10 years/ans

Lac des Mille Lacs First Nation

Bingwi Neyaashi Anishinaabek

NPA
NORTHERN POLICY ANALYTICS

NORTHERN POLICY INSTITUTE
INSTITUT DES POLITIQUES DU NORD
Giwednong Aakomenjigewin Teg
Institu dPolitik di Nor
Aen vawnd nor Lee Iway La koonpayeen

NORTHERN RECONCILIATION
RÉCONCILIATION DANS LE NORD

Research Report | Fall 2022

A House Should be a Home

Nation Rebuilding Series, Volume 7

By: Mateo Orrantia and Mercedes Labelle

northernpolicy.ca

NPI – Who We Are

Land Acknowledgement

NPI would like to acknowledge the First Peoples on whose traditional territories we live and work. NPI is grateful for the opportunity to have our offices located on these lands and thank all the generations of people who have taken care of this land.

Our main offices:

- Thunder Bay on Robinson-Superior Treaty territory and the land is the traditional territory of the Anishnaabeg and Fort William First Nation.
- Sudbury is on the Robinson-Huron Treaty territory and the land is the traditional territory of the Atikameksheng Anishnaabeg as well as Wahnapitae First Nation.
- Kirkland Lake is on the Robison-Huron Treaty territory and the land is the traditional territory of Cree, Ojibway, and Algonquin Peoples, as well as Beaverhouse First Nation.
- Each community is home to many diverse First Nations, Inuit, and Métis Peoples.

We recognize and appreciate the historic connection that Indigenous peoples have to these territories. We support their efforts to sustain and grow their nations. We also recognize the contributions that they have made in shaping and strengthening local communities, the province and the country as a whole.

This report was made possible in part through the support of the Donner Canadian Foundation and the Northern Ontario Heritage Fund Corporation. Northern Policy Institute expresses great appreciation for their generous support but emphasizes the following: The views expressed in this report are those of the author and do not necessarily reflect the opinions of the Institute, its Board of Directors, or its supporters. Quotation with appropriate credit is permissible.

Author's calculations are based on data available at the time of publication and are therefore subject to change.

Review Editor: Dr. Robert Patrick

Published by Northern Policy Institute
874 Tungsten St.
Thunder Bay, Ontario P7B 6T6
ISBN: 978-1-990372-28-5

nohfc An Agency of the Government of Ontario

Partners

Animbiigoo Zaagi'igan Anishinaabek

Our people have been present in these lands for time immemorial. Our ancestors were strong, independent people, as we are today, who moved with the seasons throughout a large area of land around Lake Nipigon. We governed ourselves using the traditional teachings we still teach our children today. Now, our community members widely scattered throughout many communities, the majority of which are located in northwestern Ontario in and around the shores of Lake Superior. We are unified by our connection to the environment, our commitment to our traditional values, and our respect for each other.

Bingwi Neyaashi Anishinaabek

The people of Bingwi Neyaashi Anishinaabek – formerly known as Sand Point First Nation – have been occupying the southeast shores of Lake Nipigon since time immemorial. Our community is dedicated to fostering a strong cultural identify, protecting Mother Earth, and to providing equal opportunities for all. Furthermore, our community vision is to grow Bingwi Neyaashi Anishinaabek's economy and become recognized as a sustainable and supportive community where businesses succeed, members thrive, and culture is celebrated.

Lac des Mille Lacs First Nation

The community of Lac des Mille Lacs First Nation is located in Northwestern Ontario, 135 km West of Thunder Bay, and encompasses roughly 5,000 HA of Mother Nature's most spectacular beauty. Our people have held and cared for our Lands and Traditional Territories since time immemorial. To fulfill our purpose and in our journey towards our vision, we, the Lac Des Mille Lacs First Nation are committed to rebuilding a strong sense of community following a holistic approach and inclusive processes for healthy community development.

Partners

Northern Policy Analytics

Northern Policy Analytics (NPA) is a community-inspired applied policy and research consulting firm based in the Yukon and Saskatchewan. Founded by Drs. Ken Coates and Greg Finnegan in response to rapidly changing conditions and opportunities in the Canadian North, NPA recognizes that Northern and Indigenous communities often experience poorer educational outcomes, higher unemployment rates, receive fewer public goods and services, and lack the economic stability needed to optimize community well-being and quality of life. Yet these communities are often located in direct proximity to some of Canada's most valuable natural resources, resulting in both opportunity and conflict.

We address both policy and economic development issues and strive to effectively bridge the gap between Indigenous communities and settler government agencies by supporting community and economic development planning, grant writing, facilitating meetings, and by supporting entrepreneurship and the development of businesses in the region. NPA also helps communities marshal the information and resources they require to improve community and economic outcomes, while mitigating the impacts of colonialism and the over-arching resource extraction sector that dominates the regional economy.

Northern Policy Institute

Northern Policy Institute is Northern Ontario's independent, evidence-driven think tank. We perform research, analyze data, and disseminate ideas. Our mission is to enhance Northern Ontario's capacity to take the lead position on socio-economic policy that impacts our communities, our province, our country, and our world.

We believe in partnership, collaboration, communication, and cooperation. Our team seeks to do inclusive research that involves broad engagement and delivers recommendations for specific, measurable action. Our success depends on our partnerships with other entities based in or passionate about Northern Ontario.

Our permanent offices are in Thunder Bay, Sudbury, and Kirkland Lake. During the summer months we have satellite offices in other regions of Northern Ontario staffed by teams of Experience North placements. These placements are university and college students working in your community on issues important to you and your neighbours.

About the Authors

Mateo Orrantia

Born and raised in Marathon, ON, Mateo is proud to call Northern Ontario home. Currently in his first year of medical school at NOSM U, Mateo tries to bring an interdisciplinary approach to problem-solving. A firm believer in a self-directed and diverse North, he wants to apply his experiences in research and grassroots activism to help foster stronger and more sustainable communities across Northern Ontario. After spending his last few summers working at Pukaskwa National Park, Mateo has become passionate about protecting the region's unparalleled natural resources. Unsure of where his future will take him - other than back to the North - Mateo has gotten involved with initiatives across disciplines, from Strength & Conditioning coaching, to literary research and student governance. When he's not working, Mateo enjoys strength training, reading, and exploring the outdoors (which usually results in a little too much bushwhacking).

Mercedes Labelle

Mercedes Labelle graduated from McGill University in 2020 with an Honours Bachelor of Political Science and Urban Systems. During her studies, she focused on Canadian politics and public policy processes, specifically researching the uneven distribution of benefits and services between urban and rural communities. At McGill, Mercedes provided analysis on Canadian Politics for the McGill Journal of Political Studies (MJPS). Through her involvement with MJPS, Mercedes developed a deeper understanding of the diverse interests and needs of the Canadian population. Having grown up in Canada, the United States, and Spain, Mercedes is eager to return to Northern Ontario, where her family now resides. In her free time, Mercedes enjoys listening to podcasts, cooking, and reading.

Contributions by Rachel Rizzuto and Charles Cirtwill

Table of Contents

Executive Summary

Successful infrastructure development goes hand-in-hand with economic and social success. It will be of utmost importance for Indigenous and non-Indigenous communities across Canada as they set their sights on recovery and prosperity in a post-COVID world.

This paper examines approaches to housing infrastructure design. It begins with the historical approach of a standard design meant to be replicated at relatively low cost in multiple locations or, alternatively, minimalist designs meant to deliver necessary functionality at the lowest cost. These approaches are generally referred to as the "basic" build model. The paper expands from there to look at more modern and innovative approaches.

Yale First Nation, Seabird Island First Nation, and Keewayin First Nation, all faced challenges with their on-reserve housing supply. These problems included overcrowding, mould, substandard building quality, high occupancy turnover, and materials not suited to local climates. The City of Welland was also experiencing a shortage of seniors housing. Through innovative housing design, such as incorporating green technologies, using local and appropriate materials, and community-identified needs-based engagement, these problems were largely overcome.

This work highlights some common problems with basic build infrastructure and illuminates examples of successful and best practices in the Canadian-Indigenous and non-Indigenous context.

