998). The Indian Act also continues to occupy a central and contentious position in relationships between First Nations and the federal government. The Act's imposition of governance structures on many First Nations reserves is seen as particularly problematic. Where these fail to reflect hereditary or other traditional practices they perpetuate cultural oppression. Further, they lead to power imbalances, allowing large families to gain and maintain control, in turn fostering conflict and corruption. As such, the Indian Act represents an ongoing impediment to self-governance and self-determination (Croal, 2010; Reilly, 2010; Smith, 1999; Wilson & Yellow Bird, 2005). The Indian Act's role in preventing private home ownership on First Nations reserves is also of direct concern to the housing crisis, where market function and individual ability to build equity are undermined (IHC, 2006; INAC, 2008). This critical area is examined in greater detail in the next chapter and in the Treaty 7 First Nations case study.

¹⁶ The proposed Northern Gateway pipeline would run from Alberta's oil sands to the Pacific Coast, in order to allow for export of the product.

Where Aboriginal values, principles and beliefs are excluded from the education system this further perpetuates the oppression of Aboriginal cultures. Puxley (2012) notes that for generations, education of both Aboriginal and non-Aboriginal people has dismissed Aboriginal culture and history as worthless and inferior. Aboriginal youth have less exposure to the experiential foundations for traditional knowledge, and are less receptive to traditional language, information, and teaching styles. This has in turn led Elders to question the value of their knowledge (Brockman, 1997).

These biases have significant implications for community well-being and cultural preservation. The widespread loss of Aboriginal languages around the world is a particularly damaging aspect of colonialism (CBC, 2012; Nettle and Romaine, 2002). A mere three of the dozens of Aboriginal languages currently spoken in Canada are expected to survive the 21st century (Croal, 2010; CTV, 2009). Where Aboriginal cultures are ‘oral’, and typically do not create written records of their history (including traditions, protocols and practices), this loss of language further implies loss of vast amounts of knowledge (Nettle and Romaine, 2002).

In a rare presentation entitled Tusaqtuut¹⁷, Inuit Elders publicly shared their experiences of cultural disruption, language loss, and subsequent challenges related to traditional knowledge retention in their communities. Traditional knowledge is integrated into the Inuit language in part through place names and nouns. These contain information about seasonal changes to the local landscape and resources, which assist in traditional

¹⁷ The name comes from the Inuit word for a specific moon phase which traditionally indicated the time had come to traverse certain arctic passages, to meet with other communities and share knowledge. The event was held on the University of Calgary campus in November 2010.

practices such as navigation and fishing. Multiple words for ‘snow’ depict its various states and the practical uses of each, for example in constructing igloos or finding fresh water in the arctic sea ice. Multiple words for a single species of fish denote different stages of growth, and are related to (in)appropriateness of harvesting them relative to life span and population. The replacement of indigenous taxonomy with single English versions leads not only to loss of knowledge about our natural environment, but to loss of culture itself. Lertzman and Vredenburg (2005) speak to this concern:

“Loss of a language represents more than a loss of words.... Languages represent meaning systems, a way for organizing and making sense of the universe. Each embodies an inimitable example of human ingenuity and adaptation to the environment.... Indigenous peoples living close to their ecosystems for long periods of time have garnered an enormous degree of descriptive and applied knowledge. Much more than “data”, this information characteristically functions within time tested resource management systems and social institutions of long resident peoples ... [and] offers alternatives for Western science based resource management,” (p. 244).

The cumulative effect of contact and colonization on Aboriginal peoples has been one of unparalleled upheaval. Foundations for their cultures were thoroughly undermined. Fundamental rights, freedoms and activities were externally controlled. And new foreign systems that were introduced into these communities – socioeconomic, political, and technological – were not adequately translated or interpreted (Crowshoe, R., pers. comm., December 2010 – October 2011; Seymour, C., pers. comm., March 16, 2011). Subsequent gaps have emerged between generations, and between traditional and contemporary knowledge and practices.

In this context, Aboriginal dependency on the state for social welfare should come as no surprise. Rather, it is completely logical that these communities require support, and face numerous socioeconomic challenges including insufficient housing resources and capacities. That this reality is in fact revelatory for some is indicative of failures of the education system, the news media, and community and political leaders to sufficiently develop awareness and to foster the political will to address the crisis.

CHAPTER 3: THE ABORIGINAL HOUSING CRISIS

This chapter provides an account of the key issues, problematic conditions and social and economic outcomes that define the Aboriginal housing crisis. Key issues are related to Aboriginal housing legislation, policy, evaluative frameworks and pricing models. Problematic conditions include those prevalent in Aboriginal communities such as disrepair, mould and crowding. Legislation and policy specific to housing on reserve lands are a particularly challenging, especially where they prevent ownership and undermine adequacy. Problematic conditions are not isolated to reserves however, but rather are also experienced in urban, rural and remote settings. This suggests the need for solutions that extend beyond reserves (and related policy and legislation) to address these broader trends and contexts. The outcomes of the crisis are particularly important: high social and economic costs indicate the urgent need to develop improved Aboriginal housing strategies.

Contemporary Policy, Legislation, Frameworks and Models

As the original territorial agreements between the Federal Government and First Nations, existing Treaties determine the geographic context for current housing on reserve lands. The limited amount of reserve land available for housing and development has practical implications for quantity, quality, availability, size of lots, servicing and infrastructure. The influence of the Treaties on Aboriginal peoples may be augmented by rapid growth of the Aboriginal population as a whole, which is four times greater than

that of non-Aboriginal peoples (Statistics Canada, 2006).¹⁸ As Seabird Island's Research

Director Jay Hope (pers. comm., May 18th, 2011) notes:

“What ends up happening with the influence of the colonial government is that we get put into reserves... and then within the reserves we get strictly lineal boundaries around the lots and property lines. Then there's a shift from the cultural thinking of this wide network of sharing in the territory to this more concentrated aspect of 'this is mine, this is my property....' So with the advent of these colonial concepts of boundaries and fence lines and lot numbers and such, we start to get these family disputes around who has the right to settle here, who has the right to construct a house, who's been here longer....

“Because we're so confined to such a defined land base... [and] our populations continue to grow... we may have had a lot, a 7 acre plot of land provided by the government say to my great grandfather in the [19]20s or [19]30s.... As the generations move and as the great grandfather passes away and as his son passes away it becomes more convoluted, because a lot of the times there's no will in the family to will that property down through the generations. If it doesn't get willed out ... there ends up being a problem with 'well, who actually owns that, who actually settles that property?' And if it does get willed down through the generations it just gets chopped up more, so you end up with a 7 acre chunk of land that's chopped up into 100 meter sections three or four generations down the road.”

Relocation that accompanied colonization and Treaty-making has been identified for its serious impacts on individual and community capacity and resources related to housing (Hawthorne, 1966; RCAP, 1996). New settlements were often located on terrain ill-suited to physical development, with little or no consideration for the viability of socioeconomic development. Key informants from the Saugeen First Nation case study

¹⁸ Statistics Canada's 2006 census indicates an average Aboriginal population growth rate of 20.1 percent as compared to 4.9 percent for the non-Aboriginal population.

indicated that their reserve land as governed by Treaty is of poor quality and ill-suited for physical development, including housing (also see Palmer et. al., 2007).

Location in rural and remote locations may also negatively influence means and routes for access, supply chains and logistical costs (David, 2003; INAC, 2010). These issues may be tied to broader systemic factors, such as seasonal weather and climate change, as well as shifts in social and education systems, and the decline of traditional methods of subsistence. Speaking from experience, Architect Rob Seniuc (pers. comm., May 20th, 2011) notes “I know some of the communities up north, they’re spending half a million dollars just maintaining houses every year that are sinking because of the permafrost problem that we have now.”¹⁹ Hawthorn (1966) points out that:

“Here [in the north], literally dozens of bands which formerly sustained themselves on a hunting, trapping and fishing economy have rapidly been abandoning their former means of livelihood and becoming dependent mainly on relief. In some cases this has been due to population outrunning the resources available. In other cases it has been due to a combination of circumstances – insufficient technical knowledge and inefficient methods; inadequate or obsolete equipment; loss of mobility due to educational requirements and to new health and welfare services; or in general, an inability to derive as large a real income from the traditional means of livelihood as can be received from relief and welfare generally,” (p.169).

In addition to problems that stem from geographic location, surrounding developments and rights of way can also impact land use and development, in turn influencing community capacity to maintain traditional cultural connections to the land. Hope (pers. comm., May 18th, 2011) describes these relationships:

¹⁹ Climatic and geographic factors have proven a key challenge in the delivery of relief modular housing to the Attawapiskat First Nation (CBC 2012, (a, b)).

“A lot of reserves have a number of right of ways that pass through the reserve lands. On Seabird we have the BC hydro transmission right of way, we have the rail line, we have the highway and we have West Coast Energy which is a gas pipeline.... The Band becomes alienated. Between the right of ways... on the right of ways... outside the right of ways - you can't really do too much... because they have a buffer zone on that right of way as well.

“There are a lot of different influences that end up chopping up the land, and hindering that development, and hindering that cultural connection to the land. Once those right of ways go off reserve into the territory they also divide up the territory so that areas aren't able to be accessed anymore – traditional hunting areas, traditional gathering areas, traditional trails also become blocked off....

“Right of ways aren't the only influence there. It becomes the influence of fee simple properties... people taking up preemptions around the reserve lands in the colonial days cut people off from their territories as well. So then we lose that connection to our territories... rather than bringing your son out into the backyard or into this mountain back here to hunt you now have to go further and further from the reserve. And as you get further and further away from the reserve those teachings become lost....”

From its introduction around the mid-20th century into the mid-1990s, housing programs on First Nations reserve lands were centrally controlled by Indian and Northern Affairs Canada (INAC) and the Canada Mortgage and Housing Corporation (CMHC). Aboriginal housing from this period is generally substandard, typified by elevated plywood bungalows that do not provide adequate shelter or services (Auditor General of Canada, 2003, 2011; Smith, D., public communication, February 2012). A minimal range of design options were available to meet the significant variety of needs and interests that follow from Aboriginal diversity, including cultural, geographic, and socioeconomic factors.

Numerous housing failures can be linked to this limited and centralized approach, including rapid degradation and cultural inappropriateness. As noted by the Auditor General of Canada (2011), “housing stock generally deteriorates more rapidly on reserves, mainly because of substandard construction practices or materials, lack of proper maintenance, and overcrowding.” Architect and Professor Tang Lee points to the absence of legal requirement to involve architects in small developments, and the authority vested in First Nations’ Chiefs and Councils to override building codes should they see fit. Lee (pers. comm., December 10th, 2010) also cites the following factors:

“[Aboriginal peoples’] lifestyle... the numbers of people that use [the home]... that they live in a rural location... that they don’t have sidewalks and streets, they have gravel roads.... They’re tracking all these things into their homes... more mud, more snow, more water, and of course sand... as they walk into the building... it’s going to get worn down much quicker than in an urban area.... The design is really not suited for a rural location.

“It is also not suited because it’s really difficult to get parts in rural communities... they may have to drive two or three hours... to get supplies.... But also their lifestyle – they might hang meat, they boil a lot of their foods for cooking... they’ve got six, seven, eight, nine, ten kids or people inside their home all breathing, and washing, and cooking. It adds a tremendous amount of humidity which we don’t experience normally in an urban environment with non-Native people. That’s a lifestyle thing. It’s not necessarily that they would abuse it. It’s just that due to the culture there’s more humidity being produced in the homes and these homes are not designed in such a way that mitigates the effects of condensation, or thermal bridging. Lack of dehumidification, lack of ventilation aggravates the condition even more.”

The 1996 on-reserve housing policy was created to provide First Nations with increased control and flexibility over housing. The policy was based on economic

incentives that were made available to those Nations who applied and had developed requisite community-based housing plans. Intended outcomes included:

- Improving housing quality, lifespan and diversity;
- Supporting pride, responsibility, and sense of ownership; and
- Linking housing to training, job creation and business development.

While an initial evaluation of the policy by INAC indicated some positive results, subsequent assessment (INAC, 2008) indicated “there is no credible demonstration that this greater flexibility led to the results achieved...,” (p.31). This later evaluation is consistent with reports of the Auditor General of Canada (2003, 2011) in recognizing significant limitations and barriers to the success of the 1996 policy. Failures were attributed in part to the policy’s optional nature, which has led to administrative complexity and inconsistency. Further, INAC (2008) indicates that:

“The major flaw with the Department’s [INAC’s] approach was to assume that supporting the development of community-based housing plans would be sufficient to lead to long-term sustainable change in the way that housing was governed, managed and financed. Evaluators found that the three key factors that underlie a successful housing program are the political will and the support of the community as well as the development of managerial and technical capacity,” (p.31).

The lack of meaningful input from First Nations themselves in the 1996 on-reserve housing policy has been identified as undermining the realization of these factors. Dewey Smith (public comm., March 2012) indicates that where the federal government “did not actively engage communities in their own solutions, [housing initiatives from this time] were a series of external interventions and imposed policies that were never articulated, defined or communicated to First Nations.” Further, it is commonly agreed

upon that key challenges remain for housing and other programs on First Nations reserves in terms of responsibility, accountability, transparency, complexity of process, and centralized decision-making by government bodies (AFN, 2006; Auditor General of Canada, 2011; CMHC, 2006). These challenges are revisited throughout this research, and in particular in the context of the recommendations in the final chapter.

As indicated in the previous chapter, the Indian Act is a particularly problematic piece of legislation relative to cross-cultural relations. The International Housing Coalition (2006) describes the Act as “the primary prohibitive factor in the development of... successful housing programs on Indian lands,” (p.12). By obstructing private home ownership on-reserve, the Indian Act undermines market function, financing and development in these communities, and prevents Aboriginal individuals’ access to a critical source of equity and leverage (IHC, 2006; INAC, 2008). As detailed below, First Nations already face challenges surrounding employment and income. The prevention of private home ownership further reduces the imperative to allocate scarce personal financial resources that may follow from this to home maintenance and upgrading, because these actions do not result in appreciation of assets as they would in a functional market. As such, barriers to home ownership can be seen as an indirect cause of degradation and inadequacy.

Issues of ownership and subsequent inadequacy are directly related to knowledge gaps that emerged through colonization, and the dependency and sense of entitlement that permeates many Aboriginal communities. Recalling Chief Seymour’s (pers. comm., March 16th, 2011) comments from the previous chapter, “the teachings of how to look

after things was taken away from [Aboriginal peoples] and so a lot of these people have the concept like somebody owes them something now.” As a result, the function and maintenance needs of home systems may not be well understood by occupants. They may therefore not use essential components such as bathroom or kitchen fans, or heat recovery ventilators, and may not report adequacy issues as they emerge (Lee, T., pers. comm., December 10th, 2010; Seymour, C., pers. comm., March 16th, 2011; Laronde, D., pers. comm., April 21st, 2011). These issues are discussed further in the case studies and conclusions.

Speaking to circumstances in the Tsuu T’ina community, Infrastructure Manager Lee Crowchild (pers. comm., December 14th, 2010) points to the introduction of social assistance as particularly problematic:

“When the late [19]60s came along and they started introducing welfare on the reserve here, and social services... it creates this legacy of dependency.... When you really ask people, they don’t really like being on social services. But when the challenges are – you have large families, you have no real jobs that you can go to, for some people they don’t have the education, whatever the other social issues are – you can’t help but be on social assistance or income support. I don’t think any normal person ever loves being in that situation.

“That’s why the home is so important, and learning how to treat your home.... When people don’t feel like they have to work to make something precious to them, then they don’t really feel like they own that. With social services, take one house there, the electrical bill needs to get paid, bring it to social services and it gets paid; the heating bill needs to get paid, you bring it to social services and it gets paid. Why should I worry about looking after this house because it’s going to get taken care of by a department, so I can just live any old way I want.

“To say that it’s a fiduciary responsibility no matter what, I don’t really agree with that. But politicians will talk differently, because they work with the government all the time, and they have to keep those fights going. Or else it will be easy for the Canadian government to walk away from a lot of stuff.”

Architect and Professor Tang Lee (pers. comm., December 10th, 2010) supports this view, drawing a direct connection between lack of ownership, social assistance, and housing inadequacy:

“When people really do not pay for their home there’s not that sense of ownership and therefore there isn’t the same desire to look after a property.... And as a result it’s not looked after. If they had to pay for it with their own money... then I think there would be a lot more respect... and perhaps they would look after it a lot more.... They’ve told me ‘if that home is badly damaged after five years I get a new home’. And so there’s more of an incentive to actually not look after it because they get a new home. That was brought to me very, very seriously by the Elders... saying ‘look, we looked after our homes – it’s 15, 20, 25 years old, and these young people, they get a new home every five years, and that’s not fair....’ That’s been part of the problem, there’s an age attitude difference as well as the whole ownership and responsibility to that property.”

Funding approvals for renovations, new unit construction, and land improvement on reserves currently remain in the domain of CMHC and INAC, controlled through vehicles such as Ministerial Loan Guarantees (MLGs), Section 95 allocations, and Certificates of Possession (CPs). Other sources of financing for housing are emerging, including the First Nations Market Housing Fund, and opportunities dedicated to Aboriginal initiatives within Canada’s Economic Action Plan (CEAP). Some of these vehicles are explored in the context of the case studies below.

Case studies by the International Housing Coalition also point to important precedents for successful housing programs within and beyond reserve lands. Innovative strategies such as revolving loans and rent-to-own programs are identified as means to foster ownership, energy efficiency, self-determination, self-reliance, economic development, meeting of community needs, and maintaining sense of community (IHC, 2006).²⁰ The Harvard Project, an important U.S.-based think tank addressing governance, social and economic development amongst Native American Tribes highlights the importance of self-determination in Aboriginal contexts:

“When Native nations make their own decisions about what development approaches to take, they consistently out-perform external decision makers—on matters as diverse as governmental form, natural resource management, economic development, health care and social service provision,” (Harvard Project, n.d., homepage, paragraph 1).

Current frameworks used to evaluate Aboriginal housing such as CMHC’s Core Housing Need (CHN, see glossary) contribute to related policy shortcomings.

Specifically, the CHN framework:

- Does not provide affordability data for housing on reserve lands where assets are typically owned by the First Nation itself;
- Uses indicators that are insufficient in assessing housing in rural and remote contexts, where incomes are generally lower and market functions differ significantly (David, 2003);
- Implicitly assumes that with sufficient income, a household can resolve housing difficulties (David, 2003);

²⁰ Also see Alcantara 2005, and Flanagan, Alcantara and Le Dressay 2010.

- Places responsibility for determining adequacy (need for significant repairs of a housing unit) on the tenant, who may not be qualified to conduct such an assessment; and
- Narrowly defines suitability as the number of bedrooms in a unit based on Canada's National Occupancy Standards, without consideration for other relevant factors such as demographics and lifestyle (IHC, 2006).²¹

In addition to the core housing need framework, CMHC's 'Maximum Unit Price' model (MUP) dictates an upper limit on initial capital cost of housing, based on the number of bedrooms in a unit (IHC, 2006). This in turn limits design options to meet actual community needs, with implications for building quality. The model also results in biases towards upfront capital cost considerations over lifecycle costs. Architect and Professor Tang Lee (pers. comm., Dec. 10th, 2010) discusses the positive implications of a longer-term view:

“The fact that these houses would last longer would actually be a savings to the community in the long run because, rather than building a home every five to 10 years they could last you 50, 60, 100 years... if it's built properly. But it needs to be designed properly, it has to have the right mechanical systems, and it has to have the right materials.... It will cost of course a little bit more to build each of those houses. And of course the whole issue is... they all get money from INAC, and they distribute that money in however way they feel is good.

“And so I don't blame them when they say 'well, we've got \$5 million dollars for houses. We can build 10 houses cheaper, or we can build 8 houses really well.' There is a housing need in these communities, and they'd rather spend the money and get 10 houses – at least two more families have a house. They don't want to spend more money on

²¹ Such factors are explored further by this research, through the concept of cultural appropriateness.

each individual house even though in the long run it would last a lot longer than the cheap houses that they build.

“They have to understand life cycle assessments and surface life of buildings, and I don’t think they fully understand that. On the other hand I’ve heard some – just talking to some of the community members – they say ‘if I get a new house, I’d rather have that, rather than a house that’s been around for 100 years....’ There’s a disconnect and a disincentive for houses that last longer.”

While there are allowances for increased expenditure within the maximum unit price model in order to achieve specific performance outcomes, the full range and availability of features that qualify have not been identified (CMHC, 1994; Shaw et. al., 2007).

Beyond the limitations of the maximum unit price model, a confidential source brought forward official CMHC documentation from 1991 which lists ‘modesty requirements’ for Aboriginal housing design. These specifications were used to determine qualification for receipt of section 95 allocations, a principal source of funding for housing on First Nations reserves. Specific features considered to be ‘immodest’ included: garages, landscaping, ensuite bathrooms, fireplaces, bay windows, costly design features, sundecks in excess of 8 feet x 10 feet, dishwashers, microwaves, sky lights, fencing and site development in excess of local norms. The same document notes that “while not all inclusive, [the] above gives the intent.” It also states that:

- The level of quality offered locally by the private sector should not be exceeded, providing minimum CMHC standards are met.
- Innovation in construction materials, systems or techniques is acceptable only if cost savings can be demonstrated.

The rationale for these requirements is unknown. One informant suggested that such restrictions might help to create the appearance of equitable treatment across different Aboriginal communities, and also to avoid perception of high costs related to these portfolios. It is also not known whether the requisite cost savings that were to accompany innovation could be manifest in long term operations and maintenance reductions, or if these could be demonstrated in reduced upfront investment. Initial correspondence with CMHC suggests that modesty requirements still exist today, though whether they have been modified since the 1991 had not been confirmed at the time of writing.

Social and Economic Outcomes

Considering housing outcomes in this context, the Royal Commission on Aboriginal Peoples (1996) aptly summarizes the contemporary Aboriginal housing crisis, stating that “conditions pose an unacceptable threat to the health of Aboriginal peoples and reinforce feelings of marginalization and hopelessness,” (housing and living conditions: meeting urgent needs, paragraph one). Specific issues and problematic conditions relevant to this research include but are not limited to housing shortages, overcrowding, substandard specifications, building disrepair, high rates of mould and fire, challenges to affordability, and inadequate access to essential services. These conditions and their relationship to negative socioeconomic outcomes are documented in numerous reports, and journal and media articles (AFN, 2006; Auditor General of Canada, 2003, 2011; Beavon, 2009; CMHC, 2002, 2007, 2010; Curry, 2010; David, 2003; Health Canada, 2005, 2009; IHC, 2006; INAC, 2004; MacMillan et. al., 1996;

Maliene et. al., 2008; Meissner, 2009; Palmer et. al., 2007; Robson, 2008; Rosenberg et. al., 1997; RCAP, 1996; Tookenay, 1996).

The high fiscal costs associated with reserve housing certainly suggest the need for a more economically sustainable approach. The 2011 Status Report of the Auditor General provides an overview of federal funding dedicated to reserve housing from April 2004 to March 2006, summarized in Table 1. The report also examines on-reserve demand, need for replacement, need for maintenance, and related costs, summarized in Table 2.

Table 1: Investment in Renovation and Construction of New Reserve Housing - April 2004 to March 2006

Investments in Housing	
Funding (\$ billions)	1,486
Number of new units constructed	9,362
Number of units receiving major renovations	13,018

Source: 2011 Status Report of the Auditor General of Canada to the House of Commons

Table 2: Demand, Replacement, Renovation and Cost of Reserve Housing

Housing Requirements	Fiscal Year 2003-04	Fiscal Year 2008-09	Increase
Demand for housing on reserves	8,500	20,000+	135+%
Housing units requiring replacement	5,199	5,480	5%
Housing units requiring major renovations	16,878	25,586	40%
Average cost per house (constructed or significantly renovated)	\$42,750	\$64,000	50%

Source: 2011 Status Report of the Auditor General of Canada to the House of Commons

The 2011 Auditor General (2011) summarizes the implications as follows:

“Investments have not kept pace with either the demand for new housing or the need for major renovations to existing units. According to unaudited data provided by INAC, the housing shortage on reserves has worsened since our 2003 audit because of increases in the demand for housing, the number of housing units having to be replaced, and the number of units requiring significant renovations for health and safety reasons. At the same time, since 2003, the average cost to build or renovate each house has risen significantly. In the 2008-09 fiscal year, new houses constructed on reserves amounted to only 30 percent of the existing houses that needed to be replaced,” (p.20).

As a result of this reality, crowding is a definitive facet of the Aboriginal housing crisis, with serious implications for occupant health and safety. Crowding increases wear, which in turn compromises adequacy. It also increases humidity, facilitating mould growth. Lastly, it increases transmission of illness and diseases, and compromises privacy, which may in turn affect hygiene (CMHC, 2002; Curry, 2010; Health Canada, 2009; MacMillan et. al., 1996; Palmer et. al., 2007; Robson, 2008; Rosenberg et. al., 1997; Tookenay, 1996). Robson (2008) aptly summarizes the situation:

“Where ... people are contracting respiratory disease because of mould infestation or shigellosis because of crowded living conditions, housing is more than a social issue, it is also a health issue. As is suggested by Health Canada, on-reserve housing is one of the most significant “Non-Medical determinants of Health” and further, a fairly accurate measure of community well-being,” (p.73).

Elaborating on the broad range of negative health outcomes associated with current Aboriginal housing inadequacies, Robson (2008) cites psychological and physiological effects, skin, intestinal and middle ear infections, tuberculosis, meningitis, hepatitis A, measles, asthma, respiratory, immune and diarrheal diseases. The direct

causes of these afflictions include overcrowding, improper ventilation, inadequate heating, high humidity levels, inadequate water servicing and waste disposal, poor drainage and unit disrepair.

Statistics on the extent of the Aboriginal housing crisis vary depending on their source and/or date. Regardless of exact numbers, estimates of the demand for renovations and new units are consistently high. The Auditor General of Canada (2011) indicates the need for repair of 44% of the existing stock and 8,500 new units. The Assembly of First Nations (2006) indicates that “First Nations homes are about four times more likely to require major repairs compared to Canadian homes and mould contaminates almost half of First Nations homes,” (p.3). Robson (2008) indicates that 38% of reserve housing units need major repair, 26% need replacement, 14% are without piped water, 19% are without flush toilets, 7% are without electricity, and 5% house multiple families in single family units.

While the above conditions and outcomes depict some of the problems faced by reserve communities, they are not isolated to this context. Similar problems are also well documented in Aboriginal non-reserve housing. The National Aboriginal Housing Association (NAHA, 2004) indicates that in the non-reserve rental market, “the incidence of need for major repair is almost twice as high for Aboriginal households (16.5% of all rental dwellings) compared with non-Aboriginal (9%),” (p.10). Similarly, David (2003) notes that non-reserve low-income rural Aboriginal households are “twice as likely to be in core housing need, and seven times more likely to be below multiple housing

standards,” (p.iii). Table 3 summarizes the NAHA (2004) report’s overview of inadequacy and affordability incidences in non-reserve rental contexts.

Table 3: Inadequacy and Affordability of Aboriginal Non-Reserve Rental Housing

	North American Indian (First Nations)	Métis	Inuit	Non-Aboriginal
Inadequacy	17%	15%	21%	9%
Affordability	16%	14%	5%	35%
Affordability Total	37%			35%
Severe rent burden	15%			12%

Source: National Aboriginal Housing Association (2004)

Off-reserve non-farm Aboriginal households have also been analyzed using indicators from CMHC’s core housing need model (CMHC, 2002). The data demonstrates challenges related to housing adequacy, suitability and affordability across Aboriginal communities, be they reserve, non-reserve, rural, urban or northern. Table 4 summarizes the findings. Conclusions of the report indicate that:

- Suitability is the foremost challenge for off-reserve non-farm Aboriginal households, and that this is especially true for Inuit and rural communities, which also face significant adequacy issues.
- Indian (First Nations) and Métis urban households struggle with both adequacy and affordability.
- Adequacy represents a distinct challenge for housing on First Nations reserves, although suitability is also a significant problem in this context.²²

²² As discussed in the context of the CHN model, affordability data is not available for reserve housing where permanent units are frequently owned by the local Band.

Collectively, these reports clearly indicate that problematic conditions are experienced across a variety of Aboriginal housing contexts. Further, they highlight the broad range of concerns including adequacy, suitability and affordability (which CMHC uses to define core housing need), and subsequent challenges to health and well-being. Beyond the issues and problematic conditions identified above, Aboriginal housing outside of reserve lands also faces challenges associated with conventional social housing initiatives.

Specifically, NAHA (2004) identifies policy and market biases that may be exacerbated by Aboriginal demographic trends:

“On pure cost effectiveness, measured by the grant amount required per unit, the smaller bachelor units will always win in a competitive process.... This is especially an issue for the Aboriginal communities where family households predominate.... Without either a policy directive to... support development of family oriented units, such proposals may be at a distinct disadvantage in a competitive process,” (p.22).

The NAHA (2004) study also identifies affordability gaps as a key challenge: where average market price is higher than affordable rent (defined as less than 30% of occupant income), “creating rental units at the average market rent level, while adding to overall supply will do very little to address the affordability needs of low wage working poor families,” (p.17). Economic challenges may be exacerbated by other contextual factors commonly exhibited in Aboriginal communities. Specifically, David (2003) points to small and dispersed populations and higher costs for their potential to reduce the viability of private markets:

Table 4: Summary of Aboriginal Housing Need in Canada

	ORNF Indian (First Nations)	ORNF Métis	ORNF Inuit	Urban Native	Rural Native	On- Reserve	Non- Aboriginal
Housing met or exceeded all standards	49%	55%	49%	50%	54%	NA	68%
Below 1 standard	52%	45%	51%	50%	46%	50%	32%
Below 2+ standards	13%	10%	10%	12%	11%	12%	4%
Below Affordability	22%	20%	7%	24%	12%	NA	Not cited
Below Adequacy	8%	9%	10%	7%	13%	23%	Not cited
Below Suitability	8%	7%	25%	7%	11%	15%	Not cited
Core Housing Need	34%	27%	33%	33%	29%	NA	18%
Occupied or could have afforded housing meeting or exceeding all standards*	66%	73%	67%	67%	71%	NA	82%
Average Income of households meeting or exceeding all standards	\$51,245	\$52,014	\$46,780	\$52,994	\$46,104	\$28,261	\$59,582

Source: Canada Mortgage and Housing Corporation (2002)

“When added together, elements like a small population, the scattered nature of settlement, and extra costs reduce viability of any private market activity in many smaller and more isolated rural communities. Low incomes, limited demand and low or non-existent profit margins have also reduced the effectiveness of private sector builders and lenders (Carter, 1993). The absence of an economically viable private sector to supply housing ... not only reduces the housing options available, it also compounds the existing problems,” (p.33).

Additionally, Aboriginal communities exhibit numerous other sources of disadvantage that may affect and/or be affected by housing outcomes. Many of these may be traced back to the cultural disruptions outlined in the previous chapter. These include but are not limited to social ills such as depression and suicide, high rates of unemployment, and lower life expectancy, standards of living, education, income and labor force activity (AFN, 2006; Berkes et. al. 2005; David, 2003; INAC, 2004; Reilly, 2010). Direct and indirect connections between these indicators and housing outcomes are outlined (David, 2003), including these key findings:

- Aboriginal unemployment is 3-4 times higher than the average in many Northern and remote communities, and those employed earn very low incomes.
- Lower-income households tended to live in older housing units which were poorly insulated and had high heating and utility costs.
- The lowest income category – below \$10,000 in annual household income – had the highest incidence of dwellings in need of major repair – 18%.
- High operating costs are particularly acute in the north. The high price of oil/fuel and in most communities the absence of local wood keeps heating costs very high (CMHC, 1999). For example, in Coral Harbor the average annual utility cost for a household living in a three-bedroom unit is almost \$12,000.