The **best practices** for housing design identified through this case study analysis include:

- Community-specific, and community-led, design established through extensive community engagement;
- Community education initiatives to establish an understanding of the new technologies/infrastructure and their proper uses and benefits; and,
- The implementation, where possible, of simple, passive technologies.

The case studies also revealed what, when possible, should be **avoided**:

- Overly complex technologies that are difficult to install, use, and maintain;
- A "one-size-fits-all" infrastructure approach, whereas community circumstances are not accounted for; and,
- Too much reliance on external actors for design, construction, and maintenance.

Introduction

Successful infrastructure development goes hand-in-hand with economic and social success. It will be of utmost importance for Indigenous and non-Indigenous communities across Canada as they set their sights on recovery and prosperity in a post-COVID world. However, conversations around Indigenous housing infrastructure development in Canada take place against a backdrop of failures largely fostered by the "basic build" approach to infrastructure funding and construction. Basic build infrastructure often follows a "blanket approach" to funding, design, and construction, without accounting for a community's unique needs and circumstances, which will be demonstrated by looking at cases from Kashechewan and Nibinamik First Nations in Northern Ontario, as well as the Tawaak Housing Association in Nova Scotia.

Although the basic build approach can sometimes allow for quicker infrastructure development with lower up-front costs, it often leads to negative project outcomes. The significant benefits associated with more innovative methods of design, on the other hand, far outweigh its disadvantages—emphasizing the importance to shift away from the historically-used basic build approach towards more innovative methods.

The Basic Build Approach

Historically, funding for First Nations housing has been provided through the 1966 federal subsidy program and later through the 1996 On-reserve Housing Support program (Olsen, 2016). These subsidy programs put a heavy emphasis on up-front costs, setting strict maximum unit construction prices that dictated a limit on initial capital costs of housing, with stringent funding timelines (Olsen, 2016). This funding is offered on an annual basis and must be competed for by communities across the country each year. This stops First Nations communities from being able to plan and carry out multi-year housing plans or development, restricting housing development to what can be planned and carried out in a single year (Patterson & Dyck, 2015). This encouraged housing designs that could be set up for low overall costs that met the minimum standards set out by the funding programs (Olsen, 2016). The centralization of funding models in this way also led to standardized home designs with minimal options for communities to adapt them to their own localities—if a community wanted to design a home, they had to choose from a set of predetermined models set out by the federal government (Kyser, 2012). These issues are further compounded by a lack of capacity, funding, and resources in many First Nations communities (Patterson & Dyck, 2015). Hence, it is evident that this has resulted in a basic approach to housing infrastructure, wherein communities are incentivized to pursue minimally acceptable housing development according to federal standards and design templates, in order to meet funding requirements.

Kashechewan First Nation, Ontario

Kashechewan is a small First Nation located near James Bay, in northern Ontario. For the most part, homes in this community borrow designs directly imported from southern Ontario with no consideration for local conditions, a reflection of the basic approach to housing design discussed in the previous section (McCartney, 2017). Houses are too small, with two-bedroom homes accommodating up to nine or 10 adults each. Moreover, houses are inappropriate for local climate conditions (frequent flooding is an issue at Kashechewan), and low temperatures (Pope, 2006). Critically, there is a sentiment among community members that basements in the homes increase opportunities for mould within, given frequent local flooding (Francis, 2016). These issues compound to leave homes in significant states of disrepair, with many experiencing severe mould issues (Francis, 2016). In some cases, as observed by Alan Pope, former Special Representative of the Minister of Indian and Northern Affairs Canada, occupants do not maintain their homes, and have little sense of responsibility for their living conditions (2006, 15). However, Pope notes this is a symptom of housing conditions on reserve, not a source (2006).

Interestingly, the basic build approach has not made it easier for homes to be developed in the community, as the community had not been able to pursue housing development for several years due to their accumulation of housing debt (Pope, 2006). The remote location of the community also makes it difficult to ship and acquire the construction materials required for pursuing housing development along the basic approach (Pope, 2016). In other words, the basic build approach had made it prohibitively expensive to develop housing on their lands, as well as being largely counterproductive.

Nibinamik First Nation, Ontario

Nibinamik is a small First Nations of approximately 200 community members living on-reserve, located in Ontario's Far North (Sharma, 2017). When a fire in the 1990s destroyed many of the locally built log homes in the community, the Nation was forced to turn to basic, prefabricated government homes to rapidly fulfill housing needs (Sharma, 2017). The resulting homes have proven inappropriate for the local climate, with temperatures descending well past freezing in the winter and foundations shifting with seasonal melts (Hutter, 2017). They encounter the same issues of overcrowding as seen in Kashechewan—with some one-bedroom homes accommodating four generations of family members (Hutter, 2017). Homes are rapidly deteriorating, and are completely inadequate for residents (Hutter, 2017). The design of the homes do not allow for the continuation of cultural practices, which contributes to their destruction and furthers the erasure of Indigenous traditions (CBC News, 2017). Community members feel as though housing conditions have contributed to significant mental health issues within Nibinamik (CBC News, 2017).

$1.37 million was directed to the community from Indigenous and Northern Affairs Canada (INAC) for the development of new duplexes on the reserve. However, this funding came with strict timelines that did not take into account local factors impacting home construction such as capacity and isolation (CBC News, 2017). The result: materials delivered to the community by the government remained unassembled, slowly rotting (CBC News, 2017).

Tawaak Housing Association, Nova Scotia

In 1981 the Tawaak Housing Association was formed as a private non-profit housing corporation that owns, operates, and delivers socially assisted rental housing in six urban areas of Nova Scotia (Tawaak Housing Association, 2012). The association was established in response to a growing need for a separate Indigenous housing program to meet existing issues of discrimination and exclusion from housing in urban centers, with the recognition of the distinct needs of the Urban Indigenous population who migrate from rural areas and reserves. The mission of the association is to provide suitable, adequate and affordable housing for Indigenous peoples (Tawaak Housing Association, 2012). The original investment by the Federal Government for the purchasing and maintenance of properties met the needs of the population, but by the late 1990's much of the funding had been cut since it was tied to mortgages that had since been paid off (Luck, 2020). With buildings that had been cheaply built or purchased over 30 years ago as of 2020, with little to no upgrades or maintenance since the time of purchase began to gain media attention for the deteriorated living conditions. Residents cite leaking roofs, water damage, leaking windows, and mould going unrepaired after multiple complaints to the landlord (Luck, 2020). With older buildings, and a limited funding model for repairs, often the project will be handled by whichever company provides the lowest bid, generally resulting in the most limited amount of work being done, and eventually causing repeated issues, or exacerbated existing issues.

Brian Dezagiacomo, who has been the executive director of Tawaak since the 1990s suggests that the unpredictable funding model is to blame for the basic build approach to repairs and maintenance that the association has taken on (Luck, 2020). They only receive limited funding which means they must prioritize the most degraded units, leaving limited room for long term investment or preventative maintenance. The basic build model of doing limited upgrades for as cheap, and as quickly as possible has created a much larger issue for the housing association and the tenants that occupy these units.

Outcomes

The three examples above are illustrative of the issues with the basic build approach to First Nations housing across the country. When taking such an approach, houses are often created that do not account for First Nations ways of life, or for local climates (Kyser, 2012). Homes are often too poorly-built to adequately withstand winters, and are particularly susceptible to spring thaws and heavy precipitation (CBC News, 2017). Modelled for non-Indigenous nuclear families, they often become overcrowded on-reserve, increasing wear and moisture—which then leads to mould development (Kyser, 2012). This can lead to homes rapidly falling into disrepair, presenting significant health risks for their occupants, making homes inadequate for their residents (Kyser, 2012). While some may contest the applicability of these examples to the broader picture, claiming them to be too extreme, the national Indigenous housing statistics shows that they are by no means an exception to the rule: almost 27.4 per cent of First Nations peoples living on-reserve in Canada live in homes that are in dire need of repairs—and 36.8 per cent of First Nations people on-reserve live in crowded housing (Statistics Canada, 2017). Conversely, only 6.5 per cent of Canadians live in housing in need of major repairs, and only 4.9 per cent live in housing that is unsuitable for their familial composition (Statistics Canada, 2017). Also, homes have been culturally inappropriate, which further contribute to mental health issues and the destruction of Indigenous cultural practices (Kyser, 2012). While the basic build model has been the main method for developing Indigenous housing infrastructure, it has largely failed in delivering positive housing outcomes for the communities.

Some contest the notion that it is the design of the houses that lead to disrepair, citing instead a lack of maintenance and care for the homes by their residents as a reason for their poor condition. This argument, however, is ultimately disingenuous as it ignores the interplay between design and ownership. The design and construction of Indigenous housing plays a critical role in whether or not residents feel a sense of ownership of their home, and are thus motivated to maintain it. Substandard design has been found to be a key factor in promoting a lack of ownership and responsibility for homes, which in turn influences the maintenance and care that homes receive (Kyser, 2012). This is not to say that poor design is the only factor, as these issues are also due to the nature of housing programs on reserve, each reserve's resource pool and administrative capacity, as well as social issues like low employment rates (Kyser, 2012). However, it must be recognized that housing design does play a critical role in that nexus of factors.

It is also not clear that the basic build model has contributed to the delivery of infrastructure in a cost-effective or timely manner, either. Neither of the on-reserve communities previously mentioned has been able to take on the development of more homes to respond to their clear local needs, despite the availability of funding in the case of Nibinamik. In fact, many First Nations are not able to respond to the massive demand for housing in their communities—as shown by the high rates of crowded housing on reserve—indicating that the basic build model may not be an effective way of delivering quick, inexpensive housing to Indigenous communities. Basic construction methods are also often not suitable for the development of housing in these communities due to capacity and climactic factors, as materials can often degrade and begin to rot when exposed to harsh environmental conditions. Yale First Nation, a community that will be discussed later on in this paper, experiences similar difficulties with the basic method, as their high rates of precipitation often delay construction for months at a time and damage building materials.

From this, we can see that the basic build method for housing development provides little in the way of advantages for First Nations communities, and yet presents significant downsides.

Case Studies: Innovation in Practice

Yale First Nation, British Columbia: Passive Houses[1]

Project Overview

Community specificities: Population is approximately 180. High prevalence of small families, couples, and singles. Rainforest-like climate with high levels of precipitation

Challenges: Mould, rotting, structural damage, weather-related construction delays, high home energy bills

Solution: Two Passive Housing units: a quad-plex and a six-plex

Funding sources: Canadian Mortgage and Housing Corporation (CHMC) provided $169,000 per unit. The Band provided an additional $300,000 worth of funding.

Cost: $200-$233 per square foot. $2,000 per module for transportation.

Project length: The Community Comprehensive Planning process took two years (2012-2014); funding was applied for in May 2016 and received in June 2016; the housing developments were completed in 2017 and 2018. From conception to completion, the projects took approximately six years.

Outcomes: Units use up to 90 percent less heating and cooling energy than typical homes. High building standards.

Yale First Nation is a small First Nation of approximately 180 members, located near Hope in southern British Columbia (Canada, 2019). During the early 2010s, the community identified housing and "being able to come back home" as priorities going forward (Zeng, 2017). In response to this, Yale embarked on a mission to provide affordable, durable, and environmentally-sensitive housing to their membership—all while avoiding the challenges that plagued previous development in the area. This resulted in the construction of two units—one quad-plex and one six-plex—which are the first passive house developments ever built in a Canadian Indigenous community (CMHC, 2018). Since their completion in 2017 and 2018, the project has been well received in the community and has resulted in energy use cost savings and lower maintenance costs. Furthermore, such work has had positive social capital impacts.

[1] Unless otherwise indicated, the information for this case study was provided to the authors via interview in June 2020.

Initial Stages

Between 2012 and 2014, Yale First Nation completed a Comprehensive Community Planning process, and through this, identified two major needs for the community: new housing and helping members return to live on reserve land (Zeng, 2017). Only three homes had been built on reserve lands in the past 22 years, and the houses that were on reserve posed significant issues to the First Nation's membership. In the winter of 2016, the average monthly energy bill for a home on reserve was $350, and individual homes in the conventional style on reserve were costing the band more than $60,000 per year to maintain—culminating in costs that were unsustainable for the band (EnergySave, 2018).

These costs are emblematic of the issues with conventional-style housing on Yale First Nation. Importantly, conventional on-site building methods are unsuitable for the Yale climate, where rain can delay construction for up to a year, cause damage to the materials that are exposed on-site, and set the stage for mould issues later on in the life of the home (Hyslop, 2017). The basic builds are also not suited for Yale's rainforest-like climate, which leads to rotting and structural damage, serving to further drive up costs (Hyslop, 2017).

Because of these issues, Crystal Sedore, the First Nation's housing manager, had to look to new housing design technologies to help fulfill the needs identified by the First Nation in a sustainable and cost-effective way. To do so, they chose to pursue modularly-constructed Passive House multiplexes[2]. The decision to build two multiplexes, rather than 10 individual houses, was made to conserve land and allow for future development on reserve, as well as help reduce building costs.

To build these homes, Yale approached Vancouver-based modular housing developer Britco in 2015, before even applying for funding (EnergySave, 2018). Britco was located near the reserve, which helped decrease project price significantly, and had significant experience in both passive housing projects and working with First Nations. Efforts were made to build a collaborative relationship with Britco that would facilitate open communication and cooperation before the project even began.

In May of 2016, Yale applied for Section 95 funding through the Canadian Mortgage and Housing Corporation (CMHC) and received conditional approval in June for $169,000 per unit (EnergySave, 2018). With this funding and $300,000 in additional funding from the band, the band would begin the design and construction of the homes (EnergySave, 2018).

[2] The design elements of Passive House design will be explored in the "Design Elements" section of this case study.

Design and Construction Process

The design of the homes was largely community-directed. The community members helped identify the priorities that had to be addressed through the design, mainly quality, cost, and environmental sustainability. Community demographics—and their high prevalence of small families, couples, and singles—informed the choice to pursue small two-bedroom designs. Housing manager Crystal Sedore and other community representatives collaborated extensively with Britco to decide on smaller aspects of the design like flooring materials and appliances, which would both fit community needs and capabilities, as well as help reduce costs. The Passive House model, with its strict energy standards, poses some restrictions to design options—as only certain layouts and materials can allow for the kind of energy conservation demanded by Passive House certifications.

The construction process for the homes was described as the easiest of any project that the housing manager had ever taken on. The entirety of home construction took place in one of Britco's facilities, taking approximately five months, about a third of the time that would've been needed for a typical home to be built (EnergySave, 2018). Taking on a modular construction process significantly reduced construction risks and the administrative burden of the process, as it eliminates many of the complicating variables that can interfere with construction (Hyslop, 2017). This allowed community administrators to spend time and energy on other on-reserve developments and aspects of the project while construction occurred, and helped make sure that the project came in on budget.

After construction was complete, the units were transported to the site and were installed on their foundations in two days (EnergySave, 2018). During this process, three community members assisted in site preparations and received training that would be valuable for future modular construction projects. Efforts were made throughout the project to involve community members in the construction process, but aging community demographics and small population made it such that there simply were not many working-age people available to help with the process.

Throughout the design and construction phases of the project, band administration endeavored to educate community members on passive house technology through community newsletters and in-person discussions. Those that were set to be tenants also received educational materials as to how to use new appliances and make full use of passive house technology. Some elements, like the airflow system, the windows, and the doors, were fairly unique and would take some learning. To ensure project success, the housing manager made sure that community members were educated and ready to make use of them.