Examining the disadvantages faced by Aboriginal communities, INAC's indexes of registered Indian human development and community well-being (INAC, 2004) indicate that:

- Nearly 50% of First Nations communities occupied the lower half of the index range while less than 3% of other Canadian communities fell within this range;
- Of the “bottom 100” Canadian communities in 2001, 92% were First Nations.

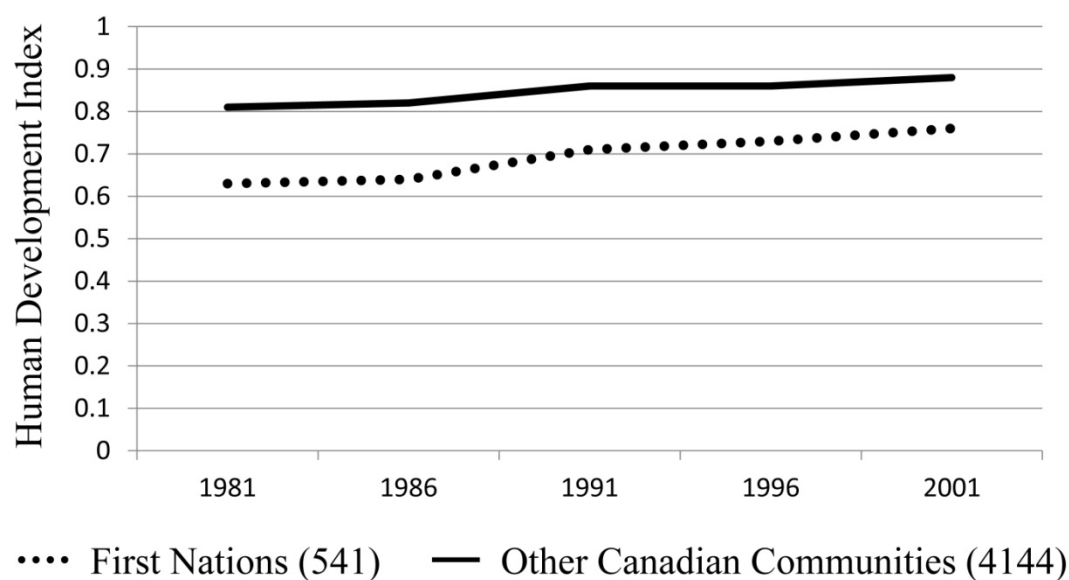
Considering the above conditions, desired performance improvements for contemporary Aboriginal housing include but are not limited to promoting occupant health and safety, structural durability, and reduced costs of implementation, operations, maintenance and replacement. Beyond these initial improvements, functional flexibility may provide means to address crowding, diverse community needs, changing family needs, and/or high rates of turnover and transition. Flexibility may also be appealing insofar as it relates to similar function in traditional structures and/or fits with current lifestyles and social activities. Recalling the previous section, the potential for cultural design considerations to help overcome knowledge gaps, marginalization and dispossession, and foster appropriateness, sense of home, identity and belonging are significant. Such considerations are explored further in chapter five, through the case studies, and in the concluding discussion on cultural appropriateness in chapter ten.

Beyond the physical design of housing assets, it is clear that housing programs themselves must also play a central role in addressing the Aboriginal housing crisis. Increasing home ownership in these communities is critical, as a foundation for increased awareness of and sense of responsibility for home operations and maintenance. Education initiatives that can address generational disconnects and knowledge gaps surrounding housing are vital. Such initiatives must necessarily be supported by policy and legislation.

While a comprehensive review of the latter falls beyond the scope of this research, related concepts are revisited in the following chapters with particular attention paid to areas of green building, clean technologies and cultural design considerations.

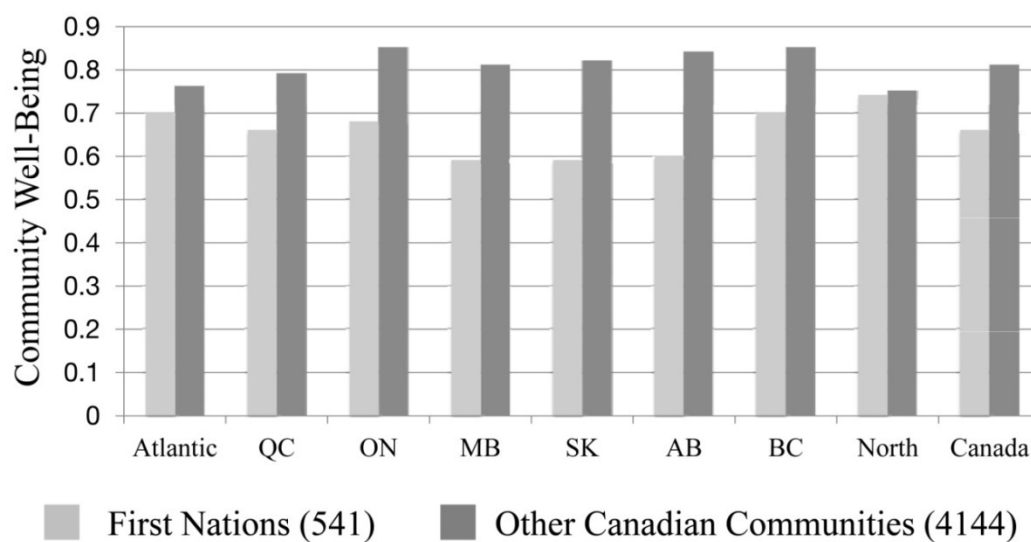
The following figures summarize the dynamics of the Aboriginal housing crisis. Figures 2 and 3 contain INAC's comparative indexes of human development and community well-being. Figure 4 provides a neutral perspective on the relationships between conventional housing determinants. Figure 5 illustrates relationships between key issues and problematic conditions that define the crisis. Figure 6 elaborates on these relationships, demonstrating the complex and interconnected nature of the Aboriginal housing crisis' causes, conditions and feedback. Extracting elements from Figure 6, Figure 7 provides an example of a characteristic feedback loop.

Figure 2. INAC Registered Indian Human Development Index



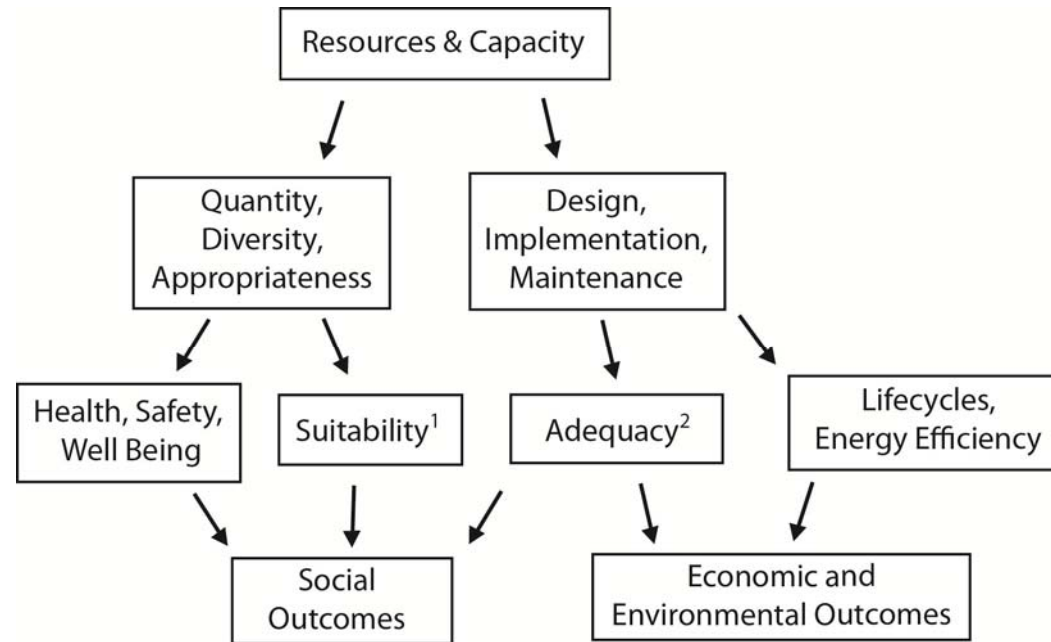
Source: INAC (2004)

Figure 3. First Nations Community Well-Being Index



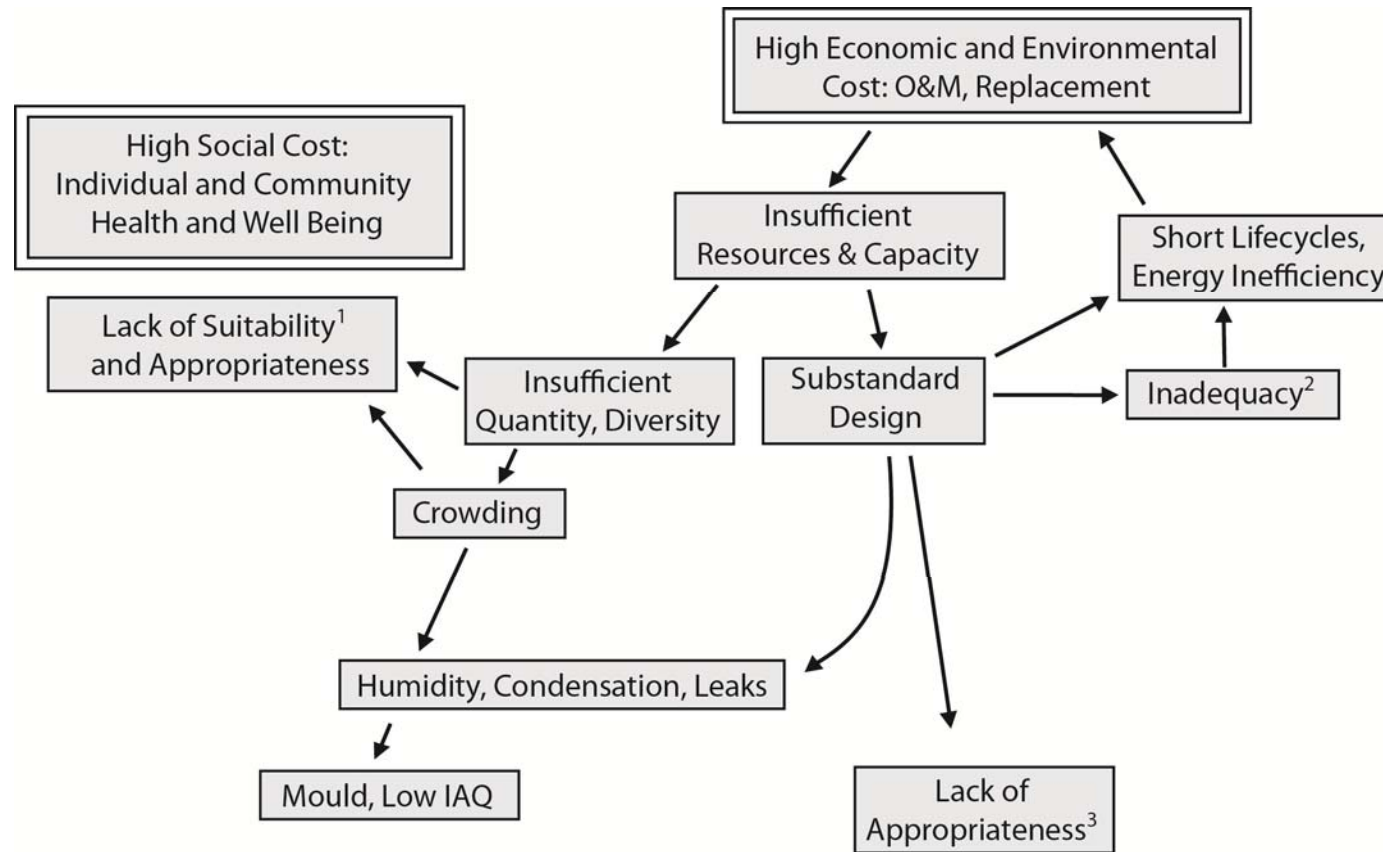
Source: INAC (2004)

Figure 4. Housing Determinants - Neutral



1. Suitability is an indicator of core housing need (CMHC), based on number of bedrooms relative to number and gender of occupants.
2. Adequacy is an indicator of core housing need (CMHC), based on need of major renovations as identified by occupants.

Figure 5. Aboriginal Housing – Key Issues and Problematic Conditions

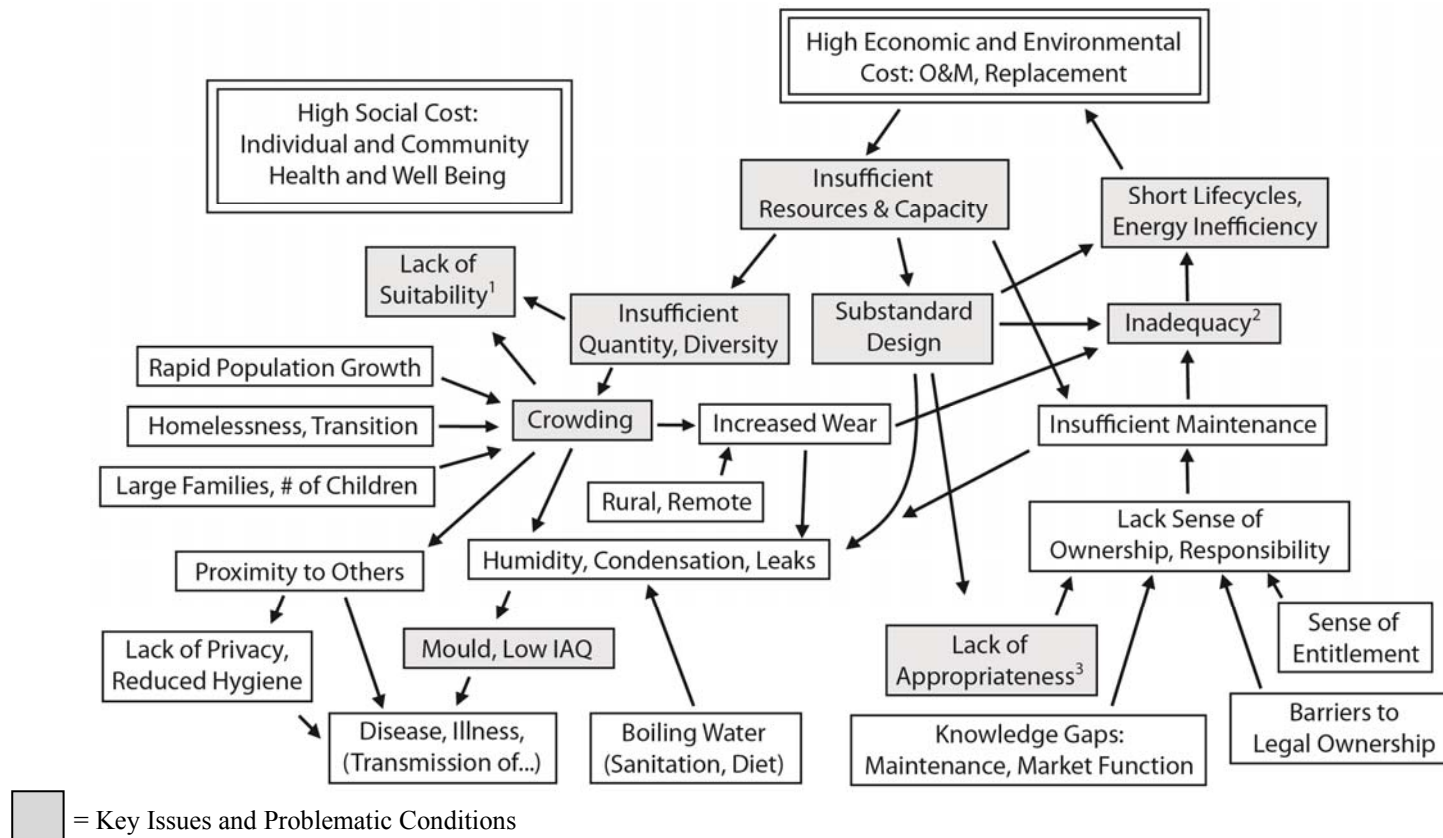


1. Suitability is an indicator of core housing need (CMHC), based on number of bedrooms relative to number and gender of occupants.

2. Adequacy is an indicator of core housing need (CMHC), based on need of major renovations as identified by occupants.

3. Appropriateness is explored as a means to increase sense of identity, ownership, and responsibility for the home, and to determine how well-suited housing strategies are to contextual factors.

Figure 6. Aboriginal Housing – Interrelated Issues, Conditions, Causes, Feedback

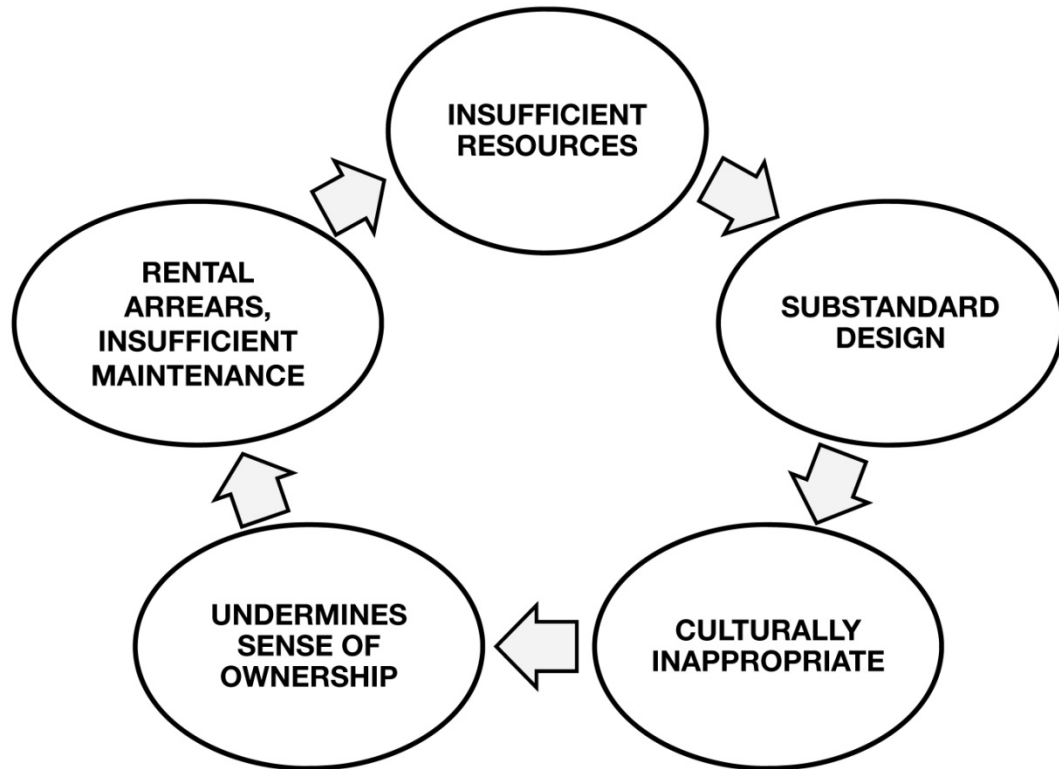


1. Suitability is an indicator of core housing need (CMHC), based on number of bedrooms relative to number and gender of occupants.

2. Adequacy is an indicator of core housing need (CMHC), based on need of major renovations as identified by occupants.

3. Appropriateness is explored as a means to increase sense of identity, ownership, and responsibility for the home, and to determine how well-suited housing strategies are to contextual factors.

Figure 7. Aboriginal Housing – Sample Feedback Loop (Extracted from figure 6)



CHAPTER 4: GREEN BUILDING AND CLEAN TECHNOLOGIES

The conditions described in the previous section illustrate the high social and economic costs currently associated with housing in many Aboriginal communities. Background research failed to uncover quantitative data on the environmental impacts that also follow from the status quo. That said, in non-Aboriginal contexts negative environmental outcomes are driven by energy and water inefficiencies, waste material, and reliance on fossil fuels (Blengini, 2009; CMHC, n.d. (a); Thormark, 2002, 2006). It is therefore reasonable to conclude that such factors act similarly here. Thus the move towards sustainable Aboriginal housing in Canada will ideally include improved performance in terms of social, economic and environmental outcomes.

Existing projects within and beyond Aboriginal communities indicate that emerging green building methods and clean technologies (cleantech) have the potential to deliver such improvements. They may be used for example, to promote occupant health and safety, reduce operating and maintenance (O&M) costs, reduce green house gas emissions, provide materials with low or no toxicity, and increase independence from conventional sources and means of service provision, which are often lacking or come at increased cost in reserve and remote communities (Blengini, 2009; CMHC, 1994, 2001, n.d (a, b); Dalla Costa, 2011; Dobie & Seniuc, 2003; Fathy, 1986; IHC, 2006; INAC, 2010; Kennedy, 2004; McDonough & Braungart, 2002; Meissner, 2009; Palmer et. al. 2007; Perzel, 2004; Proscio, 2008; Real Estate Foundation of British Columbia, 2007; Robson, 2008; Rosenberg et. al., 1997; Shaw et. al., 2007; Shear, 2008; Thormark, 2002, 2006; Tookenay, 1996; Wake, 2007).

Due to their relative newness however, green building methods and clean technologies may also be accompanied by challenges not found in more well-established approaches to housing and/or service provision (Proscio, 2008). This section of the chapter starts by identifying some of the more common strategies used to pursue the opportunities cited above. Discussion then considers some of the current challenges that also accompany emerging methods and technologies. As a whole, the section provides a foundation for the case studies, which examine how challenges and opportunities to green building and cleantech implementation may be further affected in Aboriginal contexts.

Opportunities to Deliver Improvements

Occupant health and safety is perhaps the single greatest need that emerges from the problematic housing conditions prevalent in Aboriginal communities. Effective strategies for inhibiting mould, fostering high indoor air quality, and ensuring structural durability are of particular importance. In a recent study of multiple residential renovation projects, CMHC (n.d. (a)) identified the following common strategies for promoting health and safety:

- Low- or no-emission paints, finishes, cements, sealants and adhesives — no or few Volatile Organic Compounds (VOCs)
- Low- or no-emission building materials and products (for instance, cabinetry with no formaldehyde)
- Hardwood, ceramic and linoleum flooring, instead of carpeting, to reduce chemical emissions and dust
- Direct-vent heating appliances to prevent combustion gases from entering the home

- Basement treatment (cleaning, sealing, damp-proofing, insulating) to eliminate moisture problems and mould
- A heat-recovery ventilator (HRV) — a whole-house ventilation system that continuously draws fresh air into the house and exhausts stale air

Mechanical systems play an integral role in fostering indoor air quality, and may also offer significant improvements in terms of energy efficiency, reduced environmental impact, and reduced reliance on fossil fuels. Additional relationships between mechanical equipment, other building elements and air quality are detailed in *A Guide to Mechanical Equipment for Healthy Indoor Environments* (CMHC, 2001). New technologies such as HRVs may be accompanied by special operations and/or maintenance requirements. CMHC's website provides an overview of HRV maintenance relevant in this context (CMHC, n.d. (c)).

Measures for achieving durability do not typically fall under the guise of green building in conventional contexts. Lack of durability often contributes to structural degradation in Aboriginal housing however, which in turn generates both health and safety issues and economic burden. As such, measures for achieving durability of Aboriginal housing are critical to improving social and economic outcomes of housing, and so should inform 'green' building in these communities. Further, where such degradation leads to inefficiency and waste, durability measures have the potential to mitigate associated environmental impacts.

As an expert in this field, Architect and Professor Tang Lee identifies a number of strategies for achieving both durability and indoor air quality (Lee, T., pers. comm., December 10th, 2010). Many of the following points were also highlighted by Architect

Rob Seniuc (pers. comm., May 20th, 2011). Areas susceptible to excess humidity such as bathrooms, kitchens, and the building envelope itself are particularly important considerations. These rooms should include mould-resistant materials, and durable fixtures (showers, bathtubs, tub surrounds, tub dams, and sinks) that can be easily cleaned, maintained and replaced. Strong ventilation to the building exterior is critical. Related components such as bathroom fans should be quiet so as not to deter their use. It is also important to avoid designing windows into a shower, as these may present additional challenges with condensation, leaks and repair (Shaw et. al., 2007). Thermal bridging across the building envelope must be minimized to avoid condensation, including both structural framing, and frames for windows and doors. Vinyl frames are preferable to metal or wood ones, and proper installation of frames and sills is integral to adequate performance. Hard flooring is preferable to carpet for maintaining indoor air quality, and central vacuum systems that vent to the exterior of the building are superior to a regular plug-in device. Measures such as doorstops and easy to clean surfaces are also important design elements that are both simple and affordable.

Beyond opportunities to promote occupant health and safety and structural durability, green building methods and clean technologies may be used to reduce home operating costs, experienced for example in water heating and space conditioning.

Proscio (2008) indicates that:

“Clean, efficient, durable, and environmentally harmonious structures can cost much less to operate, maintain, and occupy — even over a medium term of three to five years, and certainly over longer periods. Though a few of the green features may cost a little more to construct or install, the price is usually not prohibitive, and in any case is

quickly repaid in lower bills from utilities, fewer repairs and replacements, and more satisfied residents who place fewer demands on builders or managers. In short, the lower-cost unit — the truly affordable home — is the one that costs less to own, not merely to build,” (p.7).

CMHC has identified pertinent strategies including energy-efficient windows (high-performance units, usually argon filled and with low-E coating), air sealing (air barriers and caulking), and high-efficiency heating systems, lighting and appliances (CMHC, n.d. (a)). Such measures can also be viewed as contributing to environmental sustainability, by reducing negative impacts associated with energy generation and consumption. The CMHC website (CMHC, n.d.(a)) points to high-efficiency heating equipment as one of the most effective ways of minimizing the environmental impact of an existing house, through reduced emissions and fossil fuel pollutants.

As indicated in the previous section, material selection also plays an important part in determining a building’s environmental impact, as well as its potential to be reused, repurposed or recycled. Materials may also contribute to cultural appropriateness as explored in the fifth chapter and through the case studies. CMHC (n.d.(a)) explores innovative material selection in the context of renovation projects, which could also inform new building design:

- Materials with recycled content (insulation, flooring, shingles)
- Materials from sustainable resources (cork flooring, engineered wood products)
- Water-conserving products (toilets, showerheads, faucets)
- Durable, long-lasting products (flooring, siding, shingles)
- Reuse and refinishing of existing materials (flooring, siding, doors, trim)
- Use of demolition waste in the renovation (lumber, masonry)

- Sale, trade or give-away of demolition materials (taking material to the landfill only if there was no other choice)

Alternative sources of energy may also be used to reduce operating costs, environmental impact and dependence on fossil fuels (in cases where these contribute to the local energy mix).²³ Determining the viability of a given source can be extremely complex.²⁴ That said, technologies that are relatively easy to install and operate at the scale of individual residences are increasingly available. Solar thermal panels that preheat water are a prime example of a simple low cost system that can reduce energy demand. Such technologies may experience increased competitiveness in Aboriginal communities where the costs associated with conventional infrastructure and service provision are already high and rising.

Further, with appropriate policy and funding support, alternative energy projects may facilitate autonomy of service provision, and even offer revenue generation to support future initiatives. Jeffrey (2012) and INAC (2010) identify important precedents of cleantech implementation in Aboriginal communities. As indicated in chapter one, the scope of this research was managed in part by examining only those technologies that were integrated into the sustainable housing pilot projects of the case communities. Developing a better understanding of the feasibility of non-integrated systems in Aboriginal contexts is an important area for future research however.

²³ Defining ‘alternative’ in this context can be a contentious issue. For example, although typically viewed as a renewable source, environmental impacts of large scale hydro power were recently raised as problematic at the *Powering Up Aboriginal Energy* conference (Toronto, April 2011). Putting such debate to rest falls beyond the scope of this research.

²⁴ Viability is determined by factors including but not limited to local infrastructure, cost relative to conventional sources, supply and demand, intermittency, storage, and scalability

Conventional Challenges to Implementation

Where green building and cleantech sectors are still emerging, uncertainty, unfamiliarity and competition pose key challenges to successful implementation. In terms of uncertainty, outcomes of a given strategy may not be comprehensively understood until they have been in active use for some time. For example, a product's durability may not be proven until it has endured a full life span of actual use. Similarly, the environmental impact of a given waste material may not be known until it has occupied a landfill for some time. Uncertainty could also accompany cost and/or performance of new methods or technologies relative to conventional approaches, and may be exacerbated by other factors such as current or future market activity (Proscio, 2008). The frequent fluctuation of energy costs in today's market for example, has a direct impact on the economic viability of alternative sources of energy. If costs associated with conventional source drop, the relatively high costs of alternative energy may quickly become unattractive. As Proscio (2008) notes, this is relevant where:

“Long-term economies are a more-than-usually critical factor for residents living on very tight budgets with little cushion for sudden shocks like spikes in utility costs or failures of expensive systems,” (p.9).

Cost of emerging methods and technologies may be further affected by their state of development relative to conventional approaches. Insofar as an existing strategy is well-established, it may exhibit lower cost for numerous reasons including efficiency of process, economies of scale, market share and/or demand. An alternative energy technology which is not competitive in today's market for example, may become more so as manufacturing efficiency increases and/or costs decrease.

Green building or cleantech strategies may face additional challenges if those responsible for their implementation, operations and/or maintenance find themselves in unfamiliar territory (Proscio, 2008). For example, (sub)-contractors may inflate their estimates and/or actual charge for unfamiliar products and services. Implementation may also be slower than normal, or might need to be repeated due to error, thereby increasing cost. Lastly, benefits may be forfeited through improper maintenance or replacement. For example, interior finishes with low volatile organic compounds (VOCs) can contribute to indoor air quality, but if these are replaced with ones that contain VOCs indoor air quality will be sacrificed.

Green building methods and clean technologies may be further challenged by longer payback periods. This is particularly relevant to measures for achieving durability and energy efficiency, as well as alternative sources of energy, where benefits associated with higher upfront costs may only be experienced over the course of several years (Shaw et. al., 2007; Shear 2008). In order to function profitably, alternative energy projects may also require special arrangements with service providers, and/or operating subsidies. Shear (2008) identifies strategies to address extended payback, including funding arrangements and point-based tax credits that could facilitate energy efficiency and alternative energy initiatives.

In *Haisla Housing Study: Concept Design Report*, Shaw et. al. (2007) examine some challenges and opportunities to improving housing design in the specific context of the Haisla community of Kitimaat. Of particular relevance to green building and cleantech implementation, the report points to extended payback periods as a challenge to

adopting energy efficiency measures.²⁵ The study also identified the need for locally developed and enforced policy on material standards and quality control, to be written in plain language. Preliminary cost estimates conducted as part of the study suggest that the duplexes designed therein could be completed within local CMHC guidelines of \$120,000 per unit. Shaw et. al (2007) explicitly state however, that “CMHC guidelines would permit only a minimum of efficiency measures,” (p.26), and that “future planning in Kitimaat must include housing types for a broader range of people,” (p.41).

Additional challenges faced by green building and cleantech sectors include policy lags, and complexities in funding and certification (Proscio, 2008; Shear, 2008). Proscio (2008) points to “a persistent gap between the swift progress of green technology and the somewhat slower evolution in housing policy and funding for sustainable development,” (p.3). Proscio (2008) further notes that:

“The greatest obstacle developers face in financing green affordable housing is the reluctance of funding agencies to spend an extra dollar or two per square foot for a more durable, efficient, and cost-effective design – even when other government agencies... are actively encouraging just such designs,” (p.62).

As we have seen in chapter three, policy frameworks such as CMHC’s MUP and modesty requirements directly inhibit such innovation in Aboriginal housing (Shaw et. al., 2007; anonymous CMHC correspondence – see chapter 3).

The following list summarizes the above challenges that may be faced when implementing green building methods and/or clean technologies:

²⁵ In this case, the payback period for a tankless hot water system was estimated at 4.8 years, and the estimated payback for a heat recovery ventilator at 2-4 years.