Design Elements

There are two different housing buildings—one quad-plex and one six-plex—both of which are made up of small two-bedroom units (approximately 950 sq. ft. each) and use Passive House technology. The Passive House model is an internationally recognized standard for sustainable buildings and is viewed as a best practice for climate-specific building envelopes by the Royal Architectural Institute of Canada (RAIC, 2018). Passive Houses use scientific building principles to ensure that the house remains at a comfortable inside temperature regardless of outside temperature, with as little mechanical input as possible (see Table 1 below for specific Passive House criteria) (RAIC, 2018). In layman's terms, a Passive Houses use up to 90 percent less heating and cooling energy than typical homes and can be heated or cooled with the same energy needed to run a hairdryer (RAIC, 2018).

Table 1: Passive House Certification Energy Criteria

			Criteria[1]			Alternative Criteria[2]
Heating						
Heating demand	[kWh/(m^2a)]	≤	15			-
Heating load	[W/m^2]	≤	-			10
Cooling						
Cooling + dehumidification demand	[kWh/(m^2a)]	≤	15 + dehumidification contribution[4]			variable limit value[5]
Cooling load	[W/m^2]	≤	-			10
Airtightness						
Pressurization test result n	[1/h]	≤	0.6			
Renewable Primary Energy (PER)			Classic	Plus	Premium	
PER demand	[kWh/(m^2a)]	≤	60	45	30	±15 kWh/(m^2a) deviation from criteria...
Renewable energy generation (with reference to projected building footprint)	[kWh/(m^2a)]	≥	-	60	120	...with compensation of the above deviation by different amount of generation

Source: Passive House Institute, 2015

As it pertains to the Yale First Nation houses, this low energy demand was achieved through the use of largely simple and inexpensive techniques to improve performance—as with most Passive Houses (CMHC, 2018). These technologies include:

- **Increased Insulation:** Every aspect of the home was more highly insulated than in a typical build. The effective R-values in the six-plex were higher than typical building components (CMHC, 2020).
- **Thermal Bridge-Free Design:** These homes were built without thermal bridges to minimize heat transfer from the outside (CMHC, 2018).
- **Airtight Building Envelopes:** Houses were made as airtight as possible to reduce air exchange with the outside. This was done through improved insulation, and special doors and windows. During testing, it was found that these homes had up to 93.3 per cent reduced air exchange per hour than typical builds.
- **Triple-Glazed Windows and Airtight Doors:** High performance triple-glazed windows and an insulated airtight door served to prevent energy loss, air transfer, and eliminate cold spots in the home (CMHC, 2018).
- **Mould-Resistant Materials:** Mould-resistant materials allowed for the safe continuation of local cultural practices that can create high levels of dampness, as well as improved indoor air quality.
- **Solar Orientation:** The buildings were oriented to take advantage of solar heat, reducing heating costs in the winter and overheating in the summer (CMHC, 2018).
- **High-Efficiency Heat Recovery Ventilator (HRV):** HRV's extract heat from stale interior air before it is vented out and transfer it to incoming outdoor air, greatly reducing the home's heating- and cooling-related energy demands. These homes used a Zehnder ComfoAir 200 HRV (CMHC, 2020).
- **High-Efficiency Appliances:** High efficiency appliances are used throughout the homes, from heating systems, to washer, dryers, and fridges (CMHC, 2020).

Combined, these technologies helped the Yale homes achieve tremendously reduced energy demands. Other design choices, like low off-gas flooring materials, were made to reduce potential health risks to an aging on-reserve demographic. To reduce costs, houses were delivered to the reserve without furniture and with some aesthetic variations (Hyslop, 2017).

Project Completion and Outcomes

The six-plex was completed in March 2017, with the quad-plex finishing later that same year. Overall, the units cost $200-233 per square foot, as well as $2,000 per module for transportation—in total, this was approximately $50,000 more than the typical house models that the band could have otherwise built (EnergySave, 2018). Despite this, the homes came in exactly on budget, thanks to negotiations between the housing department and Britco. It should be noted that, despite increased costs, the band expects to save more than that on maintenance and electrical costs, which seems likely given early returns. Given that they can be heated with as much energy as six incandescent bulbs, energy bills are about $40 a month for the units. Remarkably, this is a reduction of up to 94.3 per cent of the bills for some of the old, conventional models on reserve. In the three years since their completion, maintenance demands have practically been non-existent—the only things that has needed repairing in the homes are a few leaky taps.

The housing units have been very well-received by community members, and are currently full, with both small families and couples occupying the spaces. Tenants have reacted very positively to living in the homes, especially due to the low hydro costs and high building standards. Generally, the high building quality has led to tenants truly feeling "at home" in the new units (BC Housing, 2018). Since their completion, 37 band members have returned to live on reserve, and while this was not exclusively into passive house units, the sentiment among the community is that this was greatly facilitated by the passive house developments.

For the community, one of the biggest factors to project success was the nature of their partnership with developer Britco. Described as an ongoing relationship that extended beyond business, Britco was lauded for their emphasis on open communication and community guidance. Creating the relationship early on and ensuring it endured past project completion helped the community deal with any potential complications or difficulties with the homes post-construction. Moreover, it facilitated further development in the community, through Britco's networks and knowledge.

Two drawbacks of the design have been that Passive Houses generally have low storage capabilities due to the stringent energy requirements, which led to residents storing things on their deck. Further, community members have expressed concerns about multi-plex models because it is not one that they are used to and is sometimes conceived of as "less-than" detached models.

In addition to positive cost and energy outcomes, the innovative housing developments have had a broader sociocultural impact on the community, motivating them to take on further innovative housing development and infrastructure projects. Currently, the community is working on building a new multi-purpose building and medical clinic, taking innovative approaches to those designs as well. Yale and its leadership have become a model in innovation for other communities, and is frequently invited to collaborate and speak on innovative projects and designs. As a result, there is a culture of innovation in place at the leadership level and a feeling of pride and excitement for the community among membership. The project is an example of showcasing the community to itself and building confidence in the leadership and community.

Seabird Island First Nation, British Columbia: Green Housing Technologies

Project Overview

Community specificities: Population is approximately 1,051, of which 610 live on the Seabird Island reserve.

Challenges: Substandard building quality, mould, crowding, and high rates of occupant transition.

Solution: Seven housing units (two single homes, a duplex, and a triplex) incorporating new green technologies and design strategies. Followed a traditional longhouse-style made of local wood and stones

Funding sources: Indigenous and Northern Affairs Canada (INAC), Canadian Mortgage and Housing Association (CMHC), Seabird Island First Nation band finances, and in-kind donations from private sources (over 20 private sponsors listed)

Cost: Not available due to large, unspecified amounts of private donations and no comprehensive project audit

Project length: The pilot project was presented to the community by INAC and CMHC in 2002 and construction was completed in 2004.

Outcomes: energy savings, occupant health and safety, flexibility, and adaptability to long-term, but changing, needs. Some complications with overly complex innovative technologies

Seabird Island First Nation is located a few kilometre from Agassiz, in British Columbia (AANDC, 2019b). In the early 2000s, the First Nation, like many others, was experiencing a housing crisis (Kyser, 2012). Among the critical issues were substandard building quality, mould, crowding, and high rates of occupant transition (Kyser, 2012). After being reached out to by INAC and CMHC in 2002, they embarked on a housing pilot project to develop housing units that would integrate multiple different green technologies and serve as a reference point for future Indigenous housing initiatives (Kyser, 2012). The result of this pilot project was seven housing units that incorporate a plethora of different technologies and design strategies. Successful in certain areas and less so in others, this case study provides valuable lessons to inform future development.

Initial Stages

As mentioned above, Seabird Island was approached in 2002 by INAC and CMHC to determine their interest in participating in a sustainable housing pilot project. The idea was originally to build a single home, but after community discussions the project scope expanded to include a total of seven housing units (Kyser, 2012). Given the extremely innovative nature of these homes, they were sure to cost more than the First Nation's typical maximum unit price of $80,000 to $100,000, the most they could receive from the government for housing unit construction (Kyser, 2011). As such, CMHC and INAC resources for the project would be supplemented by Band finances, and a significant amount of in-kind donations from a plethora of private sources[3] (Kyser, 2012).

Once the project was approved, an extensive engagement process with community members, private sector collaborators, and government agencies was held to determine the scope and focus of the project (Kyser, 2012). External voices suggested a shift away from a single unit towards a multi-unit/multi-plex strategy to reduce costs and land requirements, which the community agreed to (Kyser, 2011). It was decided that the project would focus on creating high quality and long-lasting houses, minimizing environmental impacts, responding to cultural considerations, and ensuring occupant health and safety (Kyser, 2012). To help achieve these goals, the project would employ a self-construction model (e.g., built by the community similar to what Habitat for Humanity employs), wherein the community would lead construction of the homes (Kyser, 2012).

Design and Construction Process

The design of the homes was a collaborative process between the community, the government, and private collaborators. During early meetings, the community identified the traditional longhouse as the structure to emulate, established the objectives for environmental performance, and helped set guidelines around size and the use of traditional materials like local wood and stones (Kyser, 2012). However, it should be noted that the design was not entirely community led. External community actors helped to decide the types of technologies and energy-saving measures that would be put in place, among other things (Kyser, 2012). While some of these choices were made with community needs in mind, it is important to note that they did not come directly from the community.

Employing a self-construction model for the project meant that the community and its members were to lead the construction of the homes, presenting a valuable opportunity for capacity-building and skill development for membership—a need the community identified early in the project (Kyser, 2011). Local trades and workers did much of the woodwork for the project, and much of the manual labour was done by community members (Kyser, 2012). However, the installation of the more advanced technologies, of which there were many, was largely led by external parties, which severely limited the use of local labour for the project (Kyser, 2012). The project ultimately wound up largely relying on external entities for much of the construction process, which was complicated when relationships with these groups broke down. For example, the company that installed the water tanks went out of business, which undermined possibilities for knowledge transfer around these systems to community members (Kyser, 2012). In the end, construction took approximately one year.

[3] Over 20 sponsors are listed by a CMHC publication, though it is unclear how much the sponsors donated.

Design Elements

All said, this project resulted in the construction of seven housing units: two single homes, a duplex, and a triplex. In accordance with Seabird Island traditions, the homes are oriented to South, incorporate locally harvested wood and stones, and are intended to reflect the traditional longhouse model. However, the homes departed from this longhouse design somewhat to accommodate for energy-efficiency measures (Kyser, 2012). In addition to the homes, a garden was built in the middle of the development, to allow for the cultivation of traditional medicinal herbs by the community (Kyser, 2011). Seeking to satisfy the needs identified by the community, the homes themselves incorporate a multitude of innovative design techniques and technologies.

In order to respond to changing family needs and foster long-term occupancy, all units incorporate CMHC Flexhousing™ concepts—allowing the units to be easily modified at a low cost, to best accommodate their occupants. More specifically, the homes can be retrofitted to create new rooms within the homes, or even to create new units altogether (Kyser, 2012). Each unit in the triplex, and both detached units, can be converted into two smaller self-contained units at low cost to the user. This is facilitated by using strategic floorplans, window placement, additional mechanical systems in the home, and separate entrances (Kyser, 2012). In addition to adaptability, a focus is placed on the accessibility of the homes. Houses are built "slab-on-grade," meaning there are no barriers to entry on the first floor of the homes. This is complimented by wider doorframes, wheelchair accessible bathrooms, and accessible switches (INAC & CMHC, n.d.).

In the interest of ensuring occupant health and safety, the homes use formaldehyde-free low off-gas insulation and paperless drywall. Also, the building uses a high-performance envelope, incorporating a rain screen, metal roofing, vinyl window frames, and a concrete radiant floor to reduce the potential for moisture penetration and subsequent mould development in the homes (Kyser, 2012). Large overhangs on the roofs and the use of water-resistant cedar for the walls further helped to reduce moisture issues in the homes (CMHC, 2009).

To reduce the environmental impact of the homes, a number of technologies, both passive and active, are incorporated in the homes:

- **Solar Roofing:** The houses' dark green steel roofs absorb heat form the sun, which is naturally transferred to the air in the cavity just below the roof, created by the spacing between the roof and its strapping. As this hot air under the roof rises to the peak, it enters a hot air plenum and is drawn by a thermostat-controlled fan down through the home. This air is pushed through plastic piping in the concrete floor, where it is radiated into the home (INAC & CMHC, n.d.).

- **Earth Tubes:** Four-inch plastic pipes were buried in the ground below-frost level, where the temperature of the ground is a fairly constant 12 degrees Celsius. Outside air is drawn in through the tubes by a fan, where it is warmed to ground temperature and then further heated to an optimum temperature before being ducted through the floors of the home (Dobie & Sieniuc, 2003).

- **Recycled Heat:** Ducts at the high points of the buildings capture rising warm air, which is drawn in by a fan to the concrete slab, where heat is stored and slowly released (Dobie & Sieniuc, 2003).

- **Preheated Domestic Water:** Cold water from the local source is held in a water pre-heat tank (which were installed under window seats in the solarium) connected to the heat recycling ducts, where the air drawn in by the recycled heat system warms it. This water then travels to the water heater for further heating and to the fan-coil unit for space heating (Dobie & Sieniuc, 2003).

- **Hydronic Radiant Floors:** The hot water heater circulates water through a fan-coil unit that transfers the water's heat to a liquid that is then circulated through the concrete slab floors. This helps heat the home and ensures that units do not need furnaces to maintain comfortable temperatures (Dobie & Sieniuc, 2003).

- **Wind Power:** Three wind turbines were installed on-site (though one was never made operational), providing up to four kW of power to the homes (Kyser, 2012).

- **Passive Technologies:** The homes incorporate high-performance windows and doors, low-energy lighting and appliances, solar orientation, recycled lumber and plastics, efficient plumbing fixtures, and double insulation to reduce the environmental footprint of the homes (Dobie & Sieniuc, 2003; Kyser, 2012). A solarium was also included in the design, to take advantage of the solar insolation received by the site, providing additional natural heat to the homes.

Project Completion and Outcomes

The community held a ceremony to celebrate the completion of construction in 2004, and the homes opened to residents soon after (Kyser, 2012). Since then, it is safe to say that the project has had mixed results.

The homes were seen by community members as connected to cultural values and have been well-received by their members, with residents reporting that they were satisfied with their new homes (CHMC, 2009; Kyser, 2012). The cultural elements included in the design, in combination with the self-construction model, has been able to foster pride in the community and an increased feeling of ownership of the homes—which is a critical issue when it comes to Indigenous housing (Kyser, 2012).

Although durability is a long-term outcome, thus far the houses have proven to be very durable and have resulted in very little maintenance costs for the community (CMHC, 2009). Eventually, it is projected that this will result in long-term savings for the community (Kyser, 2012).[4] Additionally, the houses have been able to achieve positive energy outcomes, compared to typical builds—able to attain an EneryGuide rating of 80, indicative of a highly energy-efficient new house. In 2009, a CMHC report found that the Seabird units would use 37 per cent less space heating energy and 28 per cent less water heating energy than a typical home, under similar operating conditions (CMHC, 2009). These energy savings were largely due to the integrated space and water heating system, and the efficient building envelope of the houses (CMHC, 2009).

Despite positive energy saving outcomes, many of the energy-saving technologies employed by the project were found to have significant issues. The wind turbines were around ten times more expensive than typical energy connections and were not able to achieve a reduction in operating costs or energy costs for the development. Importantly, one of the turbines (that followed a design that had not been locally tested) broke and was never repaired, as the manufacturer went out of business (Kyser, 2012). The solar heating system was found to be overly complicated as residents had issues setting the system appropriately and sometimes left exhaust vents open in the winter, leading to cold air freezing water lines in the home (CMHC, 2009). Further complicating matters, it was estimated that the energy required to run the fans drawing air exceeded the savings they provided, and occupants were not able to take advantage of passive solar gain from the solarium (CMHC, 2009). The earth tubes also presented issues, as contamination from soil during installation may have fostered mould growth and provided little in the way of

[4] For example, based on an energy use comparison between the CMHC demonstration unit and a conventional unit, savings totaled 26,697 MJ/year in a demonstration unit for a family of four. Based on a 2006 report, it was calculated that based on the natural gas rates at the time, it would amount "to $289 per year, or a Net Present Value of $6,426 over a 30 year period" – assuming maintenance is the same for both units (CMHC, 2006).

energy benefits (CMHC, 2009). All in all, many of these technologies were found to be overly complex in design, making it difficult for residents to understand, control, and maintain these technologies. (CMHC, 2009).