- Uncertainty of effectiveness in cost and performance;
- Unfamiliarity by those responsible for installation and maintenance leading to higher costs;
- Special requirements for installation, maintenance and/or replacement;
- Requirement of higher initial investment;
- Requirement of operating subsidies, and/or special arrangements with service providers;
- Extended payback period; and/or
- Increased complexity in funding and certification.
- Lags in policy, and funding agency requirements

Proscio (2008) identifies integrated design processes for their potential to combat these challenges:

“In the first... stages of development, the near-unanimous observation among practitioners is that a fully integrated design process — encompassing the developer, architect, engineers, the general contractor, major subcontractors, and other interested parties — is essential in ensuring that a project achieves the most fundamental requisite of good green design: an efficient, durable whole building where all the component features and systems perform in harmony for the long term. An initial charrette, in which the full team considers the particulars of green design one-by-one and chooses among additional options, has helped many projects achieve higher levels of sustainability than their developers first thought possible. It has also established a common understanding across the whole team of what green development will entail, why it is important, and how conventional practices and assumptions will have to change to make the project succeed,” (p.2).

Specially designed programs can further be used to educate key stakeholders such as occupants and building managers on unique maintenance and replacement needs, and develop associated capacity-building measures (Proscio, 2008). Simultaneously,

occupants facing greater than average challenges (such as those experienced in many Aboriginal communities) may have little time, energy or financial resources to dedicate to maintenance-related education.

Emerging studies in life cycle assessment (LCA) represent an important tool for pursuing improved outcomes. Literature in this area highlights building materials as a particularly important determinant, influencing not only the building lifespan, but also its direct and indirect environmental impacts through all phases, as well as options for re-use, recycling, repurposing and retrofitting (Blengini 2009; Lee, T., pers. comm., December 10th, 2010; Thormark, 2002, 2006). Benefits in these areas may offer added value in remote communities, where supply chains represent a challenge to availability and cost of materials and fuels, and their transportation and/or storage (INAC, 2010; IHC, 2006). The potential to reuse and repurpose materials, for example, would result in higher savings and increased housing output as quantities of functional materials accumulate over time.

It should be noted that material selection is a small part of the scope of LCA applications, which may also include, for example, studies of alternative energy sources and systems (Martinez, Sanz, Pellegrini, Jiménez and Blanco, 2009; Mickaityte, Zacadskas, Kaklauskas, and Tupenaite, 2008). Unfortunately, comprehensive life cycle assessment is often a complex and lengthy process. In Aboriginal contexts where resources are already insufficient, it may be beneficial to limit LCA applications for example by simply informing new project design with LCA literature review, and/or judicious application of the tool to critical areas such as materials selection.

This chapter provides a sense of some of the opportunities and challenges that accompany emerging green building methods and clean technologies. Opportunities include the potential to address key housing issues in contemporary Aboriginal contexts such as occupant health and safety, and structural durability. Simultaneously, challenges associated with these emerging sectors may be exacerbated by existing problems in Aboriginal contexts, and must be overcome if benefits are to be realized.

Looking ahead, chapter five examines considerations for Aboriginal culture that have appeared in recent discourse and practice. The case studies then provide important insight into contextual factors influencing implementation of green building methods, clean technologies, and cultural design considerations. The impact of these factors in turn provides the bases for recommendations to improve Aboriginal housing design and related policy.

CHAPTER 5: ABORIGINAL CULTURAL DESIGN CONSIDERATIONS

This chapter examines how considerations for Aboriginal cultures have influenced contemporary building designs. As indicated in chapter two, for the purposes of this research ‘culture’ denotes the systems, structures and/or processes in which the members of a given society are collectively engaged, including social, economic, political, environmental, technological, legal, philosophical and spiritual spheres. Culture may therefore be manifest in worldview, language, music, art, tradition, protocol, values, ethics, morals, needs, interests, lifestyles, activities and attitudes. This exploration responds in part to a gap in the literature, where there is relatively little research to suggest how diverse cultural needs in this sector might be approached or met, and subsequently how cultural appropriateness might be defined in relation to Aboriginal housing design.

The concept of cultural appropriateness does appear in other Aboriginal contexts, for example as a guiding principle for First Nations child and family services (Auditor General of Canada, 2011). Aside from the inclusion of the ‘client’ in the process of defining appropriateness however, little is offered to facilitate understanding of how cultural appropriateness might be realized in housing design and implementation. This section of the research complements the examination of Aboriginal history and cultures found in chapter two. Together these chapters provide a foundation for examining cultural design considerations in the case studies, and subsequent understanding of cultural appropriateness in relation to Aboriginal housing.

The rationale for research in this area is based on the assertion that the lack of consideration for culture acts as an indirect cause of contemporary Aboriginal housing

failures. Where designs fail to reference or respond to cultural values, needs and interests, housing may exacerbate feelings of marginalization and dispossession that have emerged from colonization. This can in turn undermine sense of ownership of and responsibility for the home. Subsequent lack of maintenance drives associated challenges to individual and community health and well-being, as well as insufficiency of economic resources. This feedback is isolated in Figure 7 (above) and shown in relation to broader context in Figure 6. As noted by Robson (2008):

“Including not only housing but also family relations, hunting or fishing patterns, traditional practices and even local decision-making, housing on-reserve is so much more than simply shelter. It is also... a determinant of well-being and when... the house does not provide adequate living space for the occupants or when it does not include the work space necessary to process the hunt or when the house is situated in such a way so as to preclude family gatherings, then the house is not meeting the needs of the occupants. This too is a measure of well-being,” (p.83).

Conversely, where design considerations affirm Aboriginal cultures, their inclusion in housing design may foster sense of home, place, identity, pride and belonging. Dalla Costa (2011) indicates that:

“Architecture is one of the most salient expressions of a culture. It draws from the past, defines the present, end envisions a future, all the while adapting to reflect the current values and aspirations of a society,” (p.356).²⁶

Strengthening the connection between occupant and dwelling could in turn lead to increased sense of ownership and responsibility, with important implications for

²⁶ At the time of writing, Wanda Dalla Costa was one of only ten Aboriginal architects in Canada (and the only woman among them). Although not a formal member of the project’s Aboriginal Advisory Council (as identified in chapter 1), Ms. Dalla Costa did advise on the design of the Treaty 7 First Nations sustainable housing pilot project.

maintenance and adequacy. As such, cultural design considerations represent a vital strategic component to achieving sustainable Aboriginal housing.

Traditional and Contemporary Worldviews and Needs

As indicated in the second chapter, Aboriginal peoples are extremely diverse in terms of their histories, cultures and local geographic contexts. It follows from this that there are no universal means to achieve Aboriginal cultural appropriateness. Rather, considerations for Aboriginal culture must be based on both past and contemporary contexts, including the values, needs and interests of a given individual or community. For example, what serves a remote Inuit community well will likely be very different from what is desired in a Métis community immersed in urban development. Berkes et. al. (2005) highlight concerns found in the north:

“Although Inuit communities in Nunavut were once nomadic to ensure better hunting and fishing, enclosure in government housing and mandatory schooling requires that families settle down. Today food security is limited by poverty, food contamination and Eurocentric Canadian government policy,” (p.10).

In spite of this diversity, commonalities between traditional Aboriginal cultures provide a foundation for exploration in this area. As we have seen, pre-contact Aboriginal cultures typically demonstrate close relationships with the natural environment. These continue to influence contemporary Aboriginal worldviews, which are often based on holism, and humankind’s creative and collaborative role within the natural order (Crowshoe, R., pers. comm., June 2010 – October 2011; Seymour, C., pers. comm., March 16th, 2011; King, 2003; Robson, 2008).

Basing contemporary Aboriginal housing upon a more holistic and environmentally oriented approach may therefore help to bridge cultural gaps that have emerged as a result of colonization. Dalla Costa (2011) suggests that “one of the most powerful statements that Aboriginal architecture can make today, is not about form and representation, rather it is about expressing an ecologically-based value system,” (p.378). By definition the environmental orientation of green building methods and clean technologies offer avenues to express these values.

Connection to the Land

Dalla Costa (2011) examines several buildings designed by Aboriginal architects that capture what she calls the “quintessentially Aboriginal and Canadian sentiment, our connection to the land,” (p.377). The Museum of Anthropology at the University of British Columbia, the Canadian Museum of Anthropology in Hull, Quebec, the Seabird Island First Nation School near Agassiz, British Columbia, and the Nicola Valley Institute of Technology in Merritt, British Columbia offer precedents of Aboriginal cultural expression in architecture, including but not limited to:

- Inspiration from local traditional structures, such as the longhouse (in the case of the Museum of Anthropology in Vancouver, British Columbia);
- Use of culturally significant and local natural materials;
- Provision of exterior views from the interior, maintenance of low visual profile on the exterior, and integration of special features such as berms, plantings and ponds, all fostering connection and integration into the landscape;
- Integration of modern form with cultural and contextual response as a source of meaning, for example by referencing the form of traditional boats or local biological phenomena; and

- Response to human activity and social organization in design of interior and exterior space and spatial function, and relationship to other physical features and structures, for example in the Seabird Island First Nation School's protective areas and non-hierarchical arrangement.

The Nicola Valley Institute of Technology is particularly notable for its emulation of the functional systems inherent in traditional structures (Dalla Costa, 2011). Like the Tipi, the building uses passive ventilation to meet cooling needs in summer. Like the pit house, it uses subterranean design to minimize heat loss in winter. The green roof adds insulation, and reduces runoff. That the structure delivers these connections without resorting to iconographic quotations contributes to its validity in a contemporary setting (Dalla Costa, 2011, citing Governor General Awards).

The interpretive center at the Blackfoot Crossing Historical Park offers another important precedent for architectural expression of Aboriginal culture. According to the center's literature entitled, *Design Metaphors and Concepts* (n.d.), connection to local culture and identity are identified as potential sources of pride, education and meaning. A number of strategies are used to express the local First Nations' histories and cultures:

- Structural and landscaping reference to traditional designs such as the Tipi and Sundance Lodge, community encampments, seasonal climatic conditions, and practices such as the buffalo hunt;
- Symbolic reference to animals, and geographic and astronomical features, indicating the people's place within the greater natural order;
- Use of colors tied to spirituality and/or representative of natural phenomena;
- Interior and exterior views of the valley where Treaty 7 was signed.²⁷

²⁷ The nature of and parties involved in Treaty 7 is explored further in the Treaty 7 First Nations case study.

Appropriateness and Process

Housing design and implementation processes must also be considered for their appropriateness relative to Aboriginal cultures. The *Haisla Housing Study: Concept Design Report* (Shaw et. al., 2007) was a design exercise conducted with the Haisla community of Kitimaat, British Columbia, academics from the University of Victoria and Marseau Evans Johnson Architects. The work included consideration for the Haisla culture, demographics, contemporary housing issues and conditions, and means to increase cultural appropriateness of housing in this context. Collaboration was integral to the effort, with significant community involvement in determining objectives, priorities, and potential strategies to address them. The ‘principles’ to improve housing design include features related to outdoor living, food storage, flexibility, affordability, accessibility, capacity building, durability, cultural features, energy efficiency, and health housing. While cultural features are listed separately, one could argue that the strategies identified in many of these areas represent culturally-based interests which underlie appropriateness. The full list of design strategies identified in the Haisla design study is provided in Appendix 4.

In addition to collaborative design processes, capacity building is of particular importance in relation to Aboriginal housing. Dalla Costa (2011) cites inclusion of local trades and industries in the construction process as an important vehicle for building related capacity and keeping resources within the community. Traditional housing expert Mike Lickers (pers. comm., December 10th, 2010) identifies self-construction, and specifically the Habitat for Humanity model as an important strategy for building pride and responsibility. Aboriginal Architect Bret Cardinal (pers. comm., June 2011) also

supports self-construction strategies, indicating that these helped the Oujé Bougoumou First Nation improve both housing and broader socioeconomic conditions and outcomes within their community. David (2003) recommends coordinating housing with other economic development initiatives such as job creation, and also cites sweat equity as a means to reduce borrowing and construction costs. Self-construction and related objectives including capacity building are investigated further through the case studies, and in the research conclusions.

As discussed above, improvements to Aboriginal housing rely in part upon clarification of related roles and responsibilities (AAND, 2012, Auditor General, 2011). Culturally specific ceremonies and protocols may have an important role to play in achieving such clarity. At the *First Nations Sustainable Buildings and Communities* conference (Edmonton, March 2012), President of Blue Quills First Nation college Dr. Leona Makokis (public comm., February 2012) highlighted the central role that ceremonies and protocols have traditionally played in defining First Nations governance, roles, responsibilities, healing processes, boundaries, morality and purpose. Whether and how ceremonies might be used in relation to contemporary Aboriginal housing is thus an important area for further consideration. Ceremonies were not identified within any of the literature reviewed. They contributed to cultural appropriateness in all of the case studies however, and so are explored further therein.

Design and implementation strategies that respond to or express Aboriginal culture may be accompanied by additional benefits beyond those listed above. For example, the use of local materials may incur lower transportation costs and reduce associated emissions (CMHC, 2005 (b)). Alternately, desired outcomes may be at odds

with each other. The Haisla study illustrates such a trade-off, where light wood framing was chosen over more culturally appropriate post and beam construction, in order to meet goals of affordability and simplicity. CMHC's (n.d., (b)) pre-renovation inspection checklist, (see Appendix 2), provides another example of potential trade-offs:

“Smooth flooring is easier to keep clean than carpeting and less prone to harboring mould and dust. However, each type of flooring offers a different mix of benefits and drawbacks. Pre-finished hardwood has low off-gassing, but a higher price. Cork, at a comparable cost, is harvested from a fast-growing renewable resource, but is still relatively unknown. Synthetic flooring may release more chemicals into the air, but is easier to clean and wears well,” (section: *Making the Right Choice is Sometimes a Matter of Trade-Offs*, paragraph 1).

The potential for synergies and trade-offs highlights the importance of clear communication, prioritization, and strategic decision-making in the design process. These are explored further in the context of the case studies.

These initial chapters have provided an important foundation for the following three case studies. As we have seen, green building methods, clean technologies and cultural design considerations are all relevant to discussion. Looking ahead, the case studies examine the confluence of these phenomena, and the contextual factors that influence them during design and implementation. Figure 8 provides a summary of the broader systemic context within which the case investigation and analysis is taking place.

Figure 8. Aboriginal Housing – Relationships Across Scales



CHAPTER 6: SEABIRD ISLAND FIRST NATION CASE STUDY

Introduction to the Three Case Studies

Chapters two through five presented the framework for understanding the Aboriginal housing crisis including the main issues and their causes. Potential avenues for improvement at the project level have also been identified, with a focus on green building, clean technologies and considerations for Aboriginal culture that may lead to cultural appropriateness.

Chapters six through eight examine three case studies of pilot projects in Aboriginal housing that include green building methods, clean technologies and considerations for local culture. Each case considers pre-existing housing issues and conditions within these communities. These form a basis for understanding key contextual factors. Study of the housing pilot projects are then used to expand on this baseline, in order to answer these questions:

- What green building methods, clean technologies and cultural design considerations have been implemented in Aboriginal housing pilot projects?
- What are the outcomes?
- What factors contributed to these outcomes?
- What are the opportunities, limitations and considerations in applying these strategies?

Figure 9. Case Study Map



1. Seabird Island First Nation
2. Saugeen First Nation
3. Treaty 7 First Nations

The first case study pertains to the Seabird Island First Nation. The primary source of data in this case is key informant interviews conducted in the spring of 2011 with Chief Clement Seymour, Band Manager Darryl McNeil, Housing and Public Works Manager Dwayne McNeil, project architect Rob Seniuc, and Band Research Director Jay Hope. Additional data was collected from project related materials such as videos, reports and magazine articles, and from observation of the site itself concurrent with the interviews.

Case Background: Issues, Conditions, Capacities and Economic Resources

Seabird Island First Nation is an independent community within the Sto:lo Nation, located southeast of Agassiz on the lower mainland of British Columbia (see Figure 9).²⁸ At the time of writing, informants indicated there were approximately 210 homes in the community, and that they were experiencing a shortage of roughly 50 units. The Nation was constructing 12 new units, and renovating 27, which represents approximately double their annual average, made possible in part by funding from Canada's Economic Action Plan (CEAP), as detailed below. A comprehensive physical plan was being undertaken by the Band management including demographics, GIS studies, and housing strategy development.

Seabird Island First Nation's housing capacity includes community college programs in plumbing, carpentry, painting and wallboard installation. The Band housing

²⁸ The existence of Seabird Island as an independent Nation within the greater Sto:lo is indicative of contemporary sociopolitical complexity surrounding Aboriginal peoples – in this case demonstrating a First Nation within another First Nation, within Canada. Such complexity presents significant challenges to improving Aboriginal housing, where histories and sociopolitical structures are not always well documented or understood and related issues of authority, responsibility and accountability are unclear and/or problematic.

department is certified to conduct home inspections, and has recently completed inspecting all homes in the community. Capacity challenges related to housing include insufficient funding, high rates of managerial turnover, understaffed administration, lack of specialized trades and professions such as architecture and engineering, and gaps in occupant education and responsibility. Insufficient resources are spread thinly across administration and financing, undermining maintenance and fueling inadequacy. Band Manager Darryl McNeil (pers. comm., March 17th, 2011) commented on these resource challenges:

“We have to do everything scaled back too, so that we can... have as little debt as possible.... There’s not enough money for [operations and maintenance], so you just take the high priorities, anything that’s going to create damage – water leaks, those kinds of things.”

With only the most critical problems being addressed, neglect of regular maintenance leads to widespread deterioration. The Nation does have a rent program in place intended to cover maintenance, but informants indicated that this revenue is not sufficient to cover all maintenance costs, and further, that rental arrears remain a challenge. Funding cycles were also identified as problematic where resources are granted in the rainy season, creating logistical challenges for housing implementation. Understaffing is also attributed to insufficient resources, which inhibits capacity to address both housing and broader social issues. High managerial turnover is attributed in part to unfamiliarity with management responsibilities and scope of work, where candidates frequently enter housing management without experience or preparation.

Funding for Seabird Island First Nation’s housing typically comes from INAC, administered by CMHC through section 95 allocations. Interviewees indicated that the

maximum unit price (MUP) for the region is approximately \$80,000 for a single bedroom unit. They also indicated that these funds are intended to cover not only construction costs but also servicing and site development. The amount is viewed as insufficient to meet individual project needs. Informants also reported that accompanying specifications result in substandard buildings that don't last. If these are not adhered to however, no funding is granted. High interest rates and resulting debt are perceived as further undermining the effectiveness of section 95 subsidies. According to Darryl McNeil (pers. comm., March 17th, 2011) "what really affects section 95 is the interest rate.... The old social housing program was based on the 2% and interest is at 2% right now so you virtually don't get anything - no subsidy." Resources recently allocated to First Nations within Canada's Economic Action Plan (CEAP) were identified as a particularly valuable opportunity. The community used these funds in several mould remediation projects, renovations, and the replacement of numerous furnaces and hot water tanks. They have also recently signed onto the First Nations Market Housing Fund, and hope this will contribute to improvements in housing and related capacity.

Within the Seabird Island First Nation community, housing issues and problematic conditions include substandard buildings, mould, crowding and high rates of occupant transition. The primary direct cause of mould is perceived to be leakages, as a result of occupants leaving garden hoses connected throughout the winter, which then freeze, thaw, expand and create leaks. System components designed to control humidity such as bathroom fans may also not be used, for example if they are too noisy. Crowding is a consequence of the community's housing shortage, which stems from insufficient resources and backlog. Additional occupancy pressure is created by members returning to

the community without access to their own units, resulting in as many as seven people residing in a two-bedroom unit. These issues lead to excess moisture in the home that often go unreported and unresolved, thereby fostering mould growth and structural deterioration. At the same time, under-crowding was also identified as a challenge to optimal use of housing assets. This confirms the previously identified importance of providing both diverse and flexible housing types.

Recalling quotations from the previous chapters, key informants indicated that these contemporary housing problems have evolved in part from colonization. Specifically, Chief Seymour and Research Director Jay Hope pointed to generational gaps and a sense of entitlement amongst the youth that originate in the removal of home ownership, responsibility and social vehicles for knowledge transfer. They also cited the imposition of foreign governance and ownership structures, and restrictions on access to traditional territory as particularly problematic. Further, architect Rob Seniuc highlighted the failure of centralized government housing models to consider or respond to local needs and interests. Such models also contribute to substandard specifications and funding limitations as described above.

Seabird Island First Nation's housing department has developed and is enhancing a 'Housing 101' program for occupants. The objective is to educate them on key maintenance issues, with preventative action towards mould as the primary focus. The long-term goal is to gradually shift maintenance responsibility away from the housing department, except in areas of health, safety and plumbing. Various outreach methods used by the program include open houses, discussions at community meetings, monthly newsletters and flyers, in-home education and lists of tenant responsibilities. Although no

formal assessment of results has been undertaken, informants felt the program has successfully reduced maintenance needs. Looking forward, they intend to expand its scope to include occupant perceptions of and behavior towards home systems and appliances.

Description of Housing Pilot Project

“We have, like many other First Nation communities, experienced numerous challenges to providing healthy, affordable and durable housing for our members. This project has provided us with a unique opportunity to incorporate our traditions but in a modern way to meet our housing needs. For example, the flexibility of the design reflects the traditional way we lived, it allows for our families to be unified within one structure, yet provides independence and private living space. The earth tubes and radiant floor heating and cooling system is far from new technology; in fact, our ancestors knew this and built their pit homes in-ground where it was cool in the summer and warm in the winter,” (Marcie Peters, Seabird Island First Nation Council, Housing Portfolio – quoted in Dobie and Seniuc, 2003).

In 2002, CMHC and INAC approached the Seabird Island Chief and Council to gain access to the community and determine their interest in participating in a sustainable housing pilot project. Resources would include contributions from INAC/CMHC Section 95, CEAP, Band resources, and in-kind donations from the private sector as outlined below. The initial concept was to build a single unit that would integrate multiple green building methods and clean technologies, providing a reference point for future housing initiatives.

Figure 10a. Seabird Island First Nation – Housing Pilot Plan

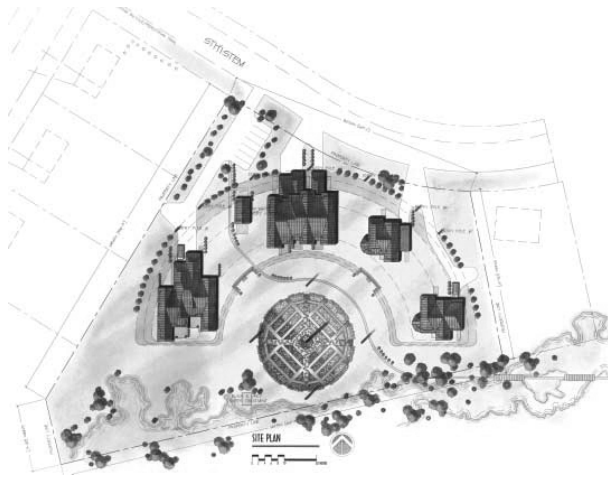


Figure 10b. Multiplex



Figure 10c. Single Family Home



Figure 10d. Medicinal Garden



Figure 10e. Carved Cedar Pole



Images courtesy of Rob Seniuc and Broadway Architects

Following initial project approval by Chief and Council, extensive consultation took place between the community and external stakeholders. Community representation on the project was wide and intergenerational. Participation from beyond the community included representatives from CMHC, as well as engineers, architects, manufacturers, suppliers, and installers of some features and system components. A shift to a multi-unit design was put forth by external stakeholders and accepted by the community. The goal of the multi-unity strategy was to demonstrate consequent reductions in land requirements and related costs of site development and servicing. Project Architect Rob Seniuc (pers. comm., May 20th, 2011) summarized this intent:

“It’s not just the housing that costs the money... it’s also the land cost and it’s the infrastructure cost. Especially when you’ve got single family... where you have one pipe going to every house at a huge cost. So right from the get go... the concept was... use less land do more clustered housing.... Get a little higher density on the land so your infrastructure cost goes down and the amount of land you use goes down.... Costs are so high now that we’ve got to find a way to make that work.... It’s both cost and the responsible environmental thing to do.”

During consultation, the community identified the longhouse as a traditional structural precedent, proposed additional objectives for environmental performance, and drove an increase of per unit square footage beyond MUP specifications. Seniuc (pers. comm., May 20th, 2011) indicates that:

“The relationship was good, but it was still tied up a bit by government... government was still dictating what could and couldn’t be built, how big it has to be.... To me it should have been the community saying that... and in the end [the community] actually pushed [for improving the design specifications] and they got it.... We moved away from that [MUP], which was a very good thing because

[the modification] was based on need, and also it was based on the idea of flexibility, so that you could change a unit.”

A self-construction model emerged as a strategy for capacity building. The objectives were to learn to implement new methods and technologies, to foster community pride, ownership, and trust between stakeholders, to keep resources within the community, and to use them more efficiently. Seniuc (pers. comm., May 20th, 2011) highlights the potential advantages:

“Through a self-construction your money goes further in many different ways because it’s about building self-capacity for future projects. So you’re training people, you’re keeping money in the community, you’re using local resources. And that’s all to me a part of sustainability. It’s not just about buildings, it’s about community.... People take ownership of a building if they’ve worked on it. If one of your neighbors was one of the carpenters on your house, they take ownership of that project.”

The Seabird Island First Nation pilot project was opened in 2004 with a ceremonial blessing involving community spiritual and political leaders. This was used to ground the project in local identity, value, and meaning. Similar events also took place in the other two case studies.

The Seabird Island sustainable development is comprised of four multi-storey buildings, totaling seven units in a combination of single family, duplex and triplex configurations which are oriented in a south facing semi-circle (see Figure 10a). The multi-storey approach diverged from the original concept of a traditional long house (a low lying structure) in order to facilitate thermal convection technologies and flexibility measures outlined below. Duplex and triplex configurations were selected to meet different needs in the community, thereby fostering optimal and long-term occupancy

(Figures 10b and c). This was considered important given the development's anticipated lifespan of 75-100 years. A circular medicinal garden was installed at the centre of the development. Four Totem poles were positioned at the cardinal directions surrounding the garden, with animals on each pole representing important community values and teachings (see Figure 10d and e).

As an additional strategy to foster optimal and long-term occupancy, the project adopted CMHC's flexhousing™ concepts²⁹, which allow modification of the units according to changing occupant needs. Specifically, the multi-storey units have been designed to accommodate retrofitting – for changes in spatial function, additional mechanical systems, and separate entrances.³⁰ Independent units on different floors may thus be created, for example to facilitate multi-generational occupancy, with the grandparents living on the ground floor (with the slab-on-grade foundation contributing to accessibility) while parents and grandchildren occupy a separate unit above. The effectiveness of these measures remains untested to date – there have been no major physical changes to the units in the first seven years of occupancy.

Relationships between goals, objectives and strategies of the Seabird Island First Nation's sustainable housing pilot project are summarized below in Table 5.

²⁹See <http://www.cmhc-schl.gc.ca/en/co/buho/flho/index.cfm>

³⁰ The aforementioned identification of under-crowding in this case provides additional justification for inclusion of flexibility measures.

Table 5: Summary of Housing Pilot Project Goals, Objectives and Strategies

Goal	Objective	Strategy
Ensure occupant health & safety	<ul style="list-style-type: none"> • Reduce mould, provide IAQ, durability 	<ul style="list-style-type: none"> • Formaldehyde-free low VOC insulation and finishing, paperless drywall • Durable materials, high performance envelope: polished concrete radiant floor, metal roof, vinyl window frames, rain screen
Minimize environmental impact	<ul style="list-style-type: none"> • Use alternative sources of energy • Increase energy/water efficiency • Use repurposed materials 	<ul style="list-style-type: none"> • Approximately 4kW of wind power, solar air roof, geo-exchange • South-facing orientation for solar exposure: passive heating, pre-heating water • Double insulation, efficient mechanical systems, lighting, plumbing fixtures, appliances, radiant floor, windows • Site graded for storm water absorption, use of drought-tolerant plant materials • Reclaimed yellow cedar telephone poles used for interior and exterior poles and beams, interior use of 'plastic wood' made from recycled bottles
Reduced O&M and replacement costs	<ul style="list-style-type: none"> • Longer maintenance cycle • Reduce dependence on hydro through alternative energy sources, energy/water efficiency 	<ul style="list-style-type: none"> • See durability and efficiency measures above • Alternative energy: approximately 4kW wind power, geo-exchange, solar thermal/air
Respond to cultural considerations, demographics	<ul style="list-style-type: none"> • Build capacity, sense of ownership, pride, trust • Reflect local values, needs, interests • Provide flexibility, adaptability to meet changing occupant needs 	<ul style="list-style-type: none"> • Multi-generational community input in design • Used local labor in construction • See alternative energy – reflects local values • Opening ceremony • Medicinal herb garden, carvings acknowledge community values • Guided by CMHC's flex housing concepts, multi-purpose adaptable floor plan • Barrier-free slab on grade ground level units • Potential to retrofit multi-storey access and additional mechanical systems

Analysis of Housing Pilot Project

The Seabird Island First Nation's sustainable housing pilot project provides a wealth of data to consider, and a valuable precedent for understanding and developing sustainable Aboriginal housing. The comprehensive approach to sustainability marked an ambitious effort to address the many housing challenges currently faced by the Seabird Island community. This resulted in a high degree of complexity however, which undermined the overall success of the initiative. The project's strengths emerge where opportunities were identified and realized, needs met, and/or lessons learned with regards to emerging methods and technologies. Unfortunately these are somewhat overshadowed by the project's weaknesses, which followed from failures to address challenges, achieve objectives and/or meet community needs and expectations.

In many cases what provides strength with respect to one objective represents a weakness relative to another. This highlights the importance of understanding relationships between context and strategies, and of integrated rather than isolated decision-making. Rather than detail all strengths and weaknesses, some more pertinent examples are explored in the text, and an overview is provided in Table 6 at the end of the section. Beyond strengths and weakness, the text explores examples of synergistic strategies – those which simultaneously addressed multiple issues – as well as some of the trade-offs that were required between strategies in order to achieve certain objectives.

The pilot project's inclusion of the Seabird Island community in both planning and implementation processes is a critical improvement on the aforementioned legacy of Aboriginal cultural oppression and externally imposed solutions (RCAP, 1996). That the community contributed meaningful input towards the finished product was a primary

strength of the project and represents a central pillar for achieving social and cultural sustainability. As Seniuc (pers. comm., May 20th, 2011) notes:

“When you have the community involved like that in different parts of the project you get what I call ownership, because everybody gets on the same page, and you also don’t go off track.... True sustainability has to have the community engaged at the local level.... It’s what you can actually achieve where you are, and the rethink that happens in a community when you put everybody’s mind around it.... All of a sudden people have a totally different way of looking at it.”

The project’s environmental orientation was also central to Aboriginal cultural appropriateness, establishing connection to local traditional values. Chief Seymour (pers. comm., March 16th, 2011) spoke to this cultural consideration:

“When they built these homes... they built it where they can capture the sun.... It mirrors a lot of things that our old people used to use... and how they captured everything from the sun’s heat.... Everything we use and everything we take care of comes from mother earth. So when we want the geothermal, we understood that’s where it was going to come from.... Bringing back the general concept that this is where it all comes from in the beginning.”

The use of repurposed hydro poles made of local yellow cedar offer a prime example of synergistic connection between cultural, environmental, economic and social outcomes. The poles – many of which were hundreds of years old – provided material and structural connections to traditional longhouse design. They were purchased at lower cost than alternatives of this quality. Further, they were processed by tradespersons within the community, thereby creating work, pride, and reducing negative environmental impacts associated with external manufacturing and transportation.

The project's diverse occupancy types and its measures for achieving flexibility and durability further responded to local issues and conditions. While the flexibility measures remain untested to date, it is reasonable to expect that these will operate as intended, allowing adaptation to changing needs in the community. Similarly, while the project's structural durability can only be demonstrated over time, it exhibits numerous robust and complementary strategies. Seniuc (pers. comm., May 20th, 2011) indicates the potential benefits that may follow from these strategies:

“Spending more money up front on better materials and better systems is going to be less maintenance. Case in point for Seabird is metal roofs versus shingle roofs. They're not going to be changing that roof for 25 years, where with the shingle they were changing it every seven to ten years.... Every main level there has a concrete floor, and that concrete floor was polished and it's got hydronic heating in it. Durable, really durable, and multifunctional.... You're putting in a slab anyways, now you're using it for your heating, and you've got a really good floor.... And really in that case I don't think any more expensive to do other than the fact that the finishing is more, but you would have had to put something over it anyways.”

Additionally, the project's adoption of a self-construction model marked an important response to community need for capacity building and developing sense of ownership. Unfortunately the results were dissatisfactory. Community informants indicated that the use of local labour was somewhat limited, and did not lead to significant positive outcomes following project completion, such as new skill sets or substantial or long-term employment opportunities. Insufficient capacity transfer from external stakeholders in relation to new technologies was also highlighted as problematic.

Band Manager Darryl McNeil (pers. comm., March 17th, 2011) commented on this shortcoming:

“The capacity at the end of the project – there was no capacity transfer.... I think that was the biggest fault with this overall project. It would’ve been nice to have operating manuals... on all these technologies. We didn’t have a champion that really took it on to understand it more.”

Lack of internal championing and over-dependency on external stakeholders for capacity building and transfer thus mark project weaknesses. External stakeholders may play a vital role in bringing emerging methods and technologies to the table. Strategies to transfer their expertise into the community must be directly addressed however, or benefits may be forfeited. While the expectation of community informants that they would learn to independently operate and/or (re)implement certain technologies was apparent in the interviews, it is unclear whether or to what degree this was addressed in the planning process.

The project’s wind turbines offer another example of unmet expectations, in this case related to technology performance, knowledge and capacity transfer and the broader policy and regulatory environment. The installation was the subject of the first small scale feed-in tariff (micro-FiT)³¹ in the province of British Columbia, and required support of high level champions in provincial politics and local service provision. Community informants estimated the cost of the development’s service connections (including both wind and geothermal systems) at \$30,000 - \$35,000. This represents

³¹ Feed-in tariffs are payments made to an independent energy producer in exchange for energy being fed onto a conventional grid, typically from an alternative energy source such as wind or solar.

roughly a ten-fold increase as compared to conventional hydro connections of \$400-\$500 per unit (times seven units = \$3,500).

Of the three turbines that were installed, one featured a new horizontal orientation that had not been locally tested. Unable to survive heavy local wind loads, the device was blown apart, and never reassembled or replaced, as the manufacturer went out of business. Anticipated benefits from the other turbines – including reduced operating costs and revenue generation from the feed-in tariff – were also not realized. Community representatives are uncertain of the exact reasons for this. The outcome highlights the risks associated with emerging feed-in policy and regulatory environments, where connection costs are high, returns uncertain, and even high level government and industry support does not guarantee results.

Outcomes of the geo-exchange earth tube system were the subject of additional problems and communication gaps. Despite lengthy excavation requirements and high costs, community informants still identified this technology as one of the project's most successful strategies. Yet performance analysis conducted by CMHC points to multiple problems with the technology. Firstly, contamination from soil during installation may have fostered mould growth, and it appears that this fact that was never relayed to the community. Secondly, energy requirements for circulating heat exceeded the value of the heat being captured by this and the solar air system. Although this information was shared with the community in a technical assessment, community informants indicated that they were unable to interpret the report due to a lack of specialized knowledge.

Further confounding the matter, custom water tanks that were installed as part of the system at a cost \$3800 per unit (approximately 500% more than conventional units),

and had to be replaced inside of their projected lifespan of 15 years (comparable to that of conventional units). In the future, the housing department plans to replace this system with a more cost effective version based on cheaper 2-stage on-demand tanks. The designer of this system also went out of business, again undermining knowledge transfer relative to the system's design, operations and maintenance. The collapse of designers/suppliers for both the geo-exchange and wind energy systems indicates the importance of partnering with individuals and organizations who have an established track record, and whose strategies are based on technologies that are proven relative to contextual factors.

In-kind donations from private sector partners were viewed as a valuable contribution to the project including materials, system components and services. Simultaneously, lack of a comprehensive audit that included all donations undermined an accurate sense of actual project costs, and subsequent ability to determine cost effectiveness and payback periods relative to conventional methods and technologies. Informants estimate costs were much higher than anticipated, at least double the initial target, which was originally based on the region's maximum unit price (MUP). Further, they believe this is the reason for a relative lack of follow-up from CMHC and INAC – that the demonstration was simply too expensive to repeat. Project Architect Rob Seniuc suggests that the maximum unit price model is simply not realistic for providing adequate housing, especially in situations where this is expected to cover site and servicing costs, or in cases where location increases supply chain costs.

The project faced additional challenges as a result of complexity and/or additional installation times, which also increased cost. The cedar shingle rain-wall resulted in

extensive cutting and mounting relative to simpler methods. While the use of cedar responded to a cultural preference for the material, this particular method was not culturally based (McNeil, Darryl and McNeil, Dwayne, pers. comm., March 17th, 2011). (In this case then, objectives of appropriateness and affordability should not be construed as competing). Sealing of multiple round windows, unconventional corners and angles, and double layer insulation were also cited as sources of increased cost. It is unclear whether any of these features were designed in response to specific cultural preferences. Community informants did indicate that this highly customized approach was inappropriate relative to the challenges they face in terms of economic resources.

Compact fluorescent lights were selected to reduce energy consumption. In retrospect these are viewed as prohibitively expensive and inconvenient due to their incompatibility with conventional sockets. Paperless drywall was applied throughout the project, in order to prevent mould and promote durability. Here, contractors' unfamiliarity with the product resulted in hourly rather than contractual rates. The extended drying time of the product (4-5 times that of conventional drywall) further drove up costs, and created a bottleneck – preventing progress and in turn driving up costs in other areas. Informants indicated that while this and other durability measures have been successful, strategic placement of the paperless drywall in high risk areas such as the bathroom and kitchen would have allowed for more timely completion.

Other health-promoting measures employed in the project include non-toxic and low VOC paints and finishes, and durable polished concrete floors. As Seniuc (pers. comm., May 20th, 2011) notes:

“We were very, very careful at Seabird to make sure that the materials that were put in there were non-toxic.... The healthy concept was a very big part – using natural materials, using stuff that doesn’t off-gas, using low VOC paints.”

The Nation’s housing department no longer installs carpet in any of their homes, and sees this as a strong strategy for promoting indoor air quality. Such measures exemplify simple and affordable ways to prioritize occupant health and safety in residential design. Problems could emerge however, if non-toxic finishes or suitable flooring materials are not readily available in remote locations, and/or are replaced with conventional ones.

In terms of cultural appropriateness, the inclusion of a medicinal herb garden might appear to be a strong component, especially since it was driven from within the community. The soil was never seeded however, and the entire garden was eventually removed. The installation and removal came at a significant cost to the community. Informants indicated that lack of interest and use may have resulted from hot summer climate, as well as hardy local weeds and insects. This outcome indicates that cultural design considerations must be considered in relation to not only tradition but also to contemporary lifestyles, interests and local conditions.

In exploring other potential considerations for local culture that could have been included, community informants cited previous installations of sheds for smoking fish. These were removed however, where resulting particulates were found to exacerbate asthma and respiratory illness in the community. This is significant, demonstrating that the absence of a particular cultural response does not mean it has not been considered or tried, as one might otherwise assume. Diversifying options for food preparation such as

smoking and canning remain an area of interest, as a potential way to support and revitalize traditional practices that still contribute to contemporary lifestyles in the community. Options for exterior cleaning and storage of outdoor activity gear, and larger driveways for multiple vehicles (including off-road vehicles that are an integral part of the outdoor lifestyles of this community) were also identified as desirable features. A formal needs assessment or community consultation to explore such interests has not been conducted to date.

Considering the adverse effect of complexity upon the project, multiple informants from both within and beyond the community suggested that this was driven by architects and engineers external to the community and that, with all due respect to them, it would have been beneficial to undertake a simplification exercise early in the design process. It is unclear whether or to what degree benefits and risks were understood by and/or communicated across stakeholders. Interviews with Darryl McNeil and Dwayne McNeil suggest that they associate the high costs, technological failures, and lack of capacity transfer not only with the project's overall complexity, but also with the multi-unit approach. Such association could negatively influence receptivity towards a multi-unit strategy in future housing developments, with indirect implications for other areas such as land base and infrastructure development.

Project architect Rob Seniuc estimated significant savings from the multi-unit approach, including reduced infrastructure costs of \$250,000 and reduced land costs of \$300,000 - \$400,000. Interview data suggests a communication gap in this area where these significant benefits were not identified by key informants within the community. Indeed, the prevailing sentiment from community informants is that a smaller and less

ambitious project might have been a better way to start. Receptivity towards the multi-unit approach is further influenced by the aforementioned preference in Aboriginal communities for dispersed single family units.³² Interview data suggests that perceptions of densification in the Seabird Island community may be polarized, with awareness centered on extremes of single units and high rises. It is difficult to determine whether the project's complexity would have been sufficiently reduced, and superior outcomes realized, had the project adhered to the original single unit strategy. It should be noted however, that a multi-unit approach does not preclude simplicity, capacity building, or affordability – as will be demonstrated in the second case study.

³² The preference for dispersed single family housing was identified by key informants in all cases, and a connection drawn between this preference and traditional lifestyles.

Table 6a: Political, Institutional, and Regulatory Strengths and Weaknesses

Note: Tables 6a-c summarizes the analysis of the Seabird Island First Nation case according to the strengths and weaknesses exhibited within the community and by the sustainable housing pilot project. It is critical to note that these are determined by the case context, and may result in different outcomes under different circumstances. Accurate interpretation of this table therefore relies upon due consideration of the case description.

	Strengths	Weaknesses
Political, institutional, regulatory	<ul style="list-style-type: none"> • Comprehensive community physical plan • Absence of Treaty provides greater freedom and flexibility in land use and related negotiation • Pilot established micro-FiT support for wind power, potential savings, revenue generation • Pilot capitalized on increasing diversity of Aboriginal specific funding (CEAP) 	<ul style="list-style-type: none"> • Vestiges of colonialism include mistrust within and beyond community, enduring socioeconomic disadvantage that affects community resources for funding housing initiatives • Complexity surrounding Nation within a Nation within a Nation • Territorial boundaries and local activity surrounding community limit quality and access to land and resources • MUP and accompanying specifications restrict housing options, negatively impact performance and longevity • Current specifications tied to funding are substandard Pilot micro-FiT required seeking special support from high level officials in government and service provision • High cost of grid connection for alternative energy feed-in, benefits ultimately not realized (reasons unknown)

Table 6b: Socio-Cultural and Economic Strengths and Weaknesses

	Strengths	Weaknesses
Socio-cultural and economic including community resources, skills, education, capacity	<ul style="list-style-type: none"> • Capacity to locally conduct inspections • ‘Housing 101’ occupant education, multiple methods • Local community college with certified trades programs • Community outreach intent behind comprehensive physical plan • Youth familiarity with technology allows access to information including housing innovations (methods, technologies, programs) • Traditional role of Elders in knowledge transfer 	<ul style="list-style-type: none"> • Housing management understaffed, high turnover • Community housing resources haven’t kept pace with demographic trends, contributing to crowding, backlogs, high rates of transition • Tenant sense of entitlement, lack of responsibility • Rental arrears undermine local government’s ability to deliver housing and community services • Lack of housing diversity → sub-optimal use (incl. under-crowding) • Misperceptions, knowledge gaps surround function, maintenance, energy demand of home appliances, systems • Emerging methods/technologies require specialized knowledge (architecture, engineering), exceed current community capacity to evaluate, implement, maintain, subsequent reliance on external stakeholders for capacity building, knowledge transfer • Reliance on government funding for housing initiatives, high interest rates and debt challenge ability to improve conditions • High cost of energy consumes limited resources • Federal income and housing subsidies not keeping pace with rising housing and energy costs

Table 6c: Strengths and Weaknesses in Process, Objectives and Strategies

	Strengths	Weaknesses
Design Process, Objectives, Strategies, and Outcomes	<ul style="list-style-type: none"> • Integrated design process • Prioritized occupant health and safety, reduced environmental impact • Multi-faceted approach to reducing O&M and replacement costs • Duplex/triplex, flexibility to meet changing individual and community needs expected to maximize occupancy • Multi-unit approach to reduce costs, land requirements • Cultural considerations to foster sense of identity, ownership incl. ceremonial opening, blessing, carvings representing community values • Alternative energy and building orientation tied to worldview • Increased square footage per unit • Use of local labor in pilot construction • Pilot established new external partnerships – introduced new methods and technologies to the community, in-kind donations of materials, systems, services 	<ul style="list-style-type: none"> • Complexity increased by exploratory approach, external stakeholders influence over objectives → increased cost, challenged capacity building, negative perception of methods/technologies, multi-unit strategy • Multi-unit strategy goes against community preference, familiarity • Insufficient selection criteria for external partners and/or lack of contractual support led to lack of follow-up from them, subsequent failure to transfer essential skills related to systems implementation, maintenance and monitoring/assessment • Lack of auditing, post-occupancy review undermines sense of total cost and effectiveness, incl. failure to adequately account for/communicate benefits of multi-unit strategy between all stakeholders • Failure to clearly identify/communicate all options, challenges, opportunities, costs, risks across stakeholders • Lack of mandate re. proven technologies led to failure: one turbine could not sustain local wind load, never replaced, geo-exchange components and installation costly, potential soil contamination during installation Unfamiliarity, complexity of many technologies and building methods increased costs: cedar shingle rain wall, round windows, paperless drywall - widespread application, extended drying time, consequent bottleneck • Custom replacements: CFL bulbs, HRV filters, low VOC finishes • Insufficient consideration for local site appropriateness and contemporary lifestyle led to costly installation unused medicinal garden

Case Conclusions

The Seabird Island First Nation faces housing issues and problematic conditions that are largely consistent with findings from the background research. As such, this case provides important insight into the Aboriginal housing crisis, illuminating strategies to achieve more sustainable outcomes, as well as potential pitfalls that must be avoided to ensure success.

At the community level self-conducted home inspections, a multi-faceted approach to occupant education, and diversification of funding sources have all proven valuable. In the context of the sustainable housing pilot project, the integrated design process that fostered community input in design and implementation marks an essential component of socio-cultural appropriateness and sustainability. Some of the green building methods and clean technologies that were used improve upon conventional housing strategies in the community, and are now providing a healthy and durable living environment for multiple community members. And alignment of these methods and technologies with the community's ecologically oriented values mark an important contribution to the project's cultural appropriateness.

Although resources and capacity are not uniquely Aboriginal challenges, they are critical factors in this and many other Aboriginal communities. The ambitious, experimental and highly customized nature of the Seabird Island pilot project was thus ill-suited to this context. This approach led to costs that were higher than expected, and complexity that exceeded the Nation's capacity to analyze, operate, maintain and/or replace systems and their components.

These findings suggest that a more incremental and cautious approach to new developments may help to mitigate cost overruns and/or project failures (the impacts of which were in this case borne by the community). Solutions should be based on affordable methods and technologies that have been tested in real-world conditions. Where these cannot be independently implemented by the community, they should be facilitated by partners who are well-established in their industry, have a track record of success and are committed to meeting the community's needs. Where alternative energy production initiatives are being considered, feed-in tariffs may also prove critical to success. In such cases, arrangements should be made explicit in the planning process.

Risks associated with the aforementioned weaknesses and failures may be mitigated in part through comprehensive communication between internal and external stakeholders, including the identification of potential challenges and special requirements that may be incurred throughout the project's entire lifecycle. It is imperative that such communication address whether and how related capacity will be transferred. It may be necessary or beneficial to extend stakeholder engagement beyond design, planning and implementation into the occupancy phase. This could prove especially valuable for advanced technologies, or cases requiring increased occupant involvement in operations, maintenance and/or replacement.

The data gathered on the Seabird Island First Nation pilot project presents a different reality from that of publicly available literature, which focuses on strengths and fails to identify many of the challenges faced during and after the development was completed. While innovation in Aboriginal housing depends upon demonstrated successes and accompanying optimism and receptivity, it is also imperative to identify

challenges and failures, in order to prevent repeated mistakes and develop best practices. Comprehensive auditing and post-occupancy evaluation have a vital role to play in achieving such awareness, and should therefore be built into Aboriginal housing initiatives wherever possible. In the Seabird Island case, the lack of such measures prevented an accurate sense of overall cost and performance relative to conventional approaches, which in turn undermined the original project goal of providing a reference point for future initiatives. The next chapter examines the more modest approach to new methods and technologies adopted by the Saugeen First Nation's housing pilot project completed in 2010.

CHAPTER 7: SAUGEEN FIRST NATION CASE STUDY

The following case study examines housing in the Saugeen First Nation. The case includes background information on conventional housing and related capacities in this community, as well as a description and analysis of their sustainable housing pilot project completed in 2010. The primary source of data in this case is key informant interviews conducted in the spring of 2011 with Chief Randall Kahgee, Housing Manager Ron Root, and Project Manager Derek Laronde. Additional data was collected from presentations at a conference on the development in the summer of 2011, and from the author's observation of the site concurrent with the conference.

Case Background: Issues, Conditions, Capacities and Economic Resources

Saugeen First Nation is located on the East shore of Lake Huron, Northeast of Saugeen Shores in Southwest Ontario (see Figure 9). At the time this research was conducted, there were approximately 309 homes on Saugeen reserve lands, including the sustainable housing pilot project. The Band renovates two homes and builds four new homes on an annual basis. Renovations are prioritized using a point system. New homes are assigned through a chronological wait list – first come, first served.

Saugeen First Nation's housing-related capacity includes local carpenters, plumbers, apprentice electricians, and construction crews with training in R2000 efficient building methods (see glossary). Gaps in specialized areas such as architecture, engineering and emerging building methods remain a challenge. The local housing department is able to conduct inspections however, reducing dependence on the Ontario First Nations Technical Services Corporation (OFNTSC). While support from the

OFNTSC in this and other areas is seen as vital, the organization's regional mandate can result in significant wait times, driving project delays and consequent increases in cost.

Housing issues and problematic conditions in the Saugeen First Nation include short building life spans, crowding, high rates of transition, high and increasing energy costs (especially those associated with heating), and high instances and rapid development of mould. Chief Kahgee (pers. comm., April 26th, 2011) spoke to these challenges:

“Even though we're closer to urban centers, we still have the same scenarios that you might see in some of the northern communities, where you have a tremendous lack of housing, where you have homes that are in a certain state and require significant repairs. We have mould issues... [and] we have a huge backlog in our housing list. At the current rate we're going it would take well over 50 to 60 years to develop the amount of homes we need in the community for those that are on the housing list already.”

Short building life spans are seen as a result of poor building quality. Crowding is driven by shortages, which stem from insufficient resources and backlog. As in the Seabird Island First Nation, crowding affects not only the Saugeen Band members within the community, but also those wishing to return to it who cannot find places to live.

In this case, the primary source of mould is perceived to be condensation from plumbing located in crawl spaces. This problem can be traced back to the introduction of modern mechanical systems, and is related to their design and construction, and occupant awareness surrounding their operation. According to Housing Manager Ron Root (pers. comm., April 26th, 2011):

“[In the] middle [19]70s when we started getting water lines delivered to the communities, at this point they started to notice changes in the building, in other words moisture.

People assumed that overcrowding was the issue, and it may have some contribution to it, but when you're bringing moisture into the house with insulated pipes, copper tubing and all that, it sweats. And normally you'll find that underneath the crawl space. So this is where all the mould started.... We didn't know anything about fans, air movement. We just relied on opening the window a quarter inch and there's your HRV.... The fans weren't moving enough air because of the envelope. That's a big volume – 1400 square foot building with an eight foot ceiling. You've got one little ceiling fan... [that] wasn't moving air enough. Range hoods – they were the ones that rotated within the building, so that's out of the question.... As we go into the [19]90s, now HRVs are introduced, and that seemed to solve a lot of things. And we're still learning from them.... In Saugeen here... 272 homes, what's the chances of all the HRVs plugged in? Probably three to ten percent are plugged in, and the rest are unused.... A 100 watt bulb will use more hydro than your HRV will. You try to tell that to the public – they won't accept that. You have to demonstrate that somewhere.”

The Saugeen housing department has begun tenant education initiatives surrounding cleaning, maintenance, control systems, filter replacement, ventilation, and heat recovery ventilators (HRVs). The above misperception surrounding the function and operating costs of HRVs was also identified in the Seabird Island First Nation case. As indicated in chapter four, HRVs may play a significant role in providing indoor air quality (David, 2003). Occupant education that specifically targets this technology and its relationship to modern air tight building methods may thus prove valuable (see CMHC, n.d (c)).

Saugeen Chief Randall Kahgee identified funding as the single greatest challenge to improving the Nation's housing conditions. Federal funding is seen as minimal, proving insufficient to maintain and repair existing stock, let alone have a significant impact on current and projected demand for new units. Current the Nation spends

approximately \$88,000 per new unit. Government subsidies contribute approximately \$23,000, with the remaining \$65,000 coming from Band-owned mortgages. Chief Kahgee (pers. comm., April 26th, 2011) commented on the situation:

“We just don’t have all the resources we need that would make a significant dent in housing in Saugeen. Of course that’s the age old problem in a lot of First Nations.... The funding that we receive at the federal level is very minimal – certainly not enough to make sure that adequate housing and sustainable housing is being built, and certainly not enough to make sure that those homes that already exist in the community are repaired or kept at a level that will ensure that sustainability in the future.... We can talk about sustainable housing and building homes that are going to last a lifetime, but the challenge will always be how do you do that with a very limited pool of resources.”

Insufficiency of resources may not only limit renovation and construction activities, but also negatively influence the type of work being undertaken. If the cost of a critical renovation exceeds the available resources for example, the work may get pushed aside for less costly and less important repairs, thereby fueling building inadequacies (Laronde, D., pers. comm., April 21st, 2011).³³ Resource insufficiency could have similar implications for new construction. For example, community need for larger units or costly accessibility features might be overlooked in favor of smaller, less accessible and less expensive developments. Lack of budget flexibility was also cited as problematic, where adequacy problems identified in the course of maintenance, secondary inspections, or destructive testing cannot be retroactively included once the initial renovations budget has been determined (Laronde, D., pers. comm., April 21st, 2011).

³³ Here it is interesting to note that this outcome is the opposite of that identified in the Seabird Island case, where resource constraints are identified as limiting renovations and repairs to only the most critical needs.

Insufficient rates and levels of maintenance may in turn create a feedback that compounds resource challenges. If critical repairs aren't being done, tenants may feel that rental arrears are justified, reducing an already scant pool of funds for maintenance and other essential services. Construction Manager Derek Laronde (pers. comm., April 21st, 2011) spoke to his experience of this issue:

“They may have a house, it may be a Band house, if they figure they're having a problem [and] nobody's fixing it, well they figure they have the right not to pay the rent. Anywhere else that wouldn't work. If you didn't pay your rent you'd be kicked out. If you didn't pay your mortgage, they'd take your home. On First Nations communities people will go for years without paying rent, which puts a lot of burden on the capital of the First Nation because that money that's supposed to be coming in isn't there, and they have to take the money from somewhere else....”

Recalling key informant testimony from the third chapter dependency, sense of entitlement, and the expectation that the Band is responsible for all home costs and maintenance was identified in preliminary interviews, and by key informants across all cases (Crowchild, L., pers. comm., December 14th, 2011; Crowshoe, R., pers. comm., December 2010-October 2011; Laronde, D., pers. comm., April 21st, 2011; Lee, T., pers. comm., December 10th, 2010; Seymour, C., pers. comm., March 16th, 2011). Informants also indicated that this issue appears to be more common in younger people – that older community members tend to be more respectful towards and take responsibility for their homes. Consequently, it was suggested by informants across cases that these kinds of generational gaps could be addressed by revisiting the traditional role of Elders in transferring knowledge. Seabird Island First Nation's Research Director Jay Hope (pers. comm., May 18th, 2011) suggests that:

“What we really have to rely on is the voice of our community and the Elders in our community who have been living here and have experienced this area for their generation. I think it’s important that we listen to them in looking for that leadership and looking for ideas around how to solve these problems. The reason that they can help is that they’ve experienced so much in their lifetime. They understand the family connections and the family dynamics, they know that it’s not for us, it’s for the future generations that we need to solve these problems. It becomes that much more important that we not only include the Elders but that we include the youth.”

Simultaneously, it was indicated that while some members of older generations are fairly progressive, not all are familiar with new building methods and technologies and their resulting costs and maintenance requirements. Informants from the Saugeen and Seabird Island First Nations case pointed to the younger generations’ familiarity with emerging communication technologies and platforms as an opportunity to increase awareness of home maintenance, operations, and general building science in the broader community.

Different generations may therefore have a supportive role to play in assisting each other with the current housing challenges. Where Elders may be able to foster a stronger sense of responsibility, youth may be able to acquire and share knowledge that is increasingly available through information technologies such as the internet. Laronde (pers. comm., April 21st, 2011) indicates that:

“Even with the younger generation now... [they] see the different approaches that people are trying to take with housing to make it sustainable not only for the community members but for the First Nation itself.... We’ve got a house now that’s going to last 50 or 75 years with very minimal costs to the community, which means other programs aren’t going to suffer. I think that approach,

[getting] that information to the younger generation is a start to getting things to change.”

At the time this research was conducted, Saugeen First Nation’s Band management was in the process of creating a 10-year strategic plan to address housing challenges in their community. The plan’s overarching goal is to completely address the community’s current waiting list. The vision includes a holistic and balanced approach that targets social, economic, and environmental outcomes. Economic priorities include efficiency of process, reduced operating and maintenance costs and reduced managerial burden related to housing. Specifically, a better balance between the local housing department, tenants and contractors is desirable, where the bulk of responsibility for housing currently rests upon the department. Encouraging occupants to obtain their own loans for maintenance and upgrading is seen as a potential strategy to increase sense of ownership and responsibility while simultaneously alleviating financial burden on the Band. A mortgage program is also being considered, which would free up revenue for housing maintenance and other services.

Numerous information gaps were cited as current challenges in these areas. Confusion surrounds not only ownership, but also the roles and responsibilities of the local housing department and tenants in home construction, contractor selection, payment, oversight, and tenant satisfaction. Informants pointed to the need to provide education on topics such as rental and mortgage programs, to ensure that occupants understand what happens if payments are not paid. In order to address such knowledge gaps, the Band intends to use the strategic housing plan as a focal point for consultation

with the community. Chief Randall Kahgee (pers. comm., April 26th, 2011) highlighted the importance of community input and support:

“The community has to be a part of that solution and accept responsibility for that solution, and make sure that whatever the path is forward that we’re all on the same page. If you don’t have community support you’re already off to a very rough start.... The community has to be involved right from the outset. They have to understand the approach. They have to agree with the approach. And they have to accept responsibility for the approach that’s going to be taken.... Any program that you’re going to implement will largely depend on your mortgage structure. So that means there has to be an acceptance and a responsibility to make sure that mortgages are paid, otherwise the plan will fall flat.”

The Saugeen First Nation’s 10-year plan will include a needs assessment that explores a range of options for singles, elders, families and single parents. The feasibility of applying the aforementioned renovation point system to new construction will also be considered, where a ‘first-come first-served’ approach is seen as less than ideal in terms of meeting special needs and diversifying unit types. A returning demographic trend towards large families was identified as presenting a distinct challenge to the provision of suitable housing in the community.³⁴ One potential strategy identified to address this is the retrofitting basements with additional bedrooms.³⁵ Broader strategies that are being explored through the plan include durable building methods, improved envelope design, better ventilation systems and alternative energy sources.

³⁴ Here ‘suitable’ is referring specifically to sufficient number of bedrooms as outlined by CMHC’s Core Housing Need (CHN) framework. See glossary for full definition of this, and other indicators of CHN.

³⁵ This strategy must be carefully evaluated however, where key informants cited crawl spaces as a hotspot for mould.

Description of Housing Pilot Project

The Saugeen First Nation sustainable housing pilot is an 8-unit townhouse complex that was completed in spring of 2010. The project's main goal was to demonstrate the capacity of green building methods and clean technologies to deliver robustness and efficiency while remaining affordable to low-income families. This responds to current building inadequacies, high and rising utility costs, and high levels of unemployment and social assistance. Reducing operating and maintenance costs (especially hydro bills) and improving tenant health and comfort were identified as key objectives, to alleviate financial burden and improve quality of life. All of the pilot project's units contain three bedrooms, addressing the demographic trend of large families, and a shortfall of housing for single families and single parents with two or more children. The original project proposal includes two phases, the second of which had yet to be implemented at the time of writing. This phase includes a 6-unit development, with the end units designed for barrier free accessibility if the need is confirmed.

The Saugeen pilot project was made possible in part through one-time funding from Canada's Economic Action Plan (CEAP) dedicated to INAC for First Nations initiatives. This differs from the Band's conventional sources for funding new units – CMHC's section 95 and section 10. Although CMHC did not fund the project, their maximum unit price (MUP) model was adhered to where it was perceived as being recognized by and therefore a vehicle to garner support from INAC. Additional funding was provided by the Band, and contributions from a local casino. Informants also cited numerous in-kind contributions from industry partners as integral to this and future

Figure 11a. Saugeen First Nation Housing Pilot Project



Figure 11b. Insulated Concrete Form



Figure 11c. Radiant Concrete Slab



Figure 11d. Eleven inch studs



Figure 11e. Eleven inch stud wall



Images courtesy of Derek Laronde and the Saugeen First Nation

initiatives (discussed below). These did not appear to undermine assessment of the total project cost as was the case in the Seabird Island pilot project.

Community consultation in the initial planning phases focused on site selection, raising awareness of project objectives, ensuring absence of opposition, and determining some aesthetic considerations. As a consequence, the project site included existing services, conserved local vegetation, and maintained a consistent aesthetic relative to other developments in the area. The central units of the building were also set back to avoid an overly institutional feel, and each unit has its own patio. Laronde (pers. comm., April 26th, 2011) indicates that:

“Trying to maintain the feel of the community was definitely an aspect that we wanted there, as far as not clear cutting everything in the community and leaving some of the natural vegetation around. Trying to keep things not to the exorbitant state where we’ve got this building that doesn’t fit with anything else in the community.”

The Saugeen First Nation adopted self-construction as a strategy to maintain affordability, build capacity, and establish a sense of community pride in and ownership over the development. As Chief Kahgee (pers. comm., April 21st, 2011) notes:

“We saw that as an excellent opportunity to not only keep costs to a specific level, but also provide training opportunities to our members.... You’re starting to then grow that capacity within the community.... I think there’s a certain amount of pride our people take in the work when they know that they’re developing it for our people – it shows.”

Project manager Derek Laronde (pers. comm., April 26th, 2011) estimated that community members made up ninety percent of the workforce, and that this provided

strong educational opportunities related to building methods. Specific outcomes related to the self-construction approach are explored further within the case analysis.

Saugeen First Nation's pilot project integrates multiple green building methods and clean technologies. The building's foundation consists of insulated concrete forms (ICF) and a radiant slab for the basement floor. The framing uses 11 inch studs to allow for increased insulation relative to conventional practice. Efficient mechanical systems and appliances were selected to reduce energy demand. The project's vinyl floors and low VOC finishes foster indoor air quality. One unit was fitted with additional integrated photovoltaic (PV) and solar thermal technologies, providing a source for demonstration and testing. Requisite components are roughed into the other units so that they can be retrofitted with these technologies.