Issues with the innovative technologies employed in the design of the homes are tied to shortcomings with the self-construction process of the homes. Despite an initial focus of the project on capacity transfer and job creation, the community expressed that the use of local labour was limited and did not lead to significant positive outcomes post-completion (Kyser, 2012). There was found to be an over-dependence on the external participants in the project and a lack of internal community project championing that severely limited capacity transfer opportunities, especially when it came to the emergent technologies (Kyser, 2012). This was further complicated by many of the private partners going out of business, or their relationship with the community dissolving (Kyser, 2012).

The project also faced time and cost challenges during construction due to design complexity and additional installation times. For example, both the cedar shingles and paperless drywall resulted in lengthy delays and increased costs for the project due to both contractor unfamiliarity and methodological requirements (Kyser, 2012).

It is very difficult to estimate the cost-effectiveness of project design choices, due to a high amount of private donations from myriad sources as well as the lack of a comprehensive project audit. Despite this, the community perception of this project is that it was overly expensive, due to unnecessary complexity in design choices (Kyser, 2012). Overall, many of the negative project outcomes stem from this complexity. A study by Kyser (2012) found that informants suggested that the complexity of the project was driven by architects and engineers external to the community. Furthermore, it was noted by the author that one of the weaknesses in this process was "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."

Welland, Niagara Region, Ontario – Financial and Environmental Innovations

Project Overview

Community specificities: The Niagara region faces a longstanding shortage of affordable housing, particularly for seniors.

Challenges: Current wait times for affordable housing range from 3 to 18 years, depending on the applicant's location and requirements.

Solution: An affordable, low-rise 67-unit development built incorporating energy-saving technologies. Both one- and two-bedroom units are available. There are also three levels of rent: rent-geared-to-income, affordable, and market.

Funding sources: Province of Ontario (Municipal Affairs and Housing's Delivering Opportunities to Ontario Renters program), Canada Mortgage and Housing Corporation (CMHC), and the Federation of Canadian Municipalities (FCM).

Cost: $9.9 million.

Project length: Construction lasted from 2012 to summer 2014.

Outcomes: Affordable housing for seniors without an ongoing operating subsidy. Delivers environmental and social benefits.

Alongside the other case studies in this paper, the Birchwood Place seniors housing project is another example of an innovative housing project that can outline lessons for a new build community. Seniors in the Niagara region have annual incomes lower than the national average, making available, affordable housing all the more crucial. To remedy the housing need, an innovative housing development project, Birchwood Place, incorporated green technologies into an innovative financing model to provide green, affordable housing to the at-need senior population.

Initial Stages and Design Process

Niagara Regional Housing (NRH), the organization responsible for community housing in the area, identified the need for more affordable housing geared towards seniors. NRH already owned and operated senior developments in the area, so the knowledge and expertise needed for a successful new development was already present.

NRH is governed by a Board of Directors comprised of Niagara Regional Councilors and community members. When choosing where to construct the new building, NRH consulted extensively with seniors already living in its existing buildings. Additionally, NRH collaborated with a team of consultants and engineers to design the building and identify the underused development site. A development committee comprised of NRH employees, regional staff, and community members played a key-role in the decisions made during the design and the construction phases (FCM, n.d.b.). The ultimate decision was to locate the development adjacent to one of its existing buildings.

Public discussions were also held at Welland City Hall to promote the project and aid interested applicants (FCM, n.d.a.). Where possible, the development incorporated green technologies, like geothermal energy systems and regenerative-drive elevators, which will be discussed further in the "Design Elements" section.

Construction Process

The construction was largely "funded by senior government grants, plus mortgage loans that are paid for via tenant rent" (NRH, 2016, 1), whereas rents and other revenues now cover operating costs. The Province of Ontario provided approximately $6.2 million in funding for the project through the Delivering Opportunities to Ontario Renters program (Ontario, 2017). Birchwood Place also received over $1.2 million in funding from the Federation of Canadian Municipalities' Green Municipal Fund; it recognized the development's reduced energy consumption, water consumption and waste, close proximity and access to public transportation, and solar-ready roof (NRH, 2016, 3). The project construction phase added over $9 million to the Welland economy by way of employment and product purchases and lasted from 2012 to 2014. The development created 50 construction jobs (FCM, n.d.b.).

Along with the construction jobs created, the project also brought new employment opportunities for a live-in building attendant, cleaners, and contractors. Additionally, the building is expected to generate about $80,000 in additional property tax revenue for the City of Welland (FCM, n.d.b.).

Through using environmentally innovative technologies, NRH did find some of the newer technologies difficult to navigate and maintain, specifically the geothermal system and the regenerative-drive elevators. The problem NRH found was the turnover in the maintenance staff: the contractor who installed the geothermal system maintained it for the first year, then ongoing work was transferred to a different company from outside the area (FCM, n.d.b.). Overly complex design was also seen in the Seabird First Nation case study, where the installation of the more advanced technology was largely led by external groups, and relied in them for much of the installation and ongoing maintenance work. Similar to what was observed in the other case studies, there is a renewed emphasis on training local community members in the installation and upkeep of newer, innovative, and likely more complex systems. With local knowledge comes less external reliance on outside operators to maintain a key technology.

Another by-product of the geothermal system's maintenance difficulties is the increased cost that comes with the ongoing work. When designed, the NRH anticipated that energy cost savings would cover the cost of the geothermal system in 25 years. In fact, at best, the system is expected to break even over its lifecycle due to the higher-than-anticipated maintenance costs (FCM, n.d.a.). A similar issue was faced with the regenerative-drive elevators. Again, the reality of high installation and maintenance costs associated with newer, innovative technologies can be partially mitigated by training community members on the systems. Then, the money for the upkeep at least stays in the community through the jobs created there.

Design Elements

Input from tenants in other buildings informed many of the design decisions to make the units more accessible for seniors, such as the layouts and inclusion of one-piece shower units. Other guiding principles for the project include universal accessibility and an aging-in-place wellness model (FCM, n.d.a.). The development also incorporates common, shared areas and outdoor space access to promote socialization and well-being. Accessibility measures in place in the units (to allow for "aging in place" and the use of wheelchairs) include lowered light switches, counters, stove, and sinks.

The 67-unit development is three stories tall. The two-bedroom units are 65.5m^2 with large balconies on the second and third floor units; there are 12. The one-bedroom units range from 47.7m^2 and 50.2m^2 with most having balconies; there are 55 (NRH, 2014, 1). In addition, the building is accessible, with laundry and garbage chutes on each floor. There are common areas and designated agency space, as well as scooter and bike storage and limited parking (NRH, 2014, 2).

In addition, the building development also included green technologies and practices wherever possible. As the purpose of this development was to provide affordable housing, implantation of environmentally friendly measures was weighed against the possibility of increased costs. The final green technologies and practices implemented include (FCM, n.d.a.):

Geothermal heating and cooling systems that are supplemented by electric heaters;

- Regenerative-drive elevators;
- Organic waste deposit bins;
- Rainwater collection used for site irrigation;
- Electric vehicle charging stations; and,
- Green living wall in lobby.

In fact, the comprehensive environmental measures resulted in Birchwood Place receiving a Leadership in Energy and Environmental Design (LEED) Silver certification (NRH, 2016, 3). In fact, the geothermal heating and cooling system reduces the building's energy use by approximately 48 per cent, compared to other building standards (FCM, n.d.b.).

But, as mentioned previously, the implementation of the technologies was not perfect. Accompanying the installation and maintenance issues, there were instances of user-error with the geothermal systems. Each unit had its own temperature controller and was connected to the geothermal network. The role of the temperature controller was to act like a back-up in case the geothermal system stopped working. The temperature controller would activate the back-up electric heat system. Some tenants initially activated the electric heating system unnecessarily, again driving up utility costs (FCM, n.d.a.). It is assumed this was caused by the complexity of the controllers themselves; some tenants required more information and a physical demonstration of using the controllers, instead of relying solely on the handbooks given. This process was largely mitigated by maintenance staff working with each tenant to set a heating and cooling schedule tailored to their needs (FCM, n.d.a.).