Pouring of the ICF began in December of 2009, and the entire project was completed by April of 2010. The project was given an Energuide rating of 86 for end units and 87 for internal units. According to Natural Resources Canada (n.d.), for a brand new house a rating of 80 or higher is excellent, and approaching little or no purchased energy.

Chief Kahgee (pers. comm., April 21st, 2011) indicated that the project was opened with a blessing ceremony, as a formal means to "keep things pure", and provide sense of calm, peace, and home. As mentioned in chapter five and in the Seabird Island case, such events provide important connections to and validation of local culture, identity, and meaning. Relationships between goals, objectives and strategies from this case are summarized in Table 7.

Table 7: Summary of Housing Pilot Project Goals, Objectives and Strategies

Goal	Objective	Strategy
Ensure affordability	<ul style="list-style-type: none"> • Reduce construction costs • Reduce O&M costs • Increase energy/water efficiency • Provide durability 	<ul style="list-style-type: none"> • Local labour, training and employment • Multi-unit townhouse approach • Capitalized on existing site services • 11 inch stud walls, R40 insulation • Efficient mechanical system, appliances, lighting, plumbing (low flow fixtures, faucet aerators, economizer shower heads), drain water heat recovery (DWHR), radiant slab thermal battery • ICF foundation, laminate vinyl flooring, paperless drywall
Build capacity	<ul style="list-style-type: none"> • Increase knowledge and ability surrounding housing construction/maintenance, alternative energy options • Keep resources within community • Test alternative energy 	<ul style="list-style-type: none"> • Local labour, training and employment based on emerging methods and technologies • Local manufacturing of 11 inch framing • One unit features additional technologies (integrated PV/solar thermal, solar air curtain), allows increased familiarity through testing and monitoring of new technologies, other units roughed-in for easy retrofit
Ensure occupant health & safety	<ul style="list-style-type: none"> • Reduce mould • Provide high IAQ • Provide durable structure 	<ul style="list-style-type: none"> • Vinyl floors, latex paint increase IAQ, reduce cleaning/replacement costs • Paperless drywall resists mould • HRV provides strong ventilation, comfort • ICF foundation R50, sealed with 6mm polyurethane rests on foam and gravel for drainage – prevent leakage, mould
Respond to cultural considerations, demographics	<ul style="list-style-type: none"> • Address community need for larger family-size units • Avoid institutional feel • Satisfy aesthetic concerns • Foster creativity, unity, pride, ownership 	<ul style="list-style-type: none"> • Consultation with community • Opening ceremony • All units 3 bedroom with balcony, middle units set back • Maintained local vegetation • Maintained consistent style with existing housing

Analysis of Housing Pilot Project

The Saugeen First Nation's application for CEAP funding of the pilot project was initially rejected due to a miscommunication surrounding the project's eligibility. Approval was eventually granted, but this initial delay resulted in a tight project completion timeline of four months, necessitating construction throughout winter. Community informants thus pointed to ambiguity and complexity in the application process as a source of challenge and risk. The schedule also prevented the local housing department from achieving the desired level of community consultation. The department would have preferred a more flexible timeframe to allow for design refinements, including community-based exploration of cultural design considerations. Chief Kahgee (pers. comm., April 21st, 2011) indicates that:

“There was a lot of uncertainty as to what the selection process was, how the criteria were scored and what would really be necessary to make sure that it was a competitive project.... The timeframes as well: ideally we'd like to have a little more flexibility on the time frames. You'd want to see that process move in a way that gives you enough time to really design, develop and modify if necessary a particular project. But the time frames on this, and some of the uncertainties around how the process worked out in terms of selection made it a challenge.”

In spite of this challenge, informants point to CEAP funding as extremely valuable, especially where funds are dedicated specifically to First Nations initiatives. Dialog did take place between Saugeen First Nation and INAC on potential positive changes for application processes and criteria going forward. There is hope that future projects will enjoy similar opportunities, though informants were uncertain as to whether this source would continue to be available.

In terms of potential cultural considerations that might have been included had project timelines allowed, the longhouse was identified as a structural precedent in the Saugeen First Nation community. Architect Bret Cardinal also pointed to a planning concept based in traditional community values, wherein roads are kept on the periphery of groups of homes that surround a protected communal area. This is viewed as a good strategy for keeping children from playing on the street, and for increasing awareness of their whereabouts while still allowing for outdoor activity. The concept parallels the protective spaces established in the plan of the Seabird Island First Nation School, as discussed in chapter five. Cultural considerations are expected to contribute to future initiatives in Saugeen First Nation: the new administration building may feature a central fire pit, and/or relevant literal representations such as an upside down canoe, a turtle, or an eagle in flight.

The multi-unit approach of Saugeen First Nation's sustainable housing pilot project was identified by interviewees as unconventional for, and generally not preferred in First Nations contexts. It was noted that instances of this strategy are increasing however, likely in response to diminishing land base and rising costs of energy and infrastructure. The specific rationale for a multi-unit strategy was not identified in this context. No significant negative feedback had been received on this matter within the project's first year of occupancy, however. Laronde (pers. comm., April 26th, 2011) spoke to the multi-unit approach:

“First Nations housing – very rarely do you find it in a group setting.... More and more because of land base you're starting to see it.... Because generally everybody likes their piece of land and likes to have their segregation from everybody else. When you start bringing everyone

together you end up with a different social atmosphere with the occupants. Sometimes putting people together doesn't work as well as you might think."

The Band has some concern over the potential outcomes of the multi-unit approach. Informants felt for example, that the method for willing these units from one generation to the next could prove more complex than with a single family dwelling, a distinct plot of land, and/or an existing certificate of possession. Determining whether the legalities surrounding certificates of possession and their relationship to multi-unit developments is, in fact, an issue falls beyond the scope of this research. This concern is related to those of the Seabird Island First Nation however, as pertaining to Treaties and their implications for land base, lot size and community attitudes towards ownership (see Jay Hope's testimony in chapter three).

Direct relationships with suppliers of structural, envelope and mechanical system components were important to reducing costs on the Saugeen pilot project. As Laronde (pers. comm., April 26th, 2011) notes:

"Building the relationships with suppliers was one of the key beneficial points for the community and for any projects that are coming up. We created relationships with some suppliers where we were getting 50% discount on material costs, and this was coming right from the factory. We didn't have to go through the middleman... where they're going to put their mark up on. We were dealing right with the manufacturers. That was for HRVs, insulation, windows.... That is a benefit for the First Nation that can carry on for any development that's going on there."

Some of these relationships were established by the community, while others were brought to the project by third parties such as consultants and engineers. These third parties were also identified as essential to project success, possessing critical knowledge,

expertise and the ability to relate this to the project's vision and objectives within the community. While CMHC was not involved in the initial project planning and implementation, their international branch has recently expressed interest, particularly in the potential for marketing the project in the United States.

The self-construction approach was not a first for Saugeen. Chief Kahgee (pers. comm., April 21st, 2011) cited a marked positive difference in attitude towards and quality of outcomes from previous self-constructed projects. In this case participation included different generations and genders, across a broad range and level of skills. Informants specifically noted that hands-on experience was more valuable than written information (Laronde, D., pers. comm., April 26th, 2011). Construction began with a single unit. If mistakes were made, site management was careful to ensure that these were undone and completed properly, emphasizing the important relationship between specifications, implementation and performance. The process was thoroughly refined and optimized over the course of the operation, until the 8th unit was completed.

Those involved in the project expressed enthusiasm towards new technologies and methods. Areas of learning included ICF foundations, vapour barriers, electrical and mechanical systems, and other means for achieving efficiency to R2000 standards. Although a micro-manufacturing model for the 11 inch wall studs was envisioned, informants' opinions vary as to its realization. Specific training and employment outcomes of the project were not tracked or assessed, and no formal feedback mechanism was put in place, indicating an area for improvement in future initiatives.

Beyond direct experiential benefits, the Saugeen pilot project generated interest within the wider community towards both housing initiatives and policy. For example,

Laronde cited a community-based push for mandatory envelope testing in new projects. The self-construction model was thus seen as important not only for building capacity and providing training and employment opportunities, but also for educating the community and strengthening support for housing and policy improvements. The Band hopes the high degree of involvement will act as benchmark for future self-construction initiatives, including a new administration building.

After the first year of occupancy, the Band undertook a preliminary evaluation of the development's performance. Maintenance requirements during this time had been minimal. Despite being better insulated by the exterior units, central units were unexpectedly found to consume the most energy. Investigation uncovered an excess of 60 home appliances and entertainment devices connected within individuals' homes, some of which may draw power even when not in use. HRVs had also been turned off or unplugged and highly-consumptive air conditioners installed. As a consequence, the Band intends to target these specific areas within their tenant education programs. Preliminary estimates by the community suggest that operating costs and environmental impact can be significantly reduced through the installation of a ten kilowatt photovoltaic array that capitalizes on the region's current FiT policy. Analysis of this case is summarized in Tables 8a-c.

Table 8a: Political, Institutional, and Regulatory Strengths and Weaknesses

Note: Tables 8a-c summarizes the analysis of the Saugeen First Nation case according to the strengths and weaknesses exhibited with the community and by the sustainable housing pilot project. It is critical to note that these are determined by the case context, and may result in different outcomes under different circumstances. Accurate interpretation of these tables therefore also relies upon due consideration of the case description.

	Strengths	Weaknesses
Political, Institutional, Regulatory	<ul style="list-style-type: none">• Receive support from OFNTSC• Ontario FiT incentivizes alternative energy, provides opportunity for savings, revenue• Pilot capitalized on increasing diversity of Aboriginal-specific funding (CEAP)• 10-year strategic plan as basis for community needs assessment• New partnerships forged with external contractors and factory suppliers for knowledge transfer related to new methods, technologies, direct bulk discount through suppliers	<ul style="list-style-type: none">• Policy instability: provincial FiT may be abolished• OFNTSC support can include long wait times• Funding dependency on CMHC section 95, section 10• Lack of housing funding flexibility precludes adaptation to emerging circumstances• Dependence on policy support (FiT) to maximize benefit of alternative energy investments

Table 8b: Socio-Cultural and Economic Strengths and Weaknesses

	Strengths	Weaknesses
Socio-cultural and economic including community resources, education, skills, capacity	<ul style="list-style-type: none"> • Capacity to locally conduct inspections • Existing precedents for self-construction model • Community college trades programs • Local trades, R2000 trained crew • Awareness, education intent behind 10-year plan • Community developing mortgage-based plan • Traditional role of Elders in keeping and transferring knowledge • Youth familiarity with technology allows access to information including housing innovations (methods, technologies, programs) 	<ul style="list-style-type: none"> • Vestiges of colonialism include enduring socioeconomic disadvantage that affects community resources for funding housing initiatives • Insufficient funding limits renovation/construction, creates bias in terms of types of projects undertaken, undermines renovation point system, drives rental arrears → feedback loop • Insufficient capacity to design, develop and maintain housing independently, lack of specialized skills including architecture, engineering within community • Knowledge gaps re. housing market function, including role of mortgages, consequences if not paid • Knowledge gap/ambiguity surrounding individual role relative to home building choices, relationships with contractors, tenant satisfaction • Tenant sense of entitlement, lack of responsibility for maintenance • Lack of rent enforcement leads to arrears • Federal housing subsidies not keeping pace with rising costs of housing and energy • Misperceptions, knowledge gaps re. energy demand of appliances – HRVs unplugged, numerous other passive energy consumers plugged in

Table 8c: Strengths and Weaknesses in Process, Objectives and Strategies

	Strengths	Weaknesses
Design Process, Objectives and Strategies	<ul style="list-style-type: none"> • MUP adhered to as basis for recognition, support of INAC/CEAP • Conducted dialogue with INAC on problems experienced in CEAP application • Improved community awareness, attitude, motivation related to future initiatives • (Re-)enforced relationship between specifications, implementation and performance • Provided comprehensive hands-on construction experience and employment opportunities to community members • Modest, simple scope, prioritizes key issues (health, durability, reduced O&M, affordability) aligned with community capacity, resources • Multi-unit approach reduces implementation and operating cost, service and land requirements • All units 3 bedroom – responds to need, demographics, optimizes occupancy • Consultation communicated objectives, ensured absence of opposition, guided aesthetic considerations • See above re. external partnerships • Single demo unit allows testing, analysis prior to scaled up implementation; other units designed for easy retrofit • Opening ceremony • Multi-generational and across-gender representation in local labor construction • Used Energuide rating system to assess project outcomes • Interest from CMHC international in promoting in US – exposure, additional support 	<ul style="list-style-type: none"> • Ambiguity of CEAP application resulted in shortened timeline, limited consultation and subsequent cultural considerations • Multi-unit strategy goes against community preference, familiarity; ambiguity surrounding potential for inheritance/will of property • No formal feedback mechanism for training and employment, no formal assessment/tracking of outcomes such as continued training/employment • Increased maintenance requirements of some technologies • Design poses limitations on user behavior, including requirement to keep windows closed for efficient system function • Requires custom replacement parts such as CFL bulbs, seasonal HRV filters • Accessibility limited to second phase of development

Case Conclusions

The Saugeen First Nation case offers important insight into the contemporary Aboriginal housing crisis, illuminating strategies to achieve more sustainable outcomes as well as some challenges that may inhibit success. The housing issues, problematic conditions, and direct and root causes identified herein are largely consistent with findings from the background research. Strategies adopted by the Nation to address these challenges may therefore prove valuable to development in other communities.

Of central importance, Saugeen First Nation's pilot project demonstrates affordable strategies for providing a healthy, durable and efficient living environment. The education, employment, awareness and interest that followed from the community's involvement in implementation are also essential to more socioeconomically sustainable housing outcomes. Modest objectives, proven methods and technologies, and a successful approach to self-construction were integral to these successes. Support from external stakeholders and adequate capacity transfer were also vital to realizing the community's vision. These strategies allowed the project to be completed on time, on budget, and with increased sense of ownership. That the project accomplished in four months what some communities take years to do is also a source of community pride. The Nation feels it is now in a position to refine this approach for use in future projects, and to offer guidance on similar initiatives beyond their community. In Laronde's (pers. comm., April 26th, 2011) words:

“This building here is the first stepping stone to making this community green. We met the needs for the community for housing on a short term basis – there's always a need for housing. For that year we gave eight families a place to live. In that respect I think we opened the eyes of the

community – they’re saying ‘Ok, Saugeen can be a leader, or spearhead the whole green community’”

The project was not without challenges. Of particular concern are those surrounding the funding application, namely ambiguity of criteria, tight timelines, lack of flexibility, and uncertainty of future availability. Subsequent scheduling compromised community-based exploration of cultural considerations, such as traditional structural and planning precedents. The community is also unable to count on similar support for future initiatives. Additional weakness stems from the lack of formal assessment and follow-up with project participants in terms of their experiences on the project, and subsequent education, professional development, and/or employment. Had such assessment taken place it would have allowed assessment of success, development of best practices, and the tailoring of future initiatives to meet community needs and interests. Future adoption of such measures may help to strengthen connections between housing initiatives and training and employment opportunities. The T’Sou-ke First Nation’s solar technology initiatives have allowed the community a clear sense of the new skill sets and employment that have resulted for its Nation members within and beyond the community (INAC, 2010), and they are open to publicly sharing this information.³⁶

Looking ahead, the next chapter provides a third and final case study of a somewhat different nature. Developed by University of Calgary students in collaboration with the Treaty 7 First Nations, this design competition prototype offers particular insight into the role of culture in improving contemporary Aboriginal housing design.

³⁶ This project was also highlighted at the *Powering Up Aboriginal Energy* conference in Toronto, April 2011.

CHAPTER 8: TREATY 7 FIRST NATIONS CASE STUDY

The following case study pertains to a sustainable housing prototype developed by University of Calgary students in collaboration with the Treaty 7 First Nations of Southern Alberta. The project was created as an entry into the United States Department of Energy's Solar Decathlon 2011, an international student design competition. As such, the case differs from the previous two, where it was developed in an academic rather than a 'real world' setting. The implications of this difference are explored below.

Sources and methods for collecting data in this case differed from the previous cases. Interviews conducted during the background research included key informants from Treaty 7 communities, namely Treaty 7 Management Corporation's housing director Arnold Jerry (who also chairs the First Nations National Housing Managers Association) and Tsuu T'ina infrastructure manager Lee Crowchild. Additionally, traditional housing expert Mike Lickers and architect Tang Lee have experience with housing in Treaty 7 and other Aboriginal communities. These interviews informed the research design of all three cases, contributing to the framing of Aboriginal housing issues and problematic conditions, and subsequent formulation of interview protocols.

While undertaking this research, I also acted as project manager of the pilot project for one year (2009-2010), and as the Aboriginal relations manager and chair of the Aboriginal Advisory Council for one year (2010-2011). Thus much of the information presented and analyzed below is based on first-hand participatory observation, including both formal and informal interaction with members of Treaty 7 and other Aboriginal communities as detailed below.

Case Background: The Solar Decathlon Competition

The Solar Decathlon is an international design competition hosted by the United States Department of Energy, which challenges post-secondary student teams to design, build and operate full-scale solar powered homes.³⁷ The competition gets its name from the ten sub-contests by which each entry is judged. Its mandate is to demonstrate the viability of solar power in contemporary residential design, based on the capacity of solar related technologies to meet household demand for energy and hot water in an affordable, efficient and aesthetically pleasing manner. Identifying a specific target market and user group is a pre-requisite to entry. The introduction of an affordability sub-contest in 2011 was significant, highlighting the economic viability (or lack thereof) of proposed solutions.³⁸ Although competing entries are designed in an academic setting, they must adhere to international building code and exhibit full functionality of mechanical and electrical systems, appliances, lighting, and interior and exterior spaces.³⁹

Differences in the nature of this case necessarily impact the degree to which it can be compared to the previous two. For example, while Treaty 7 offered a functional definition of a target market for the purposes of the competition, it does not represent a

³⁷ Since its inception in 2002, the Solar Decathlon has fostered innovation in green building and clean technologies. While the 2011 prohibited use of significant battery storage and limited energy use to that available through global solar radiation, previous competitions have been more flexible, allowing innovative energy storage, and other alternative energy sources such as wind and simulated geothermal systems. Size restrictions in the competition also consistently encouraged creative approaches to flexibility of space and spatial function. As such, the publicly available designs generated by the Solar Decathlon are a valuable source of innovation relevant to contemporary Aboriginal housing.

³⁸ Unlike the MUP model, the Solar Decathlon's 2011 affordability sub-contest did not impose a hard limit. Rather, prototypes were evaluated on total cost, with \$250,000 representing a score of 100%, and costs beyond this leading to reduced points.

³⁹ For a complete account of competition rules and sub-contests see www.SolarDecathlon.gov.

well-defined community like those of the Seabird Island and Saugeen First Nations. Rather, significant diversity follows from the Treaty 7 Nations including but not limited to their respective housing issues, conditions and capacities.⁴⁰ Consequently, it was not possible to conduct the same level of background research as was used to formulate the previous cases, as this would have exceeded the overall time and resources available for thesis research.

Nevertheless, this project is seen as an important precedent for consideration. Numerous green building methods and clean technologies were used to respond to the prevalent Aboriginal housing issues and problematic conditions identified in the background research. Furthermore, participatory experience throughout the project's design and implementation provided insight that did not follow from the other cases. Extended consultation with Aboriginal community representatives was particularly valuable. This allowed for mutual trust to develop, which in turn facilitated a more in-depth exploration of root causes of the housing crisis. The nature of the project, and the length and level of personal involvement also fostered a greater understanding of the relationship between cultural design considerations and appropriateness, sense of ownership and belonging. Exposure to relationships between processes, objectives, and stakeholders across project phases was revelatory.

⁴⁰Signed in 1877, Treaty 7 was a peace agreement between the Queen of Great Britain and Ireland and the Kainaiwa/Blood Tribe, Piikani/Peigan, and Siksika/Blackfoot, Tsuu T'ina and Stoney First Nations.

Description of Housing Pilot Project

“I am pleased to see the traditional aspects relating to shelter being emphasized within Team Canada’s Solar Decathlon 2011 submission. As First Nations, we have always held close to our heart the environment and the responsibilities we have as people to sustain the land for future generations. This project demonstrates the ability to utilize environmental resources, and to provide shelter in a traditional design,” (Chief Charlie Weasel Head, Grand Chief of Treaty 7, quoted in Solway 2011).

The initial rationale for selecting the Treaty 7 First Nations as a target market was based in part upon lessons learned by members of the student team during and after the 2009 Solar Decathlon competition. The founding members of the 2011 project wanted to improve upon this precedent, where they felt that the impacts of the competition are too often limited to the event itself, that the 2009 project did not achieve its potential beyond these limits, and subsequently that return on investment would be increased if the 2011 project were more closely tied to real world needs and interests beyond this context. Based on some limited knowledge of the Aboriginal housing crisis, the student team sought collaboration with local First Nations, in order to explore:

- The potential for green building strategies to address critical Aboriginal housing issues;
- The viability of solar power in Aboriginal contexts;
- Modular construction and temporary foundations, as a means to circumnavigate barriers to private home ownership on reserve lands;⁴¹ and
- The potential for cultural considerations to improve appropriateness of contemporary Aboriginal housing.

⁴¹ Key informants confirmed the potential of such methods to allow for home ownership.

Figure 12a. Treaty 7 First Nations Housing Pilot



Figure 12b. Design Inspiration – Tipi



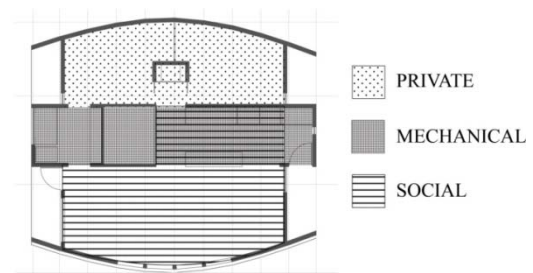
Figure 12c. Steel Sub-frame and SIPs



Figure 12d. Flexible Social Interior



Figure 12e. Floor Plan



Render 12a, photo 12c,d and e by Johann Kyser
 Photo 12b © Kim Lawrence, University of Calgary

Initial conceptual designs focused on key Aboriginal housing issues of mould, fire, shortages and rapid degradation, as outlined in chapter three. In response to these issues, magnesium oxide structural insulated panels (SIPs) were selected as the primary building material, where the product is durable, resists both fire and mould, and allows for rapid assembly. Product sponsorship was available, which was significant not only in the context of a student-driven academic project, but has also proven relevant in the previous cases. A preliminary version of the mechanical system was drafted during this phase, with the objective of reducing operating and maintenance costs through simplicity and efficiency relative to a conventional system. A purely electric strategy resulted (without solar thermal components), based on an air source heat pump, a bi-directional hydronic fan coil, and a heat recovery ventilator (HRV). While the absence of a solar thermal system decreases the overall cost effectiveness of the design, this choice was also expected to reduce maintenance needs and risk of mould from leakage of water circulation components.

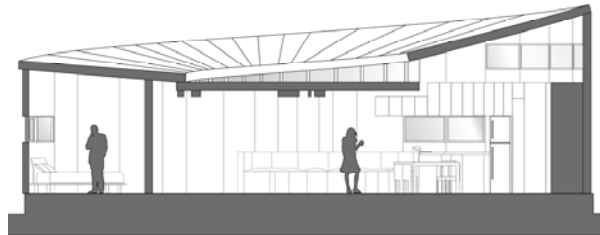
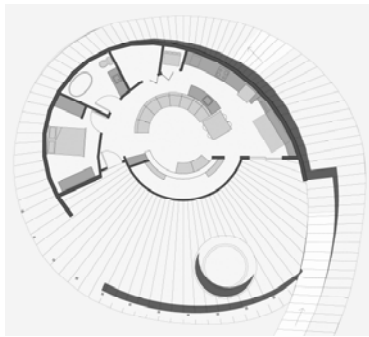
Initial community consultation included cultural orientation for the student team provided by Blood Tribe Elder Beverly Hungry Wolf and Blood Tribe Social Worker Arnold Jerry, as well as ongoing design consultation with Aboriginal Architect Wanda Dalla Costa and a design review with Grand Chief of Treaty 7 and Chief of the Blood Tribe Charlie Weasel Head.⁴² These consultations resulted in the elevated significance of Treaty 7 culture in the design process, and in particular the Tipi as a precedent for

⁴² The team's initial vision also included community capacity building as an outcome, to be achieved through partnership with one or more Treaty 7 trades institutions. This vision was not realized however, due to challenges of funding, logistics, and barriers to inter-institutional relationships.

traditional housing form and function in this area. Important design aspects that were singled out include the Tipi's rounded form and east-facing entrance, which provide spiritual connections to the sun as the source of all energy and life on earth (Crowshoe, R., pers. comm., December 2010-October 2011). The flexible interior of the Tipi, with social gathering space centered on the hearth, also informed the home's design.

Design concepts were developed through an architectural studio. The resulting strategy sought to push conventions of both modular and contemporary Aboriginal housing based on a pre-fabricated or 'kit-build' approach. Treaty 7 spirituality was integrated through rounded form and an east-facing entrance (see Figure 12a, e). Although passive ventilation is a key technological innovation of the Tipi, this was not integrated into the prototype. The product that emerged was given the name TRTL (pronounced 'turtle', short for Technological Residence Traditional Living), which conveys the design's overarching strategy to merge technology with tradition. An alternative design that was also based on facets of the Tipi received preferential feedback from some community informants. TRTL was preferred however, by several faculty members and industry professionals. Specifically, its perceived systematic nature was thought to be more readily modified and built in a student context, and would also provide consequent flexibility to adapt to different contexts beyond the competition. Figures 12d-e (above) illustrate the TRTL design concept. Figure 13 illustrates the other design concept produced at this time, dubbed 'Helio'.

Figure 13. Helio – Alternate Design Concept



Helio graphics © Matt Knapik, Genevieve Sihota, Michelle Smith and Nathan Flach

Following the design studio, representatives from within and beyond Treaty 7 were invited to form an Aboriginal Advisory Council (AAC) to the student team, in order to achieve more consistent and in-depth input from the community. The Council consisted of Lorna Crowshoe (Aboriginal Strategist, City of Calgary), Lee Crowchild (Infrastructure Manager, Tsuu T'ina First Nation), Monique Kimber (Communications Liaison, Calgary Urban Aboriginal Initiative), Chris Fry (Aboriginal Relations Representative, Esso), Shawna Cunningham (Director, Native Center, University of

Calgary), Dr. Jim Frideres (Director, International Indigenous Studies, University of Calgary), Mike Lickers (Director, Ghost River Rediscovery Initiative) and Lori Villebrun (Coordinator, Chinook Lodge, Southern Alberta Institute of Technology). Members of the AAC joined the project on a volunteer basis during the design phase, and served the project for approximately one year. Monthly meetings of the AAC were used to guide design and related activities such as branding and communications. The participation of the AAC during the competitive showcasing of the home in Washington, D.C. was a critical contribution.

At the AAC's recommendation, Spiritual-Cultural Advisor Dr. Reg Crowshoe was also invited to mentor the team and validate the project according to protocols of knowledge transfer and ceremony.⁴³ The role of Spiritual-Cultural Advisor was viewed by the AAC as a critical one, where local protocols dictate that traditional knowledge must be conveyed by individuals with transferred rights to do so. This knowledge is treated as highly sensitive, and cannot be conveyed without permission from such an individual. It was therefore integral to have the support of Dr. Crowshoe or another person with such knowledge and rights, if the project was to have the Treaty 7 community's blessing in identifying and adopting cultural housing traditions.

⁴³ The term 'Spiritual-Cultural Advisor' was put forward by the AAC as a more politically correct and accurate version of the term 'Elder'. The latter can be misleading, as it denotes specialized experience in a certain area of knowledge rather than indicating age; a person can become an 'Elder' at a very young age, and may be much younger than those upon whom he/she is responsible for providing guidance or imparting knowledge. Note that previous reference in the text to Elders is intentional, based upon individuals' own use of the term.

The design of TRTL progressed through the exploration of additional cultural considerations, strategies for transporting the modular home,⁴⁴ and engineering of mechanical and electrical systems. The AAC stressed that the home should itself be viewed as a living thing which comes from and returns to the natural order. This was to be achieved through the materials and finishes, the interior decoration, and the spatial function. Developments from this stage included a flexible floor plan resembling the Tipi, centered on the kitchen as a space for family and community gathering (see Figure 12d, e). Natural materials and a color palette that references the four elements and the Blackfoot medicine wheel were chosen. Final decorative elements include cultural items, and a winter count painted on a canvas liner that covers the vaulted ceiling. The winter count is a traditional pictographic story which in this case depicts the project's participants, the events surrounding TRTL's creation, and cultural phenomena such as the societal and familial roles of parents and children. This feature connects the home to Aboriginal oral culture and the role of narrative within it.

In order to realize TRTL's rounded form, a pre-fabricated galvanized steel sub-frame was designed to support the magnesium oxide SIPs. While this solution lacks cultural appropriateness as compared to a wood frame, steel was selected to avoid warping from humidity changes between Alberta and the competition site in Washington D.C. Preliminary sourcing indicated that steel was more cost effective than laminate

⁴⁴ Transportation included moving the home from Calgary, Alberta to the competition in Washington, D.C. and back, a total distance of approximately 3,700km or 2,300 miles each way.

wood. It also provides extreme durability.⁴⁵ The home's electrical needs are met by solar power, in the form of a grid tied 8.7 kilowatt photovoltaic array, connected to a series of micro-inverters. The size of this system and the grid tie model are discussed further in the case analysis. Micro-inverters were chosen to increase efficiency, and prevent system disruption in the event of individually shaded or damaged panels. These also allow per panel monitoring, and reduce voltages for safer installation.

Every successful applicant to the Solar Decathlon is awarded \$100,000 by the U.S. Department of Energy, conditional upon completion of specific competition tasks and deliverables. Beyond this, it is up to individual teams to determine requirements and sources for project funding. All resources for TRTL were raised by students, staff and community members of the team. The private sector was the primary source of donations for both funds and in-kind materials. The home was displayed publicly on the West Potomac Park in Washington D.C., from September 23rd – October 2nd 2011. It placed 10th out of 19 teams. Relationships between the goals, objectives and strategies of this case are summarized in Table 9.

⁴⁵ Hypothetically the steel sub-frame could be replaced by post-and-beam, laminate wood, laminate bamboo or even a conventional stick frame construction. Simplification of the structure would be a preferable first step as discussed under the case analysis, and such substitution would require new structural engineering analysis.

Table 9: Summary of Housing Pilot Project Goals, Objectives and Strategies

Goal	Objective	Strategy
Ensure occupant health & safety	<ul style="list-style-type: none"> • Prevent mould • Prevent fire • Provide high IAQ • Ensure structural and interior durability 	<ul style="list-style-type: none"> • Magnesium oxide SIPs: resist fire and mould, plus full sprinkler system • Simple, efficient, purely electric mechanical system based on HRV, air source heat pump; PV micro-inverters reduce voltage for safe installation • Ventilate key areas: kitchen range and bathroom fan • Durable hygienic finishes: cork floor, vinyl counters, glass tile; low VOCs • Durable structure: extended lifecycle estimated at 75-100 years
Deliver affordable solution with long-term view of economic viability	<ul style="list-style-type: none"> • Reduce O&M and replacement costs • Provide legal ownership on reserve lands as means to build equity 	<ul style="list-style-type: none"> • Purely electric highly efficient mechanical system to simplify operating and maintenance (including HRV, air source heat pump) • Photovoltaic (PV) power – 8.7kW net zero system, free up financial resources to contribute to rent/mortgage payments, potential FiT revenue; micro-inverters improve efficiency, allow per panel monitoring • Durability, lifespan (see health and safety) • Use of modular structure, temporary foundations
Explore strategies to achieve cultural appropriateness in Aboriginal residential design	<ul style="list-style-type: none"> • Explore potential for home to reflect worldviews, lifestyles, traditions, protocols, values, needs and interests • Determine whether appropriateness could increase sense of ownership, responsibility for the home 	<ul style="list-style-type: none"> • Solar power: sun viewed as traditional source of energy and life • Tipi inspired form: round, east facing entrance – relate home to sun, foster positive spiritual and spatial energy • Natural materials, colors: cedar, cork; colors of 4 elements, ochres • Connection to landscape: south facing patio and bay windows, round form • Oral culture: canvas interior with winter count references tipi liner, traditional pictographic story connects home to family, community • Ceremonies held to validate the home, named '<i>Spo'Pi</i>' in Blackfoot • 2-bedroom design in response to demographics of young families – maximize occupancy within 1000ft² competition limit • Flexible, open living space: centered on kitchen, fosters gathering, cooking eating according to community values • Non-load bearing wall between bedrooms allows for conversion to single bedroom or studio/office to accommodate changes in household structure.

Analysis of Housing Pilot Project

The monitoring and judging of TRTL in the Solar Decathlon 2011 offers important data for consideration. Simultaneously, acknowledging the project's initial intent – to connect with real world needs beyond the competition scope – is integral to a comprehensive assessment. Analysis of the case thus considers not only the competition findings, but also the design process, objectives and strategies, and lessons learned through implementation.

In many Aboriginal cultures it is customary to acknowledge the local Native peoples when you are on their land. The location of the University of Calgary within traditional Treaty 7 territory thus provided a strong foundation for working with this community. The project acted as such an acknowledgement, as well as a means to showcase and celebrate Treaty 7 culture on an international stage, and to raise awareness of the Aboriginal housing crisis. These factors contributed to community members' willingness to participate, and allowed for more frequent access to and collaboration with individuals and organizations.

Unfortunately the academic setting of the project proved to be far from ideal, where institutional priorities at faculty and executive levels were misaligned with those of the student team and the community. At the faculty level, the students who founded the project were barred from participating in the initial design studio, which was made available only to third year architecture students. These students had no previous exposure to the initiative, and did not remain involved after the course's completion. This undermined recruiting and initial attempts at interdisciplinary integration. It also created

lasting friction between the project's architectural and engineering strategies, where the studio failed to adhere to key objectives established by founding members during the proposal phase, such as ease of construction and transportation.

At the executive level, the project experienced an overall lack of support, and critical project decisions were made without consulting the student team. The institutional veto of monetary compensation for core roles and responsibilities was particularly damaging. This occurred a year into the project, and resulted in high turnover, which in turn undermined the student team's ability to receive and respond to community input as detailed below. Additional tension and conflict emerged from the lack of financial control granted to the students, the overall unwillingness of the executive branch to communicate directly with them, and repeated attempts by the executive to terminate the project. These dynamics led to mistrust, undermined the relationship with the Treaty 7 community, and greatly increased risk of project failure.

Relationships between community representatives and other parts of the team were also at times strained. The student team was relatively inexperienced in terms of Aboriginal initiatives, including relevant history, cultural protocols and sensitivities, methods for achieving inclusiveness, and appropriateness of language. The project's short and demanding schedule made it difficult to address this inexperience and to achieve comprehensive community participation. These issues were exacerbated by the aforementioned institutional challenges. The high rate of turnover within the student team undermined consistency of objectives and strategies, and transfer of knowledge from the community. Numerous design processes had to be repeated including community

consultations. Subsequent delays further shortened timelines, and limited response to community input.

In light of these challenges, it would have been preferable to obtain formalized support from the University prior to the project's inception, including agreement on foundational strategies and organizational structure. It also would have been preferable to form the AAC and engage the Spiritual-Cultural Advisor prior to initiating the design process. This may have helped to better establish roles, responsibilities, and a more unified strategic vision between the competition requirements and the community's values, needs, and interests.

Insistence by the AAC that their input exceed that found in a more conventional designer-client relationship was of particular significance to project outcomes. Their central role in project decision-making and their participation in the competition itself were critical to accurately and authentically representing Treaty 7 First Nations culture and identity. At times the community's role in decision-making challenged other team members' sense of ownership and control. Patient and respectful dialog was integral to resolving conflict and achieving consensus. Aboriginal communication protocols such as talking circles were particularly valuable in addressing tension and bridging cross-cultural misunderstandings. Ultimately these challenges were overcome, with results consistently viewed by participants as a true and meaningful partnership. This became a defining characteristic of the project itself, and was critical to developing a better understanding of cross-cultural challenges and opportunities in this context.

Input from Treaty 7 community representatives was particularly valuable in confirming root causes of contemporary housing issues, and identifying opportunities to address these through project design. Long-term relationships allowed sufficient trust to develop, where participants were then willing to share personal experiences of attempted cultural assimilation, malignant policy, substandard housing, and the influence of these forces on Aboriginal peoples' current struggles with identity, marginalization and dispossession. Spiritual-Cultural Advisor Dr. Reg Crowshoe emphasized challenges associated with knowledge gaps in Aboriginal communities that have emerged since colonization, and the misunderstandings that have occurred between Aboriginal and non-Aboriginal cultures. His teachings point to identification of parallels between these groups as an important means to bridge gaps and to improve cross-cultural relations.

Following the guidance of Dr. Crowshoe, ceremonies at specific locations and times throughout the TRTL project became an integral part not only of validating the project according to community protocols, but also of facilitating cross-cultural learning and appreciation for different perspectives. Four ceremonies were used to mark significant events over the course of the project, including the naming of TRTL in the Blackfoot language – *Spo'Pi*, which means turtle, or literally 'lives on stilts'.⁴⁶

In accordance with Crowshoe's teachings, these ceremonies used venue, action, language and song. These are the traditional vehicles for validation in oral cultures, and parallel methods of validation found in Western cultures. For example, oral cultures may use a song may to denote ownership or accomplishment, just as Western society would

⁴⁶ That *Spo'Pi* translates into 'lives on stilts' is particularly fitting given the intent for temporary foundations to foster legal ownership of the home on reserve lands.

use a written deed or certificate. The existence of such parallels is an important consideration for future housing initiatives. They may help to bridge cross-cultural gaps, and to translate and interpret non-Aboriginal systems within Aboriginal communities. It is absolutely essential that the inclusion of ceremonies and protocols be determined by the community in question on a case by case basis.

The value of solar power in Aboriginal contexts was initially acknowledged as ambiguous by the founding members of the student team. Expectations centered on the potential benefit of distributed energy as an important but ill-defined area in this context. The primary anticipated challenge was the high cost associated with photovoltaic panels. A critical finding that was not anticipated was the substantial amount of support for solar power that was expressed by Treaty 7 participants as a result of its synergy with their own spirituality. This synergy emerged through the course of the project, as local values and beliefs were revealed. Although it is impossible to quantify the benefit of such a connection, it clearly influenced community interest and buy-in in this case, and could prove significant in other contexts where similar beliefs are held.

Community representatives and public observers of the competition also expressed significant interest in the potential of solar power to provide independence from conventional energy sources, especially in remote communities. The degree to which the TRTL design pursues such independence was determined in part by the competition rules, which prohibit significant battery storage, and dictate that all prototypes be tied to a micro-grid. Thus TRTL does not represent a grid-independent

design.⁴⁷ Rather, the home was engineered to generate as much or more energy than it consumes over the course of a year (annual net-zero). In this way, TRTL's solar power and efficient design offsets operating costs and environmental impact by reducing demand for conventional energy sources.

The grid tie model is based on real world applications, wherein conventional energy sources are used to counter the intermittency of alternative ones. The existing grid provides electricity when the alternative source cannot. In the case of solar technologies, excess energy is produced during peak times (daytime, especially during summer), fed onto a conventional grid, sold to the existing service provider via a feed-in tariff, and repurchased during non-peak times (night, or cloudy/rainy conditions).⁴⁸

In addition to countering the intermittency of alternative energy sources, the grid-tie model introduces the potential to generate revenue should the occupants' energy production exceed their consumption. While the potential for revenue is enticing, it should be noted that alternative energy development remains risky. The Seabird Island First Nation case demonstrates the uncertainty and complexity of the emerging regulatory environment for alternative energy, and specifically grid-ties and feed-in-tariffs. In that case, the benefits of the wind power installation went unrealized despite support from provincial government and the local service provider.

⁴⁷ Such a design would require energy storage mechanisms, related control systems and greater production capacity, each of which would also incur added cost.

⁴⁸ Preliminary net metering of TRTL occurred in Washington D.C. for the 10 days of competition. The home consumed more energy than it produced at this location and time. These results are not sufficient to determine likely outcomes of annual performance however. Washington DC experienced substantial cloud cover and rain during the test period, whereas performance was modeled for a 12-month balance in Alberta. Further testing is required to determine if the system captures energy as intended.

Without feed-in tariffs, the high initial costs associated with developing alternative energy systems may be prohibitive. Where feed-in tariffs are present, long-term policy stability is highly desirable in order to ensure that costs will continue to be offset and associated benefits realized throughout the project's lifespan. Such stability depends heavily on context.⁴⁹

The official competition cost estimate for TRTL was \$286,051.31(USD), including landscaping features, labor and transportation.⁵⁰ While this price point exceeds the resources of many Aboriginal communities (and likely all regional MUPs), several factors must be considered before drawing conclusions as to the prototype's economic viability. Firstly, this estimate represents the cost of a one-time build. In keeping with the team's vision of a pre-fabricated 'kit-build', real world applications would ideally be based on mass production, which would reduce production costs. Secondly, TRTL's structural lifecycle is estimated at 75-100 years or more, which is a dramatic improvement relative to current housing in many Aboriginal communities. The photovoltaic system represents approximately 20% of the total initial cost, or \$59,000 (CDN), including installation.⁵¹ During the anticipated structural lifespan, the PV system will need to be replaced approximately three times. Even if PV prices remain constant

⁴⁹ A comprehensive evaluation of the grid-tie model's applicability in Treaty 7 First Nations and other Aboriginal contexts is beyond the scope of this research. Viability depends upon a number of complex and interrelated factors including but not limited to: current energy sources, pricing, and infrastructure; provincial energy policy, including feed-in-tariffs; willingness of local service providers to implement feed-in technology; quantity and quality alternative resources; and the cost, efficiency and scale of technologies deployed.

⁵⁰ Internal estimates by the team remain outstanding. Where TRTL is approximately 1000ft², this works out to \$294(USD) per square foot. See competition rules for detailed information on how transportation was estimated and normalized between teams.

⁵¹ Within the grid tie model, the PV could also be complemented or substituted for more cost effective alternatives such as solar thermal, wind, or geothermal systems.

over this period, overall costs including this replacement remain competitive with current reserve housing in the long term.⁵² To generalize for purposes of comparison:

- The poorest quality of contemporary Aboriginal housing necessitates recurring investment of approximately \$100,000 per unit every 10 years for 100 years.
Total = \$1,000,000
- Intermediate quality Aboriginal housing necessitates recurring investment of approximately \$100,000 per unit every 25 years for 100 years. Total \$400,000
- TRTL represents an initial investment of \$300,000, plus PV replacement costs of \$60,000 every 25 years. Total = \$480,000

This preliminary estimate suggests that TRTL is economically viable in the long term, without accounting for added value from reduced environmental impact and synergies with the community's spiritual beliefs. A more comprehensive assessment falls beyond the scope of this research, but would necessarily include such factors as:

- Potential cost reduction from mass production;
- Reductions in PV pricing over this period (Barbose, Darghouth, Wiser, and Seel, 2011);
- Increased pricing of conventional sources over this period;
- Broader economic and environmental implications of reduced demand for conventional energy sources;
- Potential for FiT-based revenue, and numerous areas of added value discussed below.

Unfortunately, TRTL's cost is prohibitive to many Aboriginal communities regardless of long term value, with MUP potentially representing an additional impasse.

⁵² The actual frequency and cost of replacement will depend heavily upon on industry trends, which have recently seen significant reduction in prices and increases in efficiency. Replacement need is cited here as once every 25 years based on manufacturer warranty, and specifications of efficiency decrease below 80% after this period.

Numerous key informants supported modular construction and temporary foundations as a strategy to facilitate private home ownership on reserve lands.⁵³ The objective would be to provide a mechanism for individuals to mortgage the unit without possessing land title. This would in turn allow individuals and families to build equity and finance improvements, for example through renovations, upgrading, and/or starting a small business or farm. Feasibility of this approach depends in part upon the capacity of enforcement bodies to seize mortgaged assets, which in turn depends upon ease and cost of (dis)assembly and transportation.⁵⁴ TRTL's design fails in this regard, where a large crane and 6 flatbed trucks are required for (dis)assembly and transportation. Other entries in the 2011 and previous Solar Decathlon competitions offer superior precedents. In particular, Illinois' 2011 pre-fabricated disaster relief housing can be shipped on a single truck and reassembled in less than 24 hours. Looking forward, a key challenge to achieving this objective is the merging the ease and cost of transport and (dis)assembly with a culturally responsive design.⁵⁵

Indeed, simplification is a critical next step to commercial viability of TRTL overall. The initial design approach – to push formal boundaries of modular and Aboriginal housing – can be viewed as both the project's greatest strength and its greatest

⁵³ TRTL is intended to rest on screw piles, which must be evaluated according to local conditions. One key informant did express doubt in the soundness of this approach, citing connectivity of modules as source of building envelope failure in existing modular projects. It was not however the legal underpinnings of the approach that were questioned.

⁵⁴ Capacity for seizure of assets is further complicated by location on reserve lands, requiring enforcement by local agencies. This dependency might deter external institutions from entering into the necessary mortgaging agreements in the first place, unless sufficient trust can be established between stakeholders.

⁵⁵ The competition's rules also include size restrictions, which encourage creative approaches towards spatial efficiency and flexibility. Innovation in this area may prove valuable in addressing overcrowding in Aboriginal contexts. Measures to expand sleeping capacity are of particular importance, but must be evaluated according to contextual criteria, including the need for durability.

weakness. The design broke numerous conventions of architectural and industry practice, resulting in a uniquely appropriate form that resonated with Treaty 7 spirituality and values. Community representatives supported the idea that such a design could foster a sense of identity in and ownership for the home, which could in turn lead to increased responsibility for it.

Simultaneously, the complexity of TRTL's form results in numerous challenges that result in misalignment with facets of the Aboriginal housing crisis. The building's shape is ill-suited to the original manufactured form and structural characteristics of the SIPs, necessitating significant modification, and inclusion of a custom built sub-frame, with associated increases in material and labor costs.⁵⁶ The large number and unusual nature of connections increase risk of leakage and therefore of mould. The home's rounded roof and floor plan present additional challenges to photovoltaic efficiency, as well as mechanical systems design and cost. The disassembly strategy that follows from this shape further results in recurring damage to the SIPs, limiting the number of times that the structure can feasibly be moved. Beyond impacting cost, durability, and systems, the complexity of the design challenges buildability and replicability, and thereby fails to respond to issues of capacity and overall demand in Aboriginal contexts.⁵⁷ Analysis of this case is summarized in Table 10.

⁵⁶ For the competition, steel was sourced more readily and affordably than glue laminate wood. Timber framing was ruled out due to potential warping from humidity changes between Alberta and Washington D.C. (as experienced in the 2009 post and beam construction). In exploring substitution, all options would need to be compared relative to objectives of affordability, durability, health and safety.

⁵⁷ As an emerging technology, SIPs themselves are subject to unfamiliarity relative to conventional methods such as stick frame. Beyond their benefits to health and safety, they do offer advantage of prefabrication in controlled conditions. Their availability may be limited however, and the custom sub-frame required by the design likely presents additional supply chain challenges.

Case Conclusions

The Treaty 7 First Nations case offers important insight into the challenges and opportunities of implementing green building methods, clean technologies and cultural design considerations in Aboriginal communities. This case was particularly valuable for its unique exploration of culturally appropriate Aboriginal housing design, the importance of which was strongly emphasized by community representatives. Community input in the design process was integral to their sense of ownership, and to the project's authentic representation of Aboriginal culture. The inclusion of traditional protocols for validation further fostered community support and cross-cultural learning.

The home itself provides numerous reference points for future initiatives. The synergy between traditional spirituality and the use of solar power resulted in a foundation for community buy-in. Traditional form, function, materials and colors helped to realize the Aboriginal Advisory Council's vision of the home as a living part of the greater natural order. Meeting community need for structural durability and promotion of occupant health and safety were also key strengths. Lastly, the potential to facilitate private ownership on reserve lands through the use of modular construction and temporary foundations marks an important area for future research.

In terms of weaknesses, outcomes of the project are not dissimilar from the Seabird Island First Nation's pilot project. As in that case, the cost and complexity of the TRTL design was misaligned with community resources and capacity. These objectives were not sufficiently prioritized relative to others, such as the decision to push formal boundaries of contemporary modular and Aboriginal housing. The commercialization

potential of the prototype thus depends heavily on design simplification and cost reduction. These remain realistic goals however, and define important areas for future research.

The prohibitive cost of TRTL should not necessarily be viewed as an outcome of exploring cultural appropriateness. That said, cost was influenced by the project's exploratory nature, including its unique culturally responsive form. To avoid similar risk in future projects, relationships between variables – for example those between form, material selection, and modular (dis)assembly and/or transportation strategy – must be carefully considered. It is difficult to determine whether a less ambitious and exploratory approach to design would have achieved the same degree of cultural appropriateness. Had timelines allowed however, it is entirely possible that a less complex but equally appropriate form may have emerged. While this approach certainly increased complexity and overall risk, it also fostered innovation, and resulted in a strong foundation for future research.

Table 10a: Strengths and Weaknesses – Design Process

Note: Tables 10a and 10b summarizes the analysis of the Treaty 7 First Nations case according to the strengths and weaknesses exhibited within the communities and by the sustainable housing pilot project. It is critical to note that these are determined by the case context, and may result in different outcomes under different circumstances. Accurate interpretation of these tables therefore also relies upon due consideration of the case description.

	Strengths	Weaknesses
Design Process	<ul style="list-style-type: none">• Acknowledgement of institution’s location within Treaty 7 territory by student team acted as important foundation for community outreach, buy-in• Patient and respectful dialog aided conflict resolution, informed consensus• Length and extent of partnership fostered trust necessary to broach sensitive topics• Adherence to community protocols of knowledge transfer greatly increased two-way cross-cultural learning• Validation according to local tradition increased community buy-in, support	<ul style="list-style-type: none">• Short and demanding schedule challenged degree of and capacity to respond to community input, resulting in increased tension• Formal consultative board established after (not prior to) initiation of design process - undermined clarity and consistency of roles, responsibilities, objectives, strategies• Team inexperience in Aboriginal contexts: ignorance of protocols, sensitivities, significance of inclusiveness• Inability to compensate for participation undermined commitment, accountability, and drove high turnover of participants• Institutional prioritization of architecture, exclusion of other disciplines undermined holistic vision, interdisciplinary integration

Table 10b: Strengths and Weaknesses – Objectives and Strategies

	Strengths	Weaknesses
Objectives, Strategies	<ul style="list-style-type: none"> • Prioritization of health, safety, durability, cultural considerations • Synergy between PV and worldview increased community buy-in, support • Long-term view of economic viability through reduced O&M, replacement costs • Facilitate legal ownership through modular construction, temporary foundations • Potential for reduced cost via mass production • Reduced environmental impact through alternative energy, energy efficiency • Opportunity to generate revenue through solar power + FiT 	<ul style="list-style-type: none"> • Initial capital cost exceeds community economic resources, and likely MUP • Grid tie depends on existence of conventional energy sources, dedicated feed-in infrastructure, policy and service provider support of grid tie/FiT, which does not yet exist in Treaty 7 regions • Architectural form increased cost and complexity of construction, systems design, (dis)assembly and house transport; ill-suited to materials and community capacity • Complexity and cost of transportation and (dis)assembly hinders ability to seize mortgaged asset, undermining goal of modularity as vehicle for ownership • Absence of solar thermal reduces cost effectiveness

CHAPTER 9: CASE COMPARISON

This chapter offers a brief comparison of the case study findings. Comparison is based upon the conventional strengths and weaknesses related to housing within the case communities, as well as the strengths, weaknesses, synergies and trade-offs that were encountered during their sustainable housing pilot projects. The background research, case studies and their comparison facilitates the identification of key factors influencing housing in the case study communities. These factors and their implications for housing design are discussed in the final chapter, which offers strategic recommendations for future initiatives, and identifies important areas for further research.

Conventional Strengths and Weaknesses in Aboriginal Housing

Housing conditions across all three cases are largely consistent with those identified in the background research, including high instances of mould, crowding, shortages, inadequacy, and short building life spans. The Seabird Island, Saugeen and Treaty 7 First Nations exhibit numerous strengths and weaknesses related to addressing these housing needs and issues,

Considering housing related strengths, the Seabird Island and Saugeen First Nations communities have members skilled in construction related trades such as plumbing and carpentry, which provide an important foundation for addressing housing needs. Saugeen capacity includes training in R2000 methods, and in this case precedents for self-construction have contributed to previous capacity and awareness building. Seabird Island's trades are supported by their local community college. In both communities local housing departments are able to independently conduct home

inspections. This allows for independent identification and assessment of adequacy issues and their direct causes, which in turn supports the development of locally appropriate responses such as tenant education and housing plans. The degree to which these strengths are present in Treaty 7 First Nations varies, but as indicated earlier, a detailed account at this scale falls beyond the scope of this research. Key informants across all cases identified community support as integral to the success of housing programs. As indicated in the background research, community-based planning and design provides an important venue for gaining this support, and for developing increased understanding of needs, interest and subsequent appropriateness of strategies. Diverse education methods are being used in these communities, to raise occupants' awareness of home operations, maintenance, and prevention of building failures.

Weaknesses to address problematic housing conditions in these communities stem from insufficient resources and capacity. Lack of overall revenue and revenue diversity – including absence or dysfunction of rental programs – makes it difficult to overcome resource insufficiency and alleviate dependency on federal funding. Insufficiency of economic resources inhibits the provision, administration and management of housing by local governments. Inexperience with housing management drives high turnover, which exacerbates existing challenges.⁵⁸ The lack of specialized skills such as architecture and engineering within these communities inhibits the independent development of improved designs. Occupant lack of responsibility, sense of entitlement, and knowledge gaps

⁵⁸ While in the Treaty 7 case turnover resulted from problematic relationships between stakeholders, its negative impact was nevertheless significant, undermining consistency of objectives, communication between stakeholders, and ability to respond to community needs.

surrounding home systems, maintenance and broader market function drive adequacy issues, and exacerbate to resource challenges through arrears. And demographic challenges exacerbate substandard housing conditions, for example through high rates of transition, large families, low employment and/or low income.

Strengths and Weaknesses of the Housing Pilot Projects

This section summarizes key strengths and weaknesses of the housing pilot projects, which follow from the relationships between context, project goals and strategies and subsequent outcomes. Comparison of the projects offers additional insight into the factors influencing new Aboriginal housing projects, including but not limited to green building and cleantech implementation. It is difficult to generalize about what constitutes a strength or weakness. Indeed, what provided strength in one case created weakness in another, because different strategies were adopted or because the influence of context was different. Table 11 provides an overview of the factors contributing to the successes of the pilot projects.

While understanding what makes a project succeed is critical, understanding what factors undermine success – i.e., factors that led to failure in the pilot projects – is of equal importance. This is particularly true where weaknesses drive or augment each other. For example, problematic relationships between stakeholders may lead to complexity in design. Subsequent misalignment with community capacity may in turn incur additional expenses, thereby augmenting existing resource challenges. Understanding types of weaknesses, their origins, and relationships between them may

help prevent pitfalls, mitigate risk and ensure positive change. The comparison of factors contributing to pilot project failures is presented in Table 12.

Beyond strengths and weaknesses, numerous synergies and trade-offs also emerged throughout the pilot projects. Synergies occurred where individual strategies were used to simultaneously address multiple objectives, as outlined in Table 13. Integrating synergistic strategies into a given design may lead to added value and efficiency by reducing the number of strategies and/or amount of resources required to meet various objectives. For example, concrete radiant slabs contribute to occupant comfort, durability, prevention of mould and reduced operating and maintenance costs. Of central importance to this research, the case studies confirm the synergy between alternative energy and traditional Aboriginal worldviews. By definition these technologies reduce dependence on conventional sources of energy. They may also reduce operating costs and even generate revenue. Simultaneously, their consistency with traditional Aboriginal values – which place a high degree of importance and respect on the natural environment – provides a foundation for community support and buy-in. Understanding how the competitiveness of alternative energy and other decentralized systems may be affected in remote locations is thus an important area for future research.

Trade-offs occurred within the pilot projects where competing objectives were not balanced or reconciled. For example, the use of magnesium oxide SIPs in the Treaty 7 pilot project represented a trade-off between occupant health and safety and environmental impact: the high embodied energy of expanded polystyrene (EPS) insulation was tolerated in light of the SIPs capacity to resist both mould and fire. The

occurrence of trade-offs highlights the importance of clearly establishing priorities early in the design process. This may help to keep a project on track and on schedule, and mitigate the potential for conflict. The community must play a central role in this process, a concept which is discussed further in the following chapter.

Table 11: Factors Contributing to Housing Pilot Project Successes

+ SIFN = Seabird Island First Nation, SFN = Saugeen First Nation, T7FN = Treaty 7 First Nations

++ Benefits not realized in this case

+++ Predicted but must be demonstrated through full life cycle

		Cases+		
Factors	Outcome	SIFN	SFN	T7FN
Community input in planning, design, validation ceremony		•	•	•
	Improved response to community values/needs/interests	•	•	•
	Increased sense of ownership, pride		•	•
Partnered with external stakeholders		•	•	•
	Knowledge sharing, established connections for future initiatives		•	•
	Reduced costs		•	•
Accessed new funding sources		•	•	•
	Allowed design innovation	•		•
	Reduced financial burden on local government+++	•	•	•
Self-construction		•	•	
	Increased capacity through training, experience, employment		•	
	Increased sense of ownership, pride		•	
	Generated interest/awareness in broader community	•	•	
Adopted Green building: innovative construction and system design		•	•	•
	Reduced O&M, replacement costs		•	•
	Increased building durability, life span+++	•	•	•
	Improved occupant health, energy, material and/or water efficiency	•	•	•
	Reduced land requirements, infrastructure costs	•	•	
Adopted Cleantech: alternative energy and efficient systems design		•	•	•
	Increased community buy-in, support	•	•	•
	Reduced dependence on conventional energy sources	++	•	•
	Local policy support improves economic viability	++	•	
Interior design based on demographics, lifestyles	Improved response to current and evolving community needs	•	•	•
Modular Design	Potential to facilitate on-reserve ownership			•
Sought Energuide rating	Contributes to assessment, comparability, development of best practices		•	

Table 12: Factors Contributing to Housing Pilot Project Failures

		Cases*		
		SIFN	SFN	T7FN
Factors	Outcome			
Misalignment with community capacity		•		•
	Complexity undermines ability to (re)implement/operate/maintain	•		•
Misalignment with community resources		•		•
	Perceived cause for lack of federal government follow-up	•		
	Cost inhibits (re)implementation, operations, maintenance	•		•
Problematic relationships between stakeholders		•	•	•
	Undermined community input in planning, design		•	•
	Resulted in increased design complexity, cost	•		•
	Necessitates construction in unfavorable conditions	•	•	
	Undermined knowledge/capacity transfer	•		•
	Undermined benefits associated with specific technologies	•		
	Undermined establishment of best practices	•		•
Unfamiliarity and/or uncertainty surrounding methods/technologies		•	•	•
	Scheduling issues, delays	•	•	•
	Cost overruns	•		•
	Structural or Technological failures	•		•
Insufficient mechanisms for auditing, formal feedback		•	•	
	Undermined accurate sense of project costs	•		
	Undermined best practices related to design	•		
	Undermined best practices related to capacity building		•	

Table 13: Synergistic Strategies

Strategy	Objectives										Cases		
	Inhibit mould, provide IAQ	Increase durability, lifespan	reduce O&M, replacement costs*	Increased efficiency (energy, H ₂ O, material)	Reduced dependence on conventional energy sources	Reduced impact on the environment	Increase community support, buy-in, ownership, pride	Flexibility of spatial function	Keep resources within community	Build Capacity	SIFN	SFN	T7FN
Community input in design, planning							•			•	•	•	•
Self-construction							•		•	•	•	•	
Paperless drywall	•	•	•			•					•	•	
Magnesium oxide SIPs	•	•	•			•							•
Insulated concrete forms	•	•	•									•	
Radiant slab, thermal battery	•	•	•			•					•	•	
Efficient systems, appliances	•	•	•	•	•	•					•	•	•
Rough-in for mechanical retrofit						•		•			•	•	
Durable, efficient envelope	•	•	•		•	•					•	•	•
Healthy finishing	•						•				•	•	
Hard flooring	•	•	•								•	•	•
Alternative Energy		•	•		•	•	•				•	•	•
Local natural materials		•	•	•	•	•	•				•	•	•
Repurposed materials		•	•			•	•				•		
Physical orientation				•	•	•	•				•		•
Interior spatial design, function							•	•			•		•
Modular, temporary foundations							•	•					•

* These strategies may also contribute to keeping resources within the community, where O&M and replacement are currently the responsibility of local government.

Key Contextual Factors

The background research, case studies and their comparison point to the following key contextual factors influencing housing initiatives in these communities, namely:

- Housing conditions and their direct causes;
- Availability of economic resources, including overall amount as well as diversity of revenue sources;
- Housing development and management capacity, including planning, design, implementation, operations, maintenance and administration; and
- Stakeholder relations and dynamics, including those between different levels of government, occupants, and external parties involved in funding, planning, design and/or implementation.⁵⁹

These factors have the potential to significantly impact housing projects including but not limited to the implementation of green building methods and clean technologies. While the nature and degree of influence varies from one case to the next, this research supports the assertion that these factors are of central importance to housing outcomes in many Aboriginal communities. These factors can therefore be considered determinants of cultural appropriateness of housing strategies in this context. Relationships between strategies, contextual factors and cultural appropriateness are explored further in the next and final chapter.

⁵⁹ While providing ample grounds upon which to explore cultural appropriateness, the contextual factors listed here are by no means thought to be exhaustive.

CHAPTER 10: RECOMMENDATIONS AND FUTURE RESEARCH

This final chapter begins with an overview of findings from the background research and case studies, highlighting important points for consideration. The concept of cultural appropriateness is then examined in relation to these points, including the key contextual factors influencing Aboriginal housing. This is followed by recommendations to improve Aboriginal housing design. The chapter closes with the identification of important areas for future research, and conclusions of the research.

Recapitulation

In order to develop recommendations for improving Aboriginal housing design, it is first necessary to recapitulate pivotal content from the previous chapters. This work began by identifying pre-contact foundations of Aboriginal cultures. Of central importance are the close relationships with and respect for nature found within these cultures, which led to complex bodies of interrelated knowledge and practices, and fostered worldviews based on holism, collaboration and balance.

Research then examined colonialism and its impact upon Aboriginal peoples. Colonization thoroughly disrupted Aboriginal cultures, and was accompanied deliberate attempts to assimilate and terminate them. Outcomes of colonialism include lasting dependency on and mistrust of the state within Aboriginal communities, as well as generational gaps, disconnects between traditional and contemporary knowledge and practices, and subsequent sense of marginalization and dispossession. Contemporary policy, legislation and other systemic forces perpetuate colonial dynamics and cross-

cultural inequities. The Aboriginal housing crisis has emerged from this history, with the issue of culture at its epicenter.

Understanding Cultural Appropriateness

The term ‘appropriate’ indicates when something fits well within a given context. Overcoming the Aboriginal housing crisis depends upon improved appropriateness of housing – of the fit between housing strategies and different Aboriginal cultures and communities. The following sections summarize how this research has enhanced our understanding of appropriateness in this context, and the resulting implications for housing initiatives.

It is critical to note at the outset that, ultimately, it is up to individual Aboriginal communities to define for themselves what is appropriate. Any attempt to externally dictate this would be inherently colonial, and so problematic for the reasons cited throughout this research. Further, a centralized or uniform approach would by nature fail to address the significant variety of contextual factors influencing housing outcomes, as identified above. Thus this research does not take a prescriptive approach to defining appropriateness or the processes or methods for achieving it. Rather, the intent is to identify factors that may be used to determine appropriateness in different contexts.