Project Completions and Outcomes

The building was completed in the summer of 2014 and has been completely occupied since then. At the completion of the project in the summer of 2014, rent prices were as follows:

- 1 bedroom (Affordable Market) = $578 (maximum);
- 1 bedroom (Market) = $714;
- 2 bedroom (Market) = $833 (NRH, 2014, 1).

The funding design elements for the Birchwood Place is quite innovative as it does not require ongoing operations subsidies, and additionally funds a 50-year capital reserve for the replacement of key systems and infrastructure. Present day, the two-bedroom units have a current market rent price of $930.00, while the one-bedroom units have market rents of $803.00 (NRH, n.d.). As mentioned previously, there are three rent levels available: rent-geared-to-income, affordable rent, and market rent.

- Rent-Geared-to-Income: Rent is set at 30 per cent of gross household income.
- Affordable Rent: Rent is set at 80 per cent of area market rent.
- Market Rent: Rent is set according to the local market (NRH, 2016, 7).

Of the 67 units, 23 (34 per cent) are rent-geared-to-income, 26 (39 per cent) are affordable, and the remaining 18 (27 per cent) are charged market rents (FCM, n.d.a.). The current model contributes to the success of the project's self-subsidization, again, not relying on ongoing operational subsidies.

As these buildings only include one- and two-bedroom units, the composition of the First Nations community must be taken into account before attempting to replicate the development. For instance, though this development was tailored towards the senior demographic, communities with a high prevalence of young couples and singles could benefit from the smaller unit size. Again, these needs must be identified through a community-engagement process that identifies infrastructure needs and gaps.

Specificities from Birchwood Place, such as senior-tailored facilities, might not perfectly carry over to the needs of a First Nation community. But there are lessons to be learned from this case study which are echoed throughout this paper: the need for community input, needs-based design, and self-construction and community maintenance training. Also, the pros and cons of incorporating of green technologies throughout the building must be weighed: more environmentally friendly infrastructure, depending on a community's priorities, might not always be the best choice. Though providing environmental benefits, innovative green technologies might be difficult to maintain and not overly cost saving.

Keewaywin First Nation, Ontario – Mod Box Shipping Container Homes

Project Overview

Community specificities: Remote community approximately 580 kilometre northwest of Thunder Bay with an on own reserve population of 491 people.

Challenges: Short construction seasons, adverse weather, remoteness, and winter road accessibility.

Solution: Four, one bedroom, 320 sq/ft shipping container homes.

Funding sources: Canadian Mortgage and Housing Corporation (CMHC)

Cost: $94,000 per one-bedroom unit

Project length: Two months of off-site construction, four hours of on-site installation, and one additional month of finishing work on the inside of the container once the structure is in place.

Outcomes: Not yet known.

An innovative housing infrastructure example, though too new to be an entire case study, must be looked at due to its innovative and flexible nature. ModBox NWO Inc. located in Thunder Bay, Ontario, has been transforming shipping containers into homes. Currently, the company is working on constructing four, one-bedroom homes destined for Keewaywin First Nation, about 580 kilometers northwest of Thunder Bay. The shipping container homes are expected to be delivered in May 2021, thus, project outcomes and completion, and long-term impacts, cannot currently be assessed.

Initial Stages

The innovative housing project for Keewaywin First Nation represents the first time a shipping container home project is funded by the Canadian Mortgage and Housing Corporation. In addition, Mod Box NWO is said to be the first company in the country to transform shipping containers into homes destined for remote communities (Laco, 2021). Shipping containers have before been refurbished into buildings, though. In fact, it is estimated this practice has been happening for around 10 to 15 years in Canada. Due to the innovative and new nature of this project, and its rollout in a remote First Nations community, it will be important to continuously re-visit project successes, best practices, and failures for an adequate lessons-learned exercise, especially for communities considering these projects.

Design and Construction

Using a pre-built shipping container as the foundation for a home shortens the construction process; on-site construction is simplified and expedited as the units can be transported to the communities after being built off-site. All upgrades, such as adding windows, drywall, electrical, and plumbing, are done in Mod Box's Thunder Bay shop. A benefit of off-site construction has to do with availability of labour, material integrity, and also adverse weather conditions in the community itself. The benefits of off-site construction are complemented by the fact the containers are also easily transportable, even along winter roads (Walters, 2021).

Once refurbished, the new homes will be transported to the communities via winter roads in late February or early March, and placed on their foundations in May, once the ground thaws and the necessary preparations can begin (ibid). The foundation materials are also constructed off-site in Thunder Bay. Once on site, the container can be put together in about four hours (Walters, 2019). Mod Box indicated they will be hiring local labourers from Keewayin to help with the remaining on-site construction. In addition, Mod Box will be using equipment already in the community to finish the units, showing collaboration between the company and the locals. Once the structure is placed on its foundation, there is approximately one month left of finishing work on the inside of the unit to complete it (ibid).

As for timelines, the shipping containers arrived in Thunder Bay on December 20th, 2020, and were transported to the refurbishment site on January 4th, 2021. As of February 10th, 2021, the containers are in their drywall phase, with transport to the communities expected to occur at the end of February or early March via winter road. The houses will be put on their foundations in May, when the ground has thawed and foundations can securely be placed (Laco, 2021). The off-site construction has the benefit of being minimally disruptive to the community, while also being able to work through winter months in a secure facility. The ease of transporting the shipping containers, paired with the other benefits, make them ideal for northern and remote communities.

Design Elements

The four shipping containers are 40 feet by eight feet, The four shipping containers are 40 feet by eight feet, totaling 320 sq/ft. The M40 homes are comprised of one bedroom that can fit a queen-sized bed, a seven-foot kitchen with stainless steel appliances, a washer and dryer, four-piece bathroom, and wood stoves. The structure is entirely steel, and 100 percent spray foam installation is used, resulting in better energy efficiency than wood or wood-framed buildings (Laco, 2021). The energy efficiency is a result of better insulating properties in the containers than wood-frame modular homes (Walters, 2021). The durable characteristics of the shipping container houses are predicted to better withstand the climates in northern communities, compared to wood buildings (Laco, 2021).

Another benefit of using shipping containers as a base for buildings is the module nature of the product. Shipping containers can be arranged in multiple configurations, such as single level of multi-story homes, can be easily transported from one location to the next, and lay the groundwork for simple additions as families grow or needs change (Mod Box, n.d.). The modular aspect makes these houses highly customizable and can be tailored to specific community demographics and needs.

The shipping containers used are sourced from a company in Winnipeg. Re-purposing these products helps keep construction sustainable. Often, shipping containers from overseas are not shipped back empty because it would be more cost-effective to build new containers, resulting in an abundance of containers to be recycled (Diaczuk, 2018). Mod Box specifically selects one-trip containers manufactured in the same year (Laco, 2021). Since the shipping containers are already built, construction time is shortened.

Project Completion and Outcomes

Again, as this project is ongoing at the time of writing, it is not possible to look at project outcomes and completion, or to gauge community reactions. If shipping container homes are to be considered by a community, ongoing, long-term outcomes should be looked at.

Advantages of Pursuing Innovative Housing Design

Environmental Outcomes

All case studies examined resulted in homes that outperformed basic build homes in environmental metrics, despite approaching the problem differently. At Yale, the principal savings emerged from the development of a high-performance envelope and the integration of multiple passive technologies. Seabird, on the other hand, used innovative heating systems, low energy appliances, and a high-quality envelope to reduce home energy demands. Seabird was able to further reduce their environmental impact by using recycled and locally sourced materials in their builds, though the direct impact of these choices is difficult to quantify. Keewaywin's shipping container homes are projected to be more energy-efficient than wood counterparts and are also made using recycled containers. The three solutions took advantage of local resources and responded to the particularities of local needs and climates. In Welland, the senior housing development incorporated green technologies, such as geothermal heating and cooling, throughout their project.