It should also be noted that the relevance appropriateness is certainly not limited to housing. Rather it can and should be explored in relation to various societal structures and processes. While such diverse applications fall beyond the scope of this research, these may well be interwoven with housing. Defining and improving appropriateness in other areas may therefore affect housing outcomes and vice versa. Ideally this section of

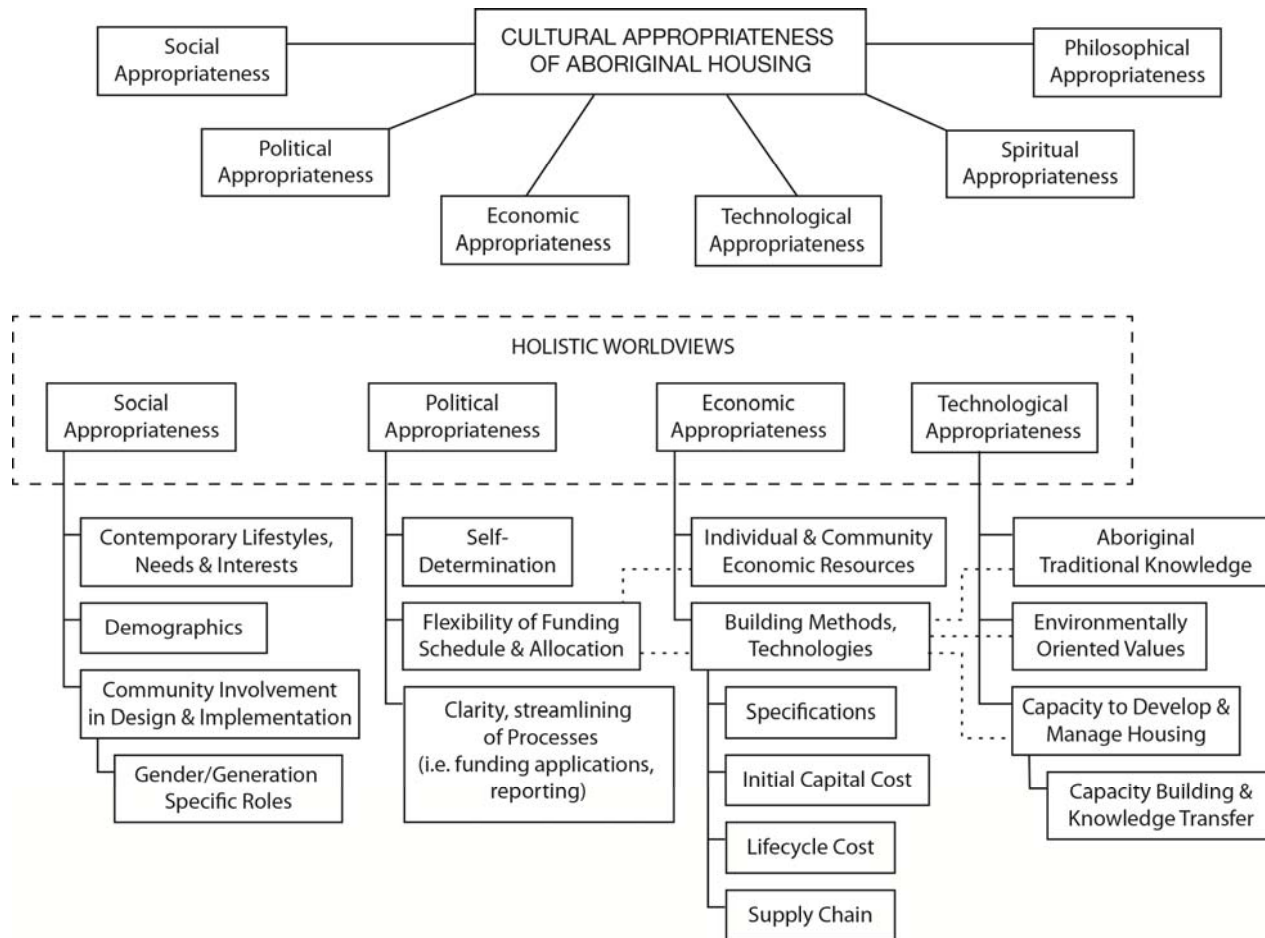
the research will provide bases for further exploration of appropriateness in relation to housing and other areas, both within and beyond Aboriginal cultural contexts.

The case study findings indicate that the appropriateness of Aboriginal housing strategies depends upon harmonious relationships between:

- the specific culture in question;
- the housing issues and conditions found therein;
- the direct, indirect and root causes of these; and
- other key contextual factors affecting outcomes.

The question of fit is thus complex, and what may be classified as appropriate is broad and highly variable from one community to the next. The following taxonomy has been developed to manage this breadth, complexity, and variability. It indicates that, insofar as housing is influenced by phenomena within different spheres (e.g., social, economic, political, technological), appropriateness in these areas are seen as contributing to a higher level category of cultural appropriateness. This follows from the definition of culture applied within this research, namely the collective engagement of its members in social, economic, political, environmental, technological, legal, philosophical and spiritual spheres (Andreatta, 2010; Bailey and Peoples, 2011). It also follows from the assertion that Aboriginal cultures exhibit distinct circumstances in these areas that require equally distinct responses. The cultural appropriateness framework is illustrated in Figure 14. The diagram is not intended to be exhaustive in terms of pertinent factors. Rather it provides examples of how these spheres are interconnected within housing. Further exploration on the topic marks an important area for future research.

Figure 14. Cultural Appropriateness of Aboriginal Housing



This conceptualization of cultural appropriateness is strong insofar as it is comprehensive, encompassing the many processes, principles and disciplines involved in housing. Further, it acknowledges the influence of colonization across these spheres, for example in diminishing housing related capacities and economic resources, and the subsequent need to respond to this influence. A comprehensive approach to cultural appropriateness is all the more important where Aboriginal worldviews typically assert holism, rather than categorical isolation as found in Western scientific paradigms (King, 2003). An interrelated approach to these phenomena is thus itself culturally appropriate.

Simultaneously, the breadth of this framework presents a challenge to a concise definition that can be readily applied to a housing project. It also threatens to erode the boundaries and meaning of existing concepts such as technological appropriateness and affordability. That said, it is easier to pare down an overly comprehensive definition, rather than to build off of one that is initially too limiting. Moreover, if applied properly, the framework upholds the integrity of the concepts involved, and facilitates greater understanding of how they are interrelated. The following discussion provides insight into these concerns.

Akubue (2002) defines technological appropriateness as an approach to community development that includes bodies of knowledge, techniques, and underlying philosophies. It is transitional and dynamic, accompanied by the intent to build skills, resources and capacities, and to adapt to changes in these areas. As such, technological appropriateness is a response to culturally specific phenomena. The Seabird Island First Nation pilot project offers an illustrative example. In this case, the ecological orientation of the green building methods and clean technologies aligned with the community's

underlying philosophy and values. Yet the highly customized approach to design and construction was ill-suited relative to the community's economic resources and technological capacities (McNeil, Dwayne, pers. comm., March 17, 2011). This approach was therefore technologically inappropriate relative to these conditions, which define culture within their community. As such, it was not only technologically inappropriate but also culturally inappropriate.

This example demonstrates that the comprehensiveness of analysis that follows from a broad definition of cultural appropriateness is meaningful, where a given project might be deemed technologically appropriate, but inappropriate relative to other phenomena (i.e., social, political, economic, philosophical, spiritual, etc.) or vice versa. Collectively, these phenomena provide criteria by which cultural appropriateness can be measured.

As another example, consider economic factors such as home operating costs. These could be viewed simply as an issue of affordability, with little or no relation to culture. In some contexts, including such costs within cultural appropriateness could certainly be questioned. Where the Aboriginal housing crisis has emerged from the disruptions of Aboriginal economic systems and resources however, and where cross-cultural dynamics perpetuate inequity in this area, these types of factors are entirely relevant to determining culturally appropriate solutions.

Determining affordability of Aboriginal housing by the same standards applied in non-Aboriginal communities may not be appropriate, where Aboriginal peoples are overrepresented in unemployment, and often earn lower-than-average income. Where many Aboriginal communities have traditions surrounding communal ownership, the

means to finance and manage housing may also contribute to cultural appropriateness (or lack thereof). Introducing private home ownership may be accompanied by challenges, barriers, and/or friction. Alternately, developing financing mechanisms and management structures that respond to local traditions could prove invaluable to fostering sense of ownership and responsibility in these communities. These examples illustrate how the factors noted in Figure 14 can contribute to a broad and meaningful understanding of cultural appropriateness. Additional factors and their potential impact on housing are discussed further below.

Aboriginal Traditional Knowledge

The absence of cultural considerations in contemporary Aboriginal housing design has:

- Perpetuated feelings of marginalization and dispossession that emerged from colonization;
- Undermined occupants' sense of identity and belonging; and
- Resulted in housing that fails to respond to occupants' values, needs, interests and/or lifestyles.

These outcomes are in turn associated with neglect of home maintenance, subsequent degradation and inadequacy of housing, serious physical, social, and mental ills, poverty, dependency on social assistance, and related economic challenges at the individual and community level.

Aboriginal traditional knowledge⁶⁰ offers an important starting point for delivering more culturally appropriate Aboriginal housing. Specifically, the integration of traditional knowledge into housing design and implementation can combat these issues by contributing to sense of identity and belonging, individual and community development, and increased sense of ownership and responsibility. Insofar as these issues are more acute in younger generations, it may be that reintroducing culture into housing design and implementation by way of traditional knowledge will help to close generational gaps, connecting younger generations to their heritage and related systems of meaning and value. Specific opportunities to integrate traditional knowledge into housing design that have emerged through this research are ceremonies, art, interior design (spatial plans and function, material and color selection etc.) and building systems.

In traditional Aboriginal cultures, ceremonies have been used to define governance, roles, responsibilities, healing processes, boundaries, morality and purpose (Makokis, L., public communication, February 2012). Dr. Reg Crowshoe, former Chief of the Piikani Nation and Spiritual-Cultural Advisor to the Treaty 7 First Nations project indicates that ceremonies also serve to validate human intent and action, and that those found in Aboriginal cultures parallel processes that occurs in non-Aboriginal ones (Crowshoe, R., pers. comm., June 2010 – October 2011).⁶¹ Crowshoe identifies four main vehicles used in ceremonies by oral cultures around the world, namely venue, action,

⁶⁰ As indicated in chapter two, this research defines traditional knowledge as the bodies of interrelated knowledge, wisdom and practices that originated in pre-contact Aboriginal cultures, which may continue to evolve within these societies today, and may relate to ecological, spiritual, philosophical, social, political or other phenomena.

⁶¹ Having had the honor to work directly with Dr. Crowshoe, his teachings have greatly informed my own thoughts in this area.

language and song. Ceremonies were used in all three of the case study pilot projects in order to recognize local cultural values and sources of meaning. Future Aboriginal housing initiatives could very well benefit from a similar approach.

In addition to ceremonies, visual art may be used to integrate traditional knowledge and culture in housing design. A prime example is the winter count (the traditional pictographic story) painted on canvas and stretched over the vaulted ceiling of the Treaty 7 First Nations TRTL home. The winter count contained elements from Tipi designs, and connects the home's contemporary origins to oral tradition (including the building methods and technologies, stakeholders and processes).

The solar power installation in the T'Sou-ke Nation provides an additional example of how visual art can bridge contemporary and traditional culture. In this case, traditional patterns were acid etched onto photovoltaic panels. The result was aesthetically pleasing, and led to increased interest of community members in the technology (Morton, D., public communication, 2012). Murals painted on homes of the Hobbema reserve are another example of artwork that has bridged traditional and contemporary culture, with a positive impact on housing. In this case, painting houses with murals has contributed to a sense of pride and provided a disincentive to vandalism and graffiti (Thompson, 2010).

As indicated in chapters two, five, and throughout the case studies, traditional Aboriginal structures can also inform contemporary building practice, thereby contributing to cultural appropriateness (Dalla Costa, 2011). Material selection, systems design, spatial orientation and function and connection to the landscape are just a few examples of how a modern building can appropriately reflect Aboriginal cultures

(CMHC, 2005 (b); Dalla Costa, 2011; Shaw et. al., 2007). These considerations provide potentially important connections to social, philosophical and spiritual values and sources of meaning.

When seeking to integrate traditional knowledge into any project (housing or otherwise), it is important to recall the holistic and contextual nature of this knowledge, and the sensitivities surrounding its appropriation (Crowshoe, R., pers. comm., June 2010 – October 2011; Lertzman, 2010; Smith, 1999). Traditional knowledge encompasses awareness of relationships and balance within the greater natural order, wisdom of appropriate and sustainable application, and protocols that govern how this knowledge is transmitted. Abstracting traditional knowledge from its original context without proper consent and due process may lead to inappropriate applications and may be viewed as disrespectful or even sacrilegious.

A more comprehensive account of the convergence of Aboriginal traditional knowledge and contemporary housing practices is beyond the scope of this work, but marks an important and fascinating area for future research. This may be explored in tandem with the synergy between traditional worldviews and the ecological orientation of green building methods and clean technologies identified herein.

Contemporary Housing Conditions

In addition to the incorporation of traditional knowledge, increased appropriateness of housing depends upon strategic responses to the issues and problematic conditions that define the contemporary Aboriginal housing crisis. Green building methods and clean technologies have been identified for their potential to deliver

positive change in these areas. The appropriateness of these strategies will follow not only from their ability to address problematic conditions however, but also from how well-suited they are to other contextual factors. The case studies show that green building and cleantech strategies may fail to meet objectives and even exacerbate existing challenges where they are not carefully aligned with the causes of a given problem, as well as local economic resources, capacities and/or stakeholder characteristics and relationships.

This research has shown that the specific causes of an individual problem vary from one case to the next.⁶² Insofar as inadequacies follow from substandard design and specifications, ensuring that contemporary building codes are adhered to is an important first step. Assessing building code requirements relative to local conditions is also important, where these may not be sufficiently stringent relative to harsh environmental conditions. Building codes can be augmented to improve performance according to emerging methods and certifications such as R2000 and Energuide (see Chapter 4 and Glossary).

In some cases, problematic conditions may have little or nothing to do with substandard design or specifications, instead originating from improper implementation, or lack of requisite maintenance. Thus beyond integrity of design, ensuring that specifications are adhered to during construction is also critical, especially in relation to the building envelope. In addition to improper implementation, disuse and/or insufficient

⁶² In the Seabird Island First Nation the primary perceived cause of mould is leakage that stems from freezing and thawing. In the Saugeen First Nation the primary perceived cause of mould is condensation from modern plumbing. Additional causes identified in the background research include crowding, and boiling of water due to cultural culinary practices and/or boil water advisories.

maintenance of building systems is a key driver of Aboriginal housing failures. Thus the appropriateness of strategies depends on whether they effectively address the direct and indirect causes. If these are overlooked, the strategy may prove insufficient in the long term. For example, mould resistant materials may offer a short term solution to infestation, but if these are improperly installed, or if occupants' fail to use or maintain ventilation systems, the problem will likely recur. Again, this is a facet of cultural appropriateness because the issue emerges from the lack of interpretation of modern methods and technologies that has accompanied their introduction into Aboriginal communities.

The degree to which housing strategies respond to contemporary Aboriginal lifestyles is a critical determinant of cultural appropriateness. The Haisla study (Shaw et al., 2007), and the Seabird Island and Treaty 7 First Nations case studies illustrate the variety of needs and interests that may follow from different lifestyles and locations, and some strategies for addressing these (see Appendix 4). Insofar as contemporary lifestyles contribute to identity and sense of place, their accommodation in housing design may foster stronger sense of identity, belonging, ownership and responsibility for the home, and may help to combat associated social ills.

Appropriateness of housing strategies must also be determined by their response to local demographics (or lack thereof). High rates of transition and large families have been identified as key housing challenges for Aboriginal communities. Accessibility for seniors and/or the disabled is another important consideration. Thus appropriateness may follow from increased occupant capacity, and/or increased flexibility of space, as well as accessibility features, depending on the specific needs of the community in question.

Additional demographics of education and employment are discussed below in relation to capacity.

Economic Resources

Where availability of economic resources is a key factor influencing Aboriginal housing initiatives, this must also inform appropriateness of housing strategies.

Insufficiency of resources is particularly problematic for First Nations governments who are responsible for housing and services, and who are subsequently unable to keep up with maintenance needs, demand for new homes and/or requisite infrastructure. In the face of these challenges, communities may (justifiably) choose quantity over quality of housing, which can contribute to premature degradation, poor conditions, and the overall perpetuation of the housing crisis.

In communities where economic development is limited, lack of revenue diversity and employment opportunities present additional challenges to overcoming resource insufficiency. At the individual level, insufficient income can inhibit the ability to pay rent, mortgages and/or address maintenance needs. This may exacerbate resource challenges at the community level, where arrears contribute to maintenance and service shortfalls. Conversely, the relatively small size of many Aboriginal communities translates into increased positive impact of small and medium size economic development ventures.

The need for economic development validates a self-construction approach to Aboriginal housing, insofar as this strategy keeps economic resources within the community and provides training and employment opportunities (Dalla Costa, 2011;

Cardinal, B., pers. comm., June 2011). This approach is discussed further below in relation to capacity. Appropriateness of housing strategies thus depends on careful alignment with community and individual economic resources. Of particular importance are the relationships between these resources and the upfront and lifecycle costs of selected methods and technologies. Simple, affordable measures to deliver durability are particularly important in reducing inadequacies while respecting these limitations.

Green building methods and clean technologies may be used to alleviate economic burden of housing in the long term, particularly through increased lifespan, reduced operating and maintenance costs, reduced dependence on conventional sources of energy, and decentralization of service provision. Strategies that do not require additional upfront costs, or are able to minimize these and thus shorten payback periods are of particular value. Simultaneously, emerging methods or technologies may come at a higher initial cost for a variety of reasons. They may also be accompanied by unfamiliarity, uncertainty or lack sufficient testing under real-world conditions with subsequent potential to increase cost overruns and/or risk of technology failure.

Other economic factors may play a considerable part in determining appropriateness of a strategy, for example where remote contexts drive up transportation cost and logistical complexity. Due consideration must be given to availability and cost of replacement parts and materials. Such issues are also tied to complexity of systems design and maintenance requirements, which are discussed further below in relation to capacity.

Given the importance of economic constraints in the context of Aboriginal housing, initiatives should be aggressive in the early identification and mitigation of

financial risks. An incremental approach to innovation may foster success and stability, which could in turn eliminate or even reverse detrimental feedback. For example, savings that follow from basic reductions in operating and maintenance costs could be redirected to address additional design features or costs associated with remote supply chains. Similarly, the introduction of reusable building materials could increase the amount of construction material available in the long term, allowing reallocation of resources to other areas.

Capacity to Design, Implement and Manage Housing

Appropriateness of Aboriginal housing strategies further depends upon their relationship to local capacities to design, implement and manage housing. The case communities exhibited important strengths in these areas including the ability to build homes and independently conduct inspections, with local colleges supporting further capacity development. Simultaneously, underrepresentation in specialized fields of architecture and engineering are a noteworthy challenge to independent housing innovation, driving the need for external support in these and many other Aboriginal communities. This issue is discussed further below under stakeholder relationships.

Increasing Aboriginal representation in higher education may therefore help to alleviate capacity shortfalls. Several related challenges must be noted, namely (1) a ‘brain drain’ that occurs when Aboriginal individuals leave their communities in search of education, (2) the stigmatization that individuals may encounter when returning to their

communities afterwards (King, 2003)⁶³, and (3) the lack of competitive professional opportunities in these fields within Aboriginal communities.

Self-construction has been identified as an appropriate strategy to address housing related capacity challenges in Aboriginal communities. Opportunities for training, employment, and awareness building within the broader community that accompany self-construction are particularly valuable. These may help to combat adequacy issues that follow from improper implementation and/or maintenance. They may also improve practices and policies applied to future initiatives, and broader community interest in these areas. Insofar as self-construction allows resources to be kept within the community, this approach may synergistically address both capacity and resource challenges. Last but certainly not least, self-construction contributes to a sense of pride, ownership and accomplishment. Success of a self-construction approach is by no means guaranteed. Planning should address numerous factors including: expected types and levels of involvement, mechanisms for tracking outcomes, gathering feedback and following up with participants, and potential provision of consistent long-term opportunities for training and employment.

Capacity issues related to the management and maintenance of Aboriginal housing have emerged in part where contemporary building methods and systems and residential market function have not been sufficiently interpreted into these communities. This may affect management capacity, where inexperience undermines competency and drives turnover, in turn exacerbating resource challenges (Crowshoe, R., pers. comm.,

⁶³ In addition to King's identification, these challenges were noted during informal discussions with Aboriginal individuals throughout the course of the research.

June 2010 – October 2011; McNeil, Darryl and Dwayne, pers. comm., March 17th, 2011; Lee, T., December 10th, 2010). Lack of interpretation may also affect the degree to which Aboriginal individuals associate value, meaning and/or personal responsibility with the home itself (Crowshoe, personal interaction, June 2010 – October 2011). Where outcomes such as managerial turnover, insufficient maintenance and rental arrears have the potential to exacerbate resource challenges, these mark particularly important areas for improvement.

Given these findings, incremental approaches to housing innovation may prove to be a culturally appropriate strategy not only in relation to an insufficiency of economic resources, but also in addressing capacity challenges. Appropriateness of methods and/or technologies will depend upon their complexity relative to conventional methods, and to the presence or lack of trades, management and occupant skills and knowledge within the community. Important precedents are emerging where educational institutions and private sector entities are reaching out to and partnering with Aboriginal communities in innovative ways that are also increasingly sensitive to cultural considerations (Jermyn, 2012; Ramsay, 2010). Apprenticeship programs using traditional language and comprehensive job-shadowing have demonstrated positive socioeconomic outcomes for both program participants and their hosts (White, 2010). And the aforementioned solar power installation in the T'Sou-ke Nation credits its success in part to the use of training programs specific to oral cultures (Rycroft, 2009).

Stakeholder Relationships

Relationships between stakeholders are another important factor that may influence the appropriateness of Aboriginal housing strategies. The stakeholders involved in housing initiatives may include federal, provincial, municipal and local Aboriginal governments, individual occupants, the broader community, and industry partners providing goods or services. Relationships between stakeholders in this context may be strained due to the history of cross-cultural misunderstandings and conflicts. Mistrust, for example, may permeate not only cross-cultural relationships, but also those within individual communities. Stereotypes of Aboriginal culture also abound, which can rapidly derail an otherwise productive initiative. Appropriateness of housing strategies may thus be further determined in part by whether and how they respond to this reality.

Research has highlighted the importance of community involvement in planning, design and implementation of Aboriginal housing initiatives. Such involvement is a critical component of appropriateness for several reasons. Firstly, insofar as the community will have a voice in determining the project's vision and associated goals, objectives and strategies, this represents a monumental improvement upon the legacy of colonialism, and specifically the external control exerted over Aboriginal housing. Further, community involvement provides a foundation for outreach, education, and buy-in that will help ensure project success. Objectives and strategies can then be clearly communicated between key stakeholders, including identification and assessment of challenges, opportunities, synergies, trade-offs, risks, roles, responsibilities and expected benefits. A more comprehensive understanding of local culture and its potential inclusion within housing design may also emerge. External stakeholders should be prepared to

manage a level of involvement that exceeds that found in conventional relationships between architects, designer, and/or developers and their clients.

External partners have a vital role to play in countering the resource and capacity challenges faced by Aboriginal communities. Dependency on external experts for technology and knowledge transfer is a reality in many different sectors and communities around the world, both Aboriginal and non-Aboriginal. In Aboriginal contexts however, colonization has increased the significance of independence and self-determination. The issue marks a complex contradiction: although dependency is undesirable, there is often an expectation within Aboriginal communities that housing be paid for by someone else (typically the federal government by way of local governments). Thus the degree to which independent housing provision is a priority will vary from one community to another, and even within a single community.

Where it is a priority and where external support is required, this support should be tailored to ensure comprehensive capacity building and knowledge and technology transfer. Otherwise capacity shortfalls may be perpetuated and improvement undermined. Ultimately the community must weigh its options in terms of what kind of external support is needed, who is able to provide it, where it is coming from and the implications of these factors for independent and self-determined housing provision. Given the historic context, it is critical that this relationship be supportive and non-hierarchical rather than dictatorial. Support can take on a variety of forms including but not limited to sharing of expertise, training, employment and/or special agreements in financing, purchasing or service provision.

Aboriginal communities must approach external partnerships with caution. Of particular relevance is the instability that may accompany startups in emerging sectors, which can undermine expected benefits and/or capacity transfer. Identifying partners with a proven track record in their area of expertise and/or with experience in Aboriginal contexts may help to mitigate risk. A more comprehensive account of strategies and scope for risk assessment, and its role in Aboriginal capacity building in this context falls beyond the scope of this research. Additional insight can be garnered from CMHC's *Feasibility of Risk Management as a Subject for Capacity Building in First Nations* (2008).

The history of cross-cultural misunderstanding and conflict between Aboriginal and non-Aboriginal peoples necessitates that trust be rebuilt (RCAP, 1996; Smith, 1999). Understanding, respect, and inclusion are all the more important in cases where support of external stakeholders is required. Appropriateness of processes and relationships may follow from specific roles associated with gender or age within a culture, requirements for types or level of inclusion, and/or as specific formats and procedures for meetings and discourse.

Some of the most successful cross-cultural learning experiences and conflict resolutions of the Treaty 7 First Nations project were centered on traditional communication protocols and validation processes, including non-hierarchical discussion that allowed all participants to express themselves. In order to realize the opportunities associated with Aboriginal cultural considerations, external stakeholders should be aware of local culture, history and protocols. Ideally this awareness will help to overcome stereotypes and racism, foster cross-cultural respect and inclusivity, and result in

appreciation for the significance of Aboriginal autonomy, self-determination, and continuing cultural evolution. Thomas King's *The Truth About Stories* (2003) is a particularly valuable source of insight in this area.

Introduction to the Recommendations

This section of the research provides recommendations for improving Aboriginal housing. The recommendations are guided by a set of underlying principles as listed below, and are categorized according to housing design and related policy. The design recommendations are intended for those parties who are responsible for and/or involved in the planning, design and implementation of Aboriginal housing initiatives. This includes local governments and the housing organizations or authorities therein, as well as various actors from the private sector (e.g., architects, engineers, housing and infrastructure managers and their staff, developers, contractors and sub-contractors). The policy recommendations are intended for entities that are responsible for creating, implementing and interpreting the regulatory environment in which Aboriginal housing occurs. Depending on context (i.e., on-reserve, off-reserve, urban, rural, remote, etc.), this may include federal, provincial, municipal and/or local Aboriginal governments and any housing authorities contained therein. Insofar as housing policy affects housing implementation, parties involved in the latter may also find the policy recommendations of interest.

The principles underlying the recommendations are expected to lead to positive change in Aboriginal housing and other initiatives and programs. For example, increasing Aboriginal self-determination – including but not limited to determination of housing

strategies – is an important part of overcoming cultural oppression that has accompanied colonization. In the context of housing, Aboriginal self-determination in turn relies on increased self-sufficiency of design, implementation and management. Self-sufficiency is itself a function of various capacities within a given community. Self-determination and self-sufficiency are thus identified as underlying principles for improving Aboriginal housing initiatives, based on response to root causes of the housing crisis.

The principles underlying the recommendations are:

- Increased self-sufficiency – encompasses knowledge transfers, information resources, and capacity building etc. at all levels, from management to occupants
- Increased self-determination – changes to power relationships with outside stakeholders, and increased community engagement in decision-making and implementation
- Exploration, inclusion of relevant cultural phenomena (protocols, values etc.)
- Response to problematic conditions and their causes
- Increased flexibility and responsiveness of funding, scheduling (to population dynamics, needs, rising costs, innovation)
- Streamlining, clarity of process
- Life cycle costing
- Reflective practice – learning from doing based on project evaluations, shared information and identification of best practices, etc

The recommendations for Aboriginal housing design and related policy are, in turn, intended to contribute to a framework that supports these underlying principles, by:

- Mitigating existing weaknesses, challenges and/or barriers;
- Avoiding strategies that have introduced or perpetuated the above;
- Maintaining, leveraging and/or optimizing existing strengths and opportunities, and/or introducing new ones.

For example, involving the community in planning, design and implementation of housing initiatives has been shown to foster self-determination and self-sufficiency, and increase sense of pride and ownership in relation to housing. As another example, where residents' lack of awareness surrounding maintenance responsibilities and procedures has been identified as a challenge that impacts economic resources within Aboriginal communities (required to achieve and maintain self-sufficiency), the recommendations target education in these areas as a means to foster positive change.

Aboriginal diversity translates into such a wide variety of contexts that it would be difficult to summarize the feasibility of the design recommendations. These are intended, however, to be highly pragmatic. That is, they are thought to be largely attainable provided that the parties involved in a given initiative are willing to dedicate the requisite time and effort. Further, they are not prescriptive with regards to specific methods and technologies, but rather offer a more general approach that can be interpreted according to different contexts (e.g., durability can be achieved through methods and materials specific to a given region).⁶⁴

While in some cases the design recommendations may imply additional costs, ideally they will in fact contribute to overall cost reductions through both direct and indirect outcomes. Many of the recommendations have less to do with cost than with communication throughout the design and implementation processes, and the criteria for selecting strategies. That said, interrelated challenges such as insufficient economic resources and extended supply chains are a complex reality that cannot be overcome by

⁶⁴ Individuals looking for insight into specific methods and/or technologies should refer back to the case study descriptions, and their individual and comparative analyses, as well as the appendices.

project design alone. Communities in this situation will necessarily be more restricted in terms of up front expenditures and design specifications, as compared to communities with greater financial independence and/or those in close proximity to sources of materials and supplies.

The policy recommendations are somewhat more prescriptive than those pertaining to design. The policy recommendations target changes to the current environment that should help to overcome key issues and shortcomings. These recommendations are not exhaustive. A more comprehensive approach to policy improvements falls beyond the scope of this research. Readers interested in such comprehensiveness are encouraged to examine the status reports of the auditor general (Auditor General, 2003, 2006, 2011), the Assembly of First Nations' report card (AFN, 2006), Aboriginal Affairs and Northern Development's evaluation of INAC's on reserve housing support (AAND, 2011), and other related sources cited throughout this work.

Regarding the feasibility of the policy recommendations, these are highly dependent upon both local contextual and broader systemic factors, and the relationships between these. For example, management capacity is a key determinant of effective economic resource allocation. As such, it is a local factor but with significant implications for policy at higher levels. Increasing the initial capital available to invest in housing may deliver little or no positive change if these resources are poorly allocated. For this reason, capacity building (including but not limited to management) is amongst the highest priorities in both the design and policy recommendations.

At higher levels, the relationships between and attitudes of governing bodies responsible for policy, funding, regulation and legislation are particularly influential. The

bureaucracy, opacity, and general lack of progress in which Aboriginal housing policy is mired offers little fuel for optimism in this area. Still, one must hope that our governments are able recognize, learn from and respond to past failures in order to deliver policies that support positive change.

Although the order of recommendations within each category approximates priority from highest to lowest, this is not strict. Where the recommendations are supported by other sources, these are indicated in square brackets.

Design Recommendations:

- Consult with the community to determine the appropriateness of enlisting advisors and/or a guiding council of community representatives who would facilitate communication, outreach, needs assessment, understanding and integration of traditional knowledge, ceremonies, and protocols.
- Determine design and implementation strategies in collaboration with the community and selected representatives or advisors (see above).
[AAC, pers. comm., June 2010 – October 2012; AAND, 2012; Crowshoe, R., pers. comm., June 2010 – October 2012; NAHA, 2004, 2007; Robson, 2008]
- Include comprehensive needs assessment, life cycle costs, and alignment with contextual factors (problematic conditions and their direct, indirect and root causes, economic resources, housing design, implementation and management capacities, stakeholder relations, demographics, values, needs, interests, lifestyles). [AAND, 2012; Lee, T., pers. comm., December 10th, 2010; NAHA, 2004, 2007; Robson, 2008; Seniuc, R., pers. comm., May 20th, 2011; Shaw et. al., 2007]
- Clearly communicate project goals, objectives and strategies between key stakeholders early on, including challenges, opportunities, expectations for performance, benefits, synergies, risks, and trade-offs. [Proscio, 2008]
- Build capacity and transfer knowledge where required relative to selected methods, technologies. Schedule transfer appropriately from initial phases through to occupancy.
- Consider self-construction as a central implementation strategy [Dalla Costa, 2011; Laronde, D., pers. comm., April 21st, 2011; Lickers, M., pers. comm., December 10th, 2010; Seniuc, R., pers. comm., May 20th, 2011].
- Educate occupants: potential topics include general and specific maintenance issues (e.g., HRVs, furnace filter replacements, disconnecting hoses in winter), [Shaw et. al., 2007], and broader housing market function (mortgages, rent,

impact of arrears on local government resources). Explore appropriateness of different educational media, venues, and methods.

- Track project outcomes of building performance, education, training, employment, overall appropriateness of housing.
- Develop and monitor performance measures and indicators, and identify best practices [AAND, 2012; Auditor General, 2011]. Pertinent areas to monitor and document:
 - Effectiveness of strategies to deliver healthy, safe, durable, flexible housing (key areas of focus are robust efficient envelope, interior finishing and mechanical system).
 - Cost and complexity of the strategies employed
 - Degree to which economic resources are kept within the community as part of project implementation, including increased training and employment during and after project completion.
 - Extent of capacity and knowledge building as part of project implementation.
 - Changes in occupant awareness regarding roles, responsibilities, maintenance needs, and system functions.
- Locally develop and enforce material standards and quality control, to be written in plain language [Shaw et. al., 2007; Smith, D., public comm., February 2012], use as complement to rather than replacement of building code and other pertinent standards and methods (e.g., Energuide and R2000).
- Develop an online portal to include local standards (see above), best practices (see above) and regional databases indicating options for local materials, associated methods and supply chain information.
- Provide opportunities for cross-cultural learning in cases where external stakeholders are involved.

Policy Recommendations:

- Facilitate the development of independent Aboriginal housing authorities, based on comprehensive capacity building (housing design, implementation and management). Increase communication surrounding existing efforts in this area. [AAND, 2012; Auditor General, 2011; Smith, D., public communication, February 2012]
- Clearly establish and communicate to Aboriginal communities the regulatory environment within which housing occurs including standards, codes and compliance, regulations, performance measures, permit processes, enforcement mechanisms, roles and responsibilities. [AAND, 2012; Auditor General, 2003, 2011; Smith, D., public communication, February 2012]
- Dedicate funding to the following areas, while avoiding the creation of unwieldy administrative requirements for local governments, where many are already overburdened in this area [Auditor General 2011]:
 - Capacity building in housing design, implementation, maintenance, management, and occupant education; incentivize participation; track outcomes.
 - Ownership models proven to work in Aboriginal housing, such as rent-to-own programs and revolving loan funds [IHC, 2006].
 - Infrastructure and site development independent of housing funds.
- Allow increased capital investment and increased flexibility of design, specifications within Maximum Unit Price model, with specific orientation towards improving social and/or long-term economic performance (e.g., measures for achieving health, safety, structural durability, flexibility, efficiency and appropriateness).
- Develop a strategic plan to replace the Maximum Unit Price model with a self-determined approach to funding.

- Increase flexibility of funding timelines to allow response to unfavorable weather and climate, to accommodate community consultation, and to permit response to maintenance needs that may emerge through investigation and destructive testing
- Ensure criteria for existing new funding opportunities (e.g., CEAP) are clear and concise. [Auditor General, 2003]
- Connect housing initiatives to broader socioeconomic development strategies. Utilize synergies between sectors to leverage increased funding (e.g., where agendas in housing, environmental protection, climate change and/or economic development overlap) [David, B., 2003; Proscio, 2008].
- Develop comprehensive strategies to reduce supply chain costs, for example through the accumulation of reusable construction materials.
- Shift responsibility for assessing adequacy away from occupants towards qualified professionals without excluding or disempowering the former.
- Improve policy frameworks:
 - Expand the definition of suitability, and/or integrate cultural appropriateness into housing frameworks. [NAHA, 2004, 2007]
 - Remove and avoid biases that emerge from funding amounts and/or criteria (e.g., where smaller unit sizes may be favored due to low cost and in disregard for community need). [NAHA, 2004]
 - Develop comprehensive policies for alternative energy initiatives in Aboriginal communities.
 - Develop affordability measures for reserve and rural housing.
 - Identify non-economic factors inhibiting the resolution of housing difficulties (why income may be insufficient in resolving problems). [David, 2003]

Important Areas for Future Research

Several important areas for future research have emerged from the above findings. These are largely centered on relationships between housing economics, economies of scale, infrastructure and service provision in Aboriginal communities.

The success of the Saugeen First Nation pilot project was based on reduced costs as a result of bulk purchasing agreements. The mutual benefits associated with such agreements could be magnified if applied at the community scale, and even more so at a national level. The high demand for renovation and construction of new units occurring at the national level and the amount of money currently allocated to Aboriginal housing by the federal government represent significant economic opportunities to develop related partnerships, for example with suppliers of building materials.

In the Treaty 7 First Nations case, pilot project costs and benefits were tied to the potential for modular construction and temporary foundations to foster private home ownership on reserve lands. Ideally mass production would demonstrate potential to generate a large number of homes that could be rapidly deployed. At the time of writing, modular homes were being deployed to the Attawapiskat First Nation in response to the state of crisis there, although this strategy had previously failed due to insufficient infrastructure. CMHC (2005, (a)) provides additional information on receptivity towards manufactured housing in Aboriginal communities. Beyond this issue, the feasibility of modularity and temporary foundations as a vehicle to provide ownership is a critical area for further research (as explored in the Treaty 7 First Nations case).

The viability of alternative energy and other cleantech initiatives in Aboriginal contexts is another key area for future research. The scope of this thesis was managed by

examining only those methods and technologies that are currently integrated into housing. Even within this scope, key opportunities may not have featured as prominently as they could have. Of particular and increasing importance to many Aboriginal communities are issues surrounding water and its treatment. While some measures for increasing water efficiency were discussed herein, additional strategies for capturing and treating water within the home or at the community level will undoubtedly prove beneficial.

Beyond methods and technologies integrated into housing, larger cleantech initiatives may also prove instrumental to overcoming the challenges surrounding infrastructure and service provision in rural or remote Aboriginal communities. Of particular interest are strategies that revolve around decentralization of these systems and services, as well as the potential for alternative energy in particular to alleviate dependency on conventional sources and even generate revenue. The precedents identified above and the case study data provide important areas for consideration, including requirements for stakeholder and policy support.

The feasibility of multi-unit developments in Aboriginal communities is another critical area for future research. Multi-unit developments offer potential savings relative to dispersed single family homes. Specifically, they require less materials, labor, land and infrastructure. Receptivity is a potential barrier however, where multi-unit developments are not common and not preferred in Aboriginal contexts. Yet many of the challenges associated with housing and service provision in these communities emerge out of their remote and dispersed nature. Community preference for dispersed single family

development should therefore be examined, and potentially confronted from within the community in order to address and overcome these challenges.

The strengths and weaknesses associated with communal ownership should also be considered in future research specific to First Nations. For example, as the owner of all reserve homes and infrastructure, a given Band could elect to implement technologies at the community scale rather than depending on individual uptake. While not exactly incremental or cautionary, this approach may be amenable to communities facing fewer resource and capacity challenges. Associated risk may also be mitigated through careful monitoring and assessment of pilots.

The community-scale solar thermal installation in Drake's Landing, Okotoks, Alberta offers an important precedent that has recently emerged successfully from proof-of-concept studies.⁶⁵ The project features solar thermal collectors distributed throughout the community. These feed into a collective storage tank that efficiently provides for the majority of home space heating requirements throughout the community. Numerous other projects of similar nature have been implemented, for example in Denmark and Germany. A critical determinant of feasibility however, is the proximity of homes to one another and to the central tank, where distance travelled by requisite infrastructure is a key determinant of overall cost. This relates back to the discussion above, on housing dispersion and type preference in Aboriginal communities. Beyond alternative energy sources, community scale and community owned applications could include innovations in water related technologies such as capture, filtration, and reuse.

⁶⁵ This project was addressed at a Natural Resources Canada seminar on large scale solar energy storage, in Calgary, Alberta, October 2011.

Finally, future research should look to advance our understanding of the topics contained herein in a variety of contexts, including but not limited to Métis, Inuit and urban Aboriginal communities. The contextual factors identified above will undoubtedly differ, and additional factors influencing cultural appropriateness may also be identified.

This last topic dovetails into the potential for Aboriginal knowledge to inform our own understanding of and approach to numerous disciplines including but certainly not limited to building science. Underlying many Aboriginal cultures is a principle of interconnectedness, manifest in the belief that all things come from and should return to Mother Earth. Implicit in this principle is the need to comprehensively understand and respect what society is taking from and putting back into the environment. This necessarily extends to methods of extraction, production, end-of-life processing, and related impacts upon all life on this planet.

This principle of interconnectedness is directly related to contemporary efforts to reduce humanity's impact on the natural environment. The notion of 'cradle to cradle' design, the broader purpose of life cycle assessment, and the act of recycling and/or repurposing materials are all in essence seeking a more harmonious and balanced relationship between humanity and nature. Transitioning to this circular mode of thinking and being represents a significant challenge for modern society however, insofar as it has emerged from and continues to depend upon a diametrically opposed model. As McDonough and Braungart (2002) note:

“At its deepest foundation, the industrial infrastructure we have today is linear: it is focused on making a product and getting it to a customer quickly and cheaply without considering much else,” (p.26).

Where the circularity and interconnectedness found in Aboriginal worldviews provides an alternative to this problematic linear model, it is high time these worldviews occupy a more prominent role in our ways of learning, thinking and interacting with the world around us.

Conclusions

Considering this research in its entirety, it is clear that emerging green building methods, clean technologies, and cultural design considerations have significant roles to play in addressing the Aboriginal housing crisis. These may improve upon the key issues and problematic conditions defining the crisis. Further, they have the potential to respond to broader systemic forces and root causes of the crisis that have emerged from colonialism. Success of these strategies depends heavily upon an understanding of local culture and alignment with contextual factors. Otherwise, they may cause more harm than good by draining valuable resources and discouraging innovation.

Truly meaningful and comprehensive improvement further relies on change at the systemic level. Architect Rob Seniuc (pers. comm., May 20th, 2011) aptly summarized this reality, stating that housing failures will persist so long as we continue to address the problems in isolation, as though they have no bearing on and are not affected by broader phenomena. Put simply, it does not make sense to expect improvements in housing without due consideration for its relationship to community scale issues such as infrastructure, services and socioeconomic development. Solutions that extend beyond housing to broader institutions, including but not limited to systems of law, policy, governance and education are required. These issues are not isolated to the interests of

Aboriginal peoples. Rather, they are pertinent to the greater publics' interests, where they have serious ethical and moral implications for our society as a whole. As Lertzman and Vredenburg (2005) suggest:

“A holistic approach to sustainable development must address the biophysical, organizational and cultural systems within which human life is embedded and upon which it is dependent. The ethics of sustainable development oblige the preservation of all these aspects of human (and non-human) life for current and future generations,” (p.250).

In short, Aboriginal peoples must be afforded the same opportunities that are often taken for granted outside this context – to determine their own future, and the role of culture within it. Anything less is unsustainable, and will perpetuate not only housing failures but also the broader cross-cultural conflicts, misunderstandings and inequities that have persisted for decades.

Glossary

Aboriginal – is an umbrella term that includes First Nations, Métis, and Inuit peoples. There are over 600 distinct Aboriginal groups in Canada, for whom distinct cultural heritage is an integral part of their identity. These represent approximately 1.2 million people, or 3.8% of Canada's total population. (Census Canada 2006)

Aboriginal Affairs and Northern Development Canada (AANDC) – formerly Indian and Northern Affairs Canada (INAC), AANDC is the official federal body that governs relationships between Aboriginal groups and the government of Canada.

Adequacy – one of three indicators used by Canada Mortgage and Housing Corporation (CMHC, 2002) to measure core housing need (CHN), adequacy measures whether a residential unit is in need of significant repair, according to the tenant.

Affordability – one of three indicators used by Canada Mortgage and Housing Corporation (CMHC, 2002) to measure core housing need (CHN), based on whether the rental or purchase of a given residential unit is less than 30% of an individual's or household's income.

Affordable housing – the definition of affordable housing follows that of CMHC identified above. Affordable housing is distinct from social housing, the former being a measure of cost, the latter being subsidized (Real Estate Foundation of British Columbia, 2007).

Affordable Housing Initiative - under the Affordable Housing Initiative (AHI), the federal government, through Canada Mortgage and Housing Corporation, provides contributions to increase the supply of off- reserve affordable housing, in partnership with provinces and territories. [See http://www.cmhc-schl.gc.ca/en/inpr/afhoce/fias/fias_005.cfm]

Appropriateness –this concept surfaced in the context of Aboriginal housing in literature, case study interviews and observation. Despite this frequency, the term remains ambiguous. This is due in part to the diversity of Aboriginal contexts, which result in equally diverse definitions. One of the objectives of this study is to explore principles that may guide the concept of appropriateness, and its potential to contribute to improved housing. This discussion is related to that surrounding 'suitability', as described below.

Canada's Economic Action Plan (CEAP) – a federal program for economic stimulus that includes programs specific to First Nations.

Canada Mortgage and Housing Corporation (CMHC) – Canada’s national housing agency.

Certificates of Possession (CPs) – are documents issued under the Indian act and administered by Band Councils which permit individuals to occupy and use on-reserve land.

Clean technology(-ies) – methods for essential service provision (such as electricity, heat, potable water, and waste water treatment) that offer reduced environmental impact relative to conventional methods.

Core Housing Need (CHN) – employed by CMHC, core housing need is a model that accounts for housing conditions in Canada. A household is said to be in core housing need if it falls below one or more standards of adequacy, affordability, or suitability (CMHC, 2002).

First Nations – Aboriginal peoples who are of non-mixed Aboriginal heritage (non-Métis), and not Inuit.

Feed-in-Tariff (FiT) – payments made to an independent energy producer in exchange for energy being fed onto a conventional grid, typically from an alternative energy source such as wind or solar.

Green building – describes methods which prioritize reduces environmental impact and/or occupant health and safety.

Indian and Northern Affairs Canada (INAC) – the former title for what is now Aboriginal Affairs and Northern Development Canada (AAND), INAC/AAND is the official federal body that governs relationships between Aboriginal groups and the government of Canada.

Indoor Air Quality (IAQ) – is used to describe the quality of indoor environments relative to human health, based on factors such as humidity, off-gassing and other particulates.

Life Cycle Assessment (LCA) – is a comprehensive tool that examines all stages of a project’s, in order to assess its environmental impact. LCA can be applied to a variety of projects, from consumer products to skyscrapers. In the context of the built environment,

LCA includes examination of relationships between material production, transportation, implementation, and decommissioning, environmental impact, and human health.’

First Nations Market Housing Fund – a \$300 million dollar fund established by the federal government in 2007, intended to support financing arrangements for housing developments on reserve and settlement lands.

Maximum Unit Price (MUP) – is a policy employed by CMHC which limits the amount of capital that can be spent per unit in a given geographic region.

Ministerial Loan Guarantee – provided by AANDC, an MLG allows individuals and communities to secure housing loans despite the fact that they cannot give a lender the rights to the property (Auditor General’s Report 2003).

National Building Code – is the federal document which outlines requirements for design and construction of new buildings and renovations of existing buildings. Specific requirements pertain to safety, health, accessibility, and fire and structural protection.

Ontario First Nations Technical Services Corporation - a corporation responsible for providing technical advice and services to 134 First Nations in Ontario.

R2000 – a voluntary technical performance standard for residential construction, administered by Natural Resources Canada, delivered through service organizations across the country. The aim of R2000 is to promote the use of cost-effective energy-efficient building practices and technologies.

Section 95 – CMHC’s program for on-reserve non-profit housing provision.

Social housing – subsidized housing developments. Many on-reserve homes will fall under this category. Some communities have rent-to-own programs in place, which may or may not be subsidized. Social housing is distinct from affordable housing, the former denoting subsidization, the latter being a measure of cost. (Real Estate Foundation of British Columbia 2007)

Suitability – one of three indicators used by CMHC to measure core housing need (CMHC, 2002), suitability indicates whether a unit has a sufficient number of bedrooms relative to occupancy and gender, based on the National Occupancy Standard of Canada. This research is seeking a more comprehensive definition of suitability or appropriateness, and explores how cultural considerations may contribute to this end.

Sustainability – in this context, sustainability is applied to human activity. In March of 1987, the Brundtland Commission of the United Nations defined sustainable development as that which meets the needs of the present without compromising the ability of future generations to meet their own needs. Contemporary discussion surrounding sustainability also includes a triple-bottom-line approach – that is, the inclusion of environmental, economic, and social spheres. Aboriginal concepts of sustainability experienced in this research center on a similar theme, including ‘seven generations’ as the temporal basis in which our current actions ought to be grounded.

Volatile Organic Compounds (VOCs) – are found in various human-made products, including finishes and paints used in interior decoration. These compromise indoor air quality (IAQ) with negative outcomes for occupant health.

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Appendix 1: Interview Protocols

The following interview protocols provide the semi-structured questions and probes that were used to collect data in the preliminary interviews and case study interviews respectively. The latter protocol evolved throughout the research as understanding of the topic increased. The protocol reflects the full content of this evolution.

Preliminary Interview Protocol:

A) Aboriginal Housing:

1. Please state your current professional position and length of time you have held this position.
2. Please describe to what extent this position has included experience with housing in Aboriginal communities, and/or related issues.
3. Prior to your current position, have you had other professional experience related to Aboriginal housing? If so, please elaborate.
4. What are the key issues in contemporary Aboriginal housing in rural communities and/or on-reserve?

Probe: mold, fire, crowding, suitability, adequacy, affordability
ownership, responsibility, approvals, certification, inspection, maintenance
5. Which of these issues (if any) are you familiar with in the context of [community X]?

Please elaborate on the specifics of this/these issue(s), including the extent, variance, and causes. Would you consider these issues of higher or lower concern than the ones you mentioned?

6. What is being done to address this/these issue(s)?

Probe: are there current or future initiatives such as funding or training programs?

7. Why does this issue persist? i.e., What are the barriers to addressing this issue?

Probe: identification/impact of contributing factors: cultural, political, social, economic.

8. What more could be done to address this issue, and who could/would/should it be done by?

9. Are there specific opportunities inherent in the community that might facilitate improvement on this issue?

10. Are you aware of any green building methods or clean technologies being used to address specific housing issues in [community X] or another Aboriginal community?
If so, please explain.

b) How successful are these technologies?

c) What specific problems have been encountered, if any?

B) Green Building Methods and/or Clean Technologies:

1. Please state your current professional position and length of time you have held this position.
2. Please describe to what extent this position has included experience with green building methods and/or clean technologies in residential design.
3. Prior to your current position, have you had other related professional experience?
4. Are there 'low hanging fruit' for design in this area? If so, what are they?
5. What is considered the leading edge of design in this area?

6. Are you aware of specific green building methods/clean technologies that offer strong performance in: preventing/reducing mold, reducing risk of fire, increasing energy/material/water efficiency, independence from conventional service grids?
7. What are the key issues with these or other green building and/or clean technologies?
Probe: affordability, grid parity, familiarity, complexity, availability, cost of operation and maintenance. Please elaborate on the specifics of this/these issue(s), including the extent, variance, and causes.
8. Why does this issue persist? i.e., What are the barriers to addressing this issue?
Probe: identification/impact of contributing factors: Do cultural, political, social, economic. What is being done to address this issue? What more could be done to address this issue, and who could/would/should it be done by?

Case Study Interview Protocol:

1. Please state your current professional position and length of time you have held this position.
2. Please describe your experience with housing in Aboriginal communities, (and specifically [community X]), and/or related experience.
3. Prior to your current position, have you had other professional experience related to Aboriginal housing? If so, please elaborate.
4. Please describe the current housing activities and capacities in community X.
Probe: number of homes, annual amount of renovation and/or new construction, related capacities (education, skills, employment, management), economic resources.

5. What are the key housing issues and problematic conditions in community X?

Probe: ownership, responsibility, inadequacy (mould, disrepair, inspection), crowding/shortages, cost, other.

6. How are issues and/or conditions prioritized?

7. What is being done to address them?

Probe: planning, training, maintenance, funding (new sources)

8. What are the challenges or barriers to addressing them?

Probe: political, social, economic.

9. Please describe the sustainable housing pilot project in community X.

Probe: goals, objectives, priorities, stakeholders, sources of funding, design and implementation processes, specific green building methods and/or clean technologies, cultural design considerations, outcomes, contextual factors influencing outcomes.

Appendix 2: CMHC Pre-Renovation Inspection Checklist

The following Pre-Renovation Inspection Checklist is used by the Canada Mortgage and Housing Corporation (CMHC, n.d. (b)). The list is not specific to Aboriginal contexts, and has not been evaluated by this research. Insofar as the checklist is informed by Healthy Housing™ and energy-efficient approaches and features however, it can be considered relevant to the challenges and conditions in Aboriginal housing as outlined throughout this research. Subsequently, the list may prove relevant in the development and/or improvement of existing housing programs and projects. In determining relevance, specific attention should be paid to the overall goals, as well as those found under each section. CMHC indicates that these options should be considered in the planning process, prior to purchasing materials or starting implementation. Homeowners can also review these with a renovator, and contractors can present them as options to customers.

Goals: Determine the condition of the home and what needs doing, and setting priorities.

- Homeowner inspection
- Renovator inspection
- Building inspection by certified home inspector
- Energy assessment
- Environmental assessment
- Equipment inspection: heating, cooling, ventilation, hot water, etc.
- Electrical/fire inspection
- Kitchen - Goals: Save water and energy. Improve air quality. Think recycling.
- Restricted-flow taps (aerator)
- Energy-efficient windows, doors and skylights
- Energy-efficient appliances

- Energy-efficient lighting
- Task lighting
- Low-maintenance, durable flooring (tile, linoleum, hardwood, ceramic)
- Low-emission cabinets (hardwood, sealed particle board)
- Low-emission countertop (solid surface, laminates)
- Low- or no-VOC paints
- Low-emission cements, grouts and caulking
- Range hood vented to the outside
- Area/whole-house ventilation
- Built-in recycling centre

Bathroom

Goals: Save water, control moisture and air quality, be resource-efficient, save energy.

- Low-flow toilet, showerhead and faucets
- Low-maintenance, durable, non-slip flooring (tile, linoleum)
- Low-emission cabinets (hardwood, sealed particle board)
- Low-emission countertop (solid surface, laminates)
- Waterproof wall finish
- Low- or no-VOC paints
- Low-emission cements, grouts and caulking
- Energy-efficient windows and skylights
- Energy-efficient lighting
- High-efficiency exhaust fans
- Protection against scalding
- Safety and accessibility features (grab bars)
- Energy-efficient windows and exterior doors
- Programmable thermostats
- Energy-efficient lighting
- Area lighting

- Automatic timers and dimmer switches
- Low-emission, easy-maintenance flooring (hardwood, cork, marble, ceramic)
- Carpeting and area rugs from natural or recycled material
- Low-emission trim and moldings
- Low-emission solid wood doors
- Low- or no-VOC paints and varnishes
- Low-emission cements, grouts and caulking
- Low-emission furniture and drapery (hardwood frames, natural fabrics)

Basement

Goals: Control moisture and air quality, eliminate mould, save energy, think comfort if basement is living space.

- Determine and deal with sources of mould (repair, replacement, etc.)
- Mould treatment with warm water and detergent
- Air and moisture sealing of walls
- Moisture and soil gas sealing of floors
- Upgraded insulation
- Ventilation
- Reduce concrete floor dust with water-based wax sealer
- Energy-efficient lighting
- Natural light with high-performance windows
- Low-emission finishing materials

Mechanical Room or Area

Goals: Save energy, control air quality, minimize water contaminants.

- Energy-efficient, sealed-combustion and correctly sized heating equipment
- Energy-efficient hot water tank
- Energy-efficient furnace fan motor

- Separate, direct air supply for equipment
- Insulated hot water pipes
- Non-lead pipes
- Air filtration and humidification/dehumidification
- Whole-house ventilation system (heat recovery ventilator)
- Effective, balanced, sealed ductwork or distribution system
- Water purification system
- Central vacuum exhausted outdoors
- Attic - Goals: Save energy and increase the comfort of the whole house.
- Upgraded insulation
- Air sealing and vapour barrier
- Weather stripping and insulating attic hatch
- Ventilation

The Structure, or What You Do Not See

Goals: Save energy, prevent moisture infiltration, improve air quality, increase comfort, be resource-efficient, reduce noise and dust.

- Insulation (recycled content)
- Air sealing (windows, doors, electrical outlets)
- Vapour barrier
- Framing, sheathing, underlay: low-emission, resource-efficient
- Drywall with recycled content
- The Exterior - Goals: Reduce maintenance and replacements. Reduce moisture problems.
- Low-maintenance, durable exterior finishes
- Low-maintenance trim, soffits and fascia
- Air and moisture sealing
- Long-lasting roofing

- Eavestroughing
- Drainage away from the foundation
- Chimney flashing (no leaking)
- Properly located air intakes and exhausts for systems and appliances
- Effective lighting for safety
- Roof overhang for shading
- Ice dam prevention
- Landscaping - Goals: Conserve water. Reduce use of chemicals. Enjoy low maintenance.
- Drought-resistant native plants (xeriscaping)
- Reduced lawn area (less water and fertilizer)
- Cistern or rain collection system
- Composter for organic wastes
- Organic garden
- Trees for windbreak and shade

Appendix 3: CMHC – A Better Way to Renovate

The following list identifies strategies used in the Renovation Demonstration program (CMHC, n.d. (a)). The program included partnerships between CMHC, Natural Resources Canada, the Canadian Home Builders Association and several industry professionals. Through multiple projects, the program identified the following measures to bring a home in disrepair up to modern standards for health, safety and efficiency. The program was not specific to Aboriginal housing. Insofar as these issues are found in existing Aboriginal housing however, they may prove relevant to the development and/or improvement of related programs and projects. These measures have not been evaluated through the course of this research. Rather, they have been provided as an additional source of potential strategies and design options to inform such development and improvement. In determining appropriateness, due consideration must be given to the contextual factors identified within this research.

Energy Retrofitting & Insulation

- Window replacement, with energy-efficient, high-performance units (usually with low-E coating and argon fill)
- Air sealing (air barriers and caulking)
- High-efficiency heating systems, lighting and appliances

Occupant Health

Canadians spend almost 90 percent of their time indoors. Protecting indoor air quality is very important. The most common approaches were:

- Low- or no-emission paints, finishes, cements, sealants and adhesives — no or few Volatile Organic Compounds (VOCs)

- Low- or no-emission building materials and products (for instance, cabinetry with no formaldehyde)
- Hardwood, ceramic and linoleum flooring, instead of carpeting, to reduce chemical emissions and dust
- Direct-vent heating appliances to prevent combustion gases from entering the home
- Basement treatment (cleaning, sealing, damp-proofing, insulating) to eliminate moisture problems and mould
- A heat-recovery ventilator (HRV) — a whole-house ventilation system that continuously draws fresh air into the house and exhausts stale air

Resource Efficiency

Renovation teams selected materials and products according to environmental criteria.

Each renovator also developed a demolition and waste management plan. Approaches included:

- Materials with recycled content (insulation, flooring, shingles)
- Materials from sustainable resources (cork flooring, engineered wood products)
- Water-conserving products (toilets, showerheads, faucets)
- Durable, long-lasting products (flooring, siding, shingles)
- Reuse and refinishing of existing materials (flooring, siding, doors, trim)
- Use of demolition waste in the renovation (lumber, masonry)
- Sale, trade or give-away of demolition materials (taking material to the landfill only if there was no other choice)

Affordability

In general, the Renovation Demonstration features did not significantly increase renovation costs. In the long run, lower costs for energy, water, maintenance and replacement will pay for many additional renovation costs.

Appendix 4: Haisla Housing Study Design Principles

The following list identifies the design principles that emerged from the Haisla Housing Study (Shaw et. al., 2007). This collaborative workshop-based design research was conducted by academics at the University of Victoria, Marseau Evans Johnson Architects and members of the Haisla community in Kitimaat, British Columbia. The intent of the study was to engage the Haisla First Nation in an investigation of their on-reserve housing in order to develop a more culturally appropriate, environmentally responsive and energy efficient housing type that the Nation could implement in future development of housing in their community. These measures have not been evaluated by this research, and originate from factors specific to the Haisla community and their culture. With that in mind, where the housing challenges and conditions in this community are commonly found in other Aboriginal communities, the information herein may prove relevant to the development and/or improvement of other Aboriginal housing programs and projects.

Outdoor Living

- Provide a connection of kitchen to outdoors (canning - bringing in game, etc...)
- Provide a connection of laundry to outdoors for clothesline, etc...
- Provide a mudroom zone - transition between in/out
- Provide storage related to entry - gear, equipment, etc...
- Consider connection of the house to the smoke house, root cellar, outside work bench, garden, and solar exposure to these areas
- Consider the relationship of the driveway to smokehouse for loading/unloading
- Consider roof slope and two foot overhang to avoid snow collection at entries and main paths of travel

Food Storage

- Provide large freezer capacity - fish, meat, vegetables, bulk purchasing
- Provide cool storage for canning - consider traditional root cellar
- Provide pantry adjacent to the kitchen

Living Space

- Provide big kitchens
- Provide big eating areas, big living rooms, large gathering areas
- Plan for southern exposure to feature rooms

Flexibility

- Consider the ability to expand living space for gathering

Affordability

- Provide a smaller footprint - reduce overall area - plan for easily accessible lockable storage space outside the unit
- Increase energy efficiency
- Utilize simple construction methods / materials
- Balance initial cost with long term cost i.e. maintenance

Accessibility

- Provide at-grade ground floor (no steps)
- Provide living space on ground floor
- Consider future change in house planning (aging, reduced mobility, having children)
- Minimum three foot doors

Capacity Building/Training

- Develop material standards and quality control from within the community as part of Housing

Policy

- Provide opportunity for site milled material - lumber, siding, interior paneling
- Specify construction method/materials that can be built on site without highly skilled knowledge or specialized equipment
- Consider the role of responsibility in sense of ownership (I built this house!)
- Consider the connection of health + housing and address the need for training in systems and maintenance

Durability / Quality

- Balance cultural materials (wood) in the more private zones with long lasting tough materials where there is high traffic / use
- Specify systems that will perform over the entire life of the house with planned maintenance
- Specify construction methods / materials that ensure quality

Cultural

- Specify wood siding / structure / interior finishing (where not sacrificing durability)
- Provide opportunity to paint exterior with cultural symbols
- Consider location of the entrance - central to living space - ceremonial
- Consider Big House / post and beam design

Energy Efficiency

- Reduce energy use (+ monthly utility bill)
- Consider natural energy sources / passive systems i.e., solar, wind, geothermal
- Healthy Housing
- Reduce the use of material that will host mould - select construction methods / materials that ensure positive air quality and thermal comfort - provide day lighting to all occupied spaces
- Consider skylights
- Improve ventilation strategies beyond bathroom / kitchen exhaust

- Train housing owners in ventilation and heating systems of their homes, including care and maintenance.