This, combined with the fact that environmental stewardship is a key aspect of Indigenous culture across the country, indicates that empowering First Nations to lead the design of their homes will create sustainable, low-consumption, environmentally conscious results. We should be careful, however, to propose blanket design solutions that would benefit all First Nations similarly—what works for one community may not be suitable for other climates or demographic makeups. After all, many of the issues with the "basic build" approach stem from doing just that. It is of utmost importance that communities take the lead in selecting approaches that will work for them and their location. This can be seen in the Seabird Island case study, wherein many of the technologies that are proven elsewhere, like earth tubes and a solar roof, were not very effective in the case of the community. As well, the Welland case study shows that green technologies can be more difficult, compared to conventional methods, to install and maintain. Plus, the new technologies might not result in long-term cost savings.

It does seem that passive technologies should be emphasized in the pursuit of energy reductions for Indigenous homes. On Seabird Island, many of the active technologies proved too complex to be properly operated, while many of their energy savings were credited to their high-quality building envelope. Absent extensive capacity building and resident education, active technologies can seemingly become burdensome to homeowners or tenants, as also seen with user-errors with the geothermal systems in Welland. Passive technologies, like the ones employed by Yale First Nation, can result in incredible energy savings with a lower administrative and operational burden.

Durability

Whereas the "Basic Build" housing model often results in the use of materials and building techniques that are inappropriate for their anticipated climates, taking an innovative approach allows for design choices that directly address the demands of local climates. The first two First Nations case studies examined make concerted efforts to address rainforest-like precipitation levels in southern British Columbia, both through material choice and design considerations like the incorporation of a rain screen. In responding directly to these needs, neither development has incurred substantial maintenance costs thus far. Keewayin's remote and northern location pose its own unique challenges, but the structural integrity and insulation properties are projected to withstand the harsh winters faced in the region.

Durability is also addressed in these projects by ensuring that homes are culturally appropriate. Culturally appropriate design allows different spaces in the home to be used for their intended purposes and be prepared to handle the structural demands of those uses. Historically, Indigenous homes have been designed without considerations for familial composition or cultural practices like traditional cooking methods that can result in significant moisture accumulation in homes (Casault, 2003). At Yale First Nation, mould-resistant materials are used to ensure that kitchens are ready to handle alternative cooking methods. Both the Yale and Seabird projects are made with occupant demographics in mind, helping ensure that homes are prepared to accommodate the demands of local family sizes and makeups. The Welland development is also durable in the sense that it allows seniors to "age in place," with the necessary infrastructure and adaptations necessary for the long-term. Though it is not stated whether members of Keewaywin were consulted during the design process of the shipping container homes, the modular and flexibility of the units lend themselves to future modifications to address changing needs.

That being said, it is important to note that durability must be monitored over the long term, and the four projects are still relatively new.

Cultural Appropriateness

The Yale and Seabird case studies, as well as the Welland case study, demonstrate steps were taken to ensure that their housing projects were culturally appropriate, as mentioned in the previous section. Cultural appropriateness can range from tailoring to different family dynamics, practices, and even needs of different groups, like seniors. Admittedly, the demands of the Passive House model impose limitations on what can be done to ensure cultural appropriateness, so the steps taken by Yale were more subtle than those at Seabird Island. At Yale, cultural appropriateness involved responding to community demographic requirements, community design priorities, and ensuring that house design allowed for cultural practices to occur. The Seabird Island project was able to go further than this by using traditional materials and building models, using traditional home orientations, and incorporating Indigenous art in the project. This resulted in a project that was deemed culturally appropriate and representative of local traditions by community leadership (Kyser, 2012). The Welland study, though not a case study in showcasing First Nations culture, did still account for the needs of seniors by providing access to outdoor space and shared areas. This allows then independence, as well as opportunities for social interaction. What is important is the engagement process that identifies these needs in the first place, then the adequate implementation of them in the final infrastructure design. On the other hand, it is not known whether community discussions did occur in the design of the shipping container homes destined for Keewaywin, but there are wood stoves included in the units.

The importance of cultural appropriateness for Indigenous housing is difficult to overstate, as it acts as an important mediator for several key housing outcomes in an Indigenous context. A lack of cultural appropriateness can hinder a sense of ownership and responsibility for a home, resulting in insufficient maintenance, inadequacy, and an eventual shortened lifecycle (Kyser, 2012). Homes are critical social and psychosocial spaces for occupants, and a lack of cultural appropriateness can affect well-being in that regard and undermine overall community wellness (NAN & Together Design Lab, 2018).

Community Impact

Engaging in innovative housing development appears to have a tangible impact on communities. First, these projects seem to resonate well with community membership on account of their high design standards, cultural appropriateness, and end-user savings. At Yale, this has motivated members to move back to the community and become excited about their Nation’s future. The innovative nature of these projects has helped generate a sense of pride in community within membership which, in Yale’s case, has helped lay the groundwork for further innovative infrastructure development. In Welland, the senior development helped fill a large housing gap in the community, while doing so in a way that is affordable for the residents.

These communities have also become models held up for other communities to follow. Yale has come to be regarded as a local leader in housing development. Seabird, on the other hand, was able to open one of their homes as a showcase to other communities, offering tours and educational workshops—helping to bring additional revenue and visibility to the community (Kask, 2004).

Disadvantages of Innovative Housing Builds

Higher Up-Front Costs

When pursuing higher design standards, it is likely that projects will cost more than those taking the basic build approach. This can be due to purchasing high-quality materials, extended design and construction processes, and investments in high-quality appliances and innovative technologies. At Yale First Nation, CMHC funding had to be supplemented by Band funds—whereas in Seabird's case, private project sponsors helped support the initiative. It is likely that, when pursuing innovative housing, a region's Maximum Unit Price (MUP), set by CMHC, will not be enough to fund a project and additional funds will need to be sought. However, this is not to suggest that these costs are unreasonable. In fact, many have suggested that MUP's are problematically low (Kyser, 2012). Also, some green technologies, like the geothermal heating and cooling system in Welland, were more expensive at the onset, but were predicted to pay themselves off in 25 years. In fact, this system payback through energy costs savings will likely never occur, due to higher installation and maintenance costs.

Construction and Installation Complications

As seen with Seabird Island, using innovative methods and design elements can result in delays in the construction process. Some elements, like paperless drywall, were relatively new to contractors working on building construction. Other times, design elements like cedar walls require a significant investment of time and effort to be installed by their nature. Moreover, it might be difficult to find local maintenance-people with the skills needed to install and maintain these projects, like seen in Welland. Combined, these can lead to delayed construction processes and increased project costs. It should be noted that Yale was able to avoid this by ensuring that their project partners were very experienced with the design choices made and in working with First Nations. The Keewaywin units were also able to avoid construction delays, due to off-site construction in a secure facility. Nevertheless, innovative housing projects, especially those in remote communities, have longer project timelines than their basic-build and/or non-Indigenous project counterparts.

Outcomes Undermined in Pursuit of Innovation Goals

In these projects, we see instances where the pursuit of innovation comes at the cost of other outcomes or community design preferences. In some instances, a multi-plex model is used to reduce energy consumption and save money. However, both communities expressed issues with the multiplex model, arguing that it was not as culturally appropriate as other options like detached houses. At Yale, using a passive house model limited available storage space, negatively impacting their cultural appropriateness. Further, we can see that the use of complicated technologies at Seabird and Welland, in the pursuit of showcasing innovative potential, undermined community capacity-building, resident operation, and cost-effectiveness—while not being particularly effective (in Seabird's case) in saving energy. While it is too soon to tell what the outcome is in Keewaywin, the case should be monitored.

It must be recognized that innovation can sometimes be at odds with other outcomes desired by the community, a fact that must be countenanced against the potential benefits of said innovative design choices.

Successful Practices

Community Design

It is of utmost importance that communities are able to lead the design process, to maximize the benefits of housing development. This is because housing design must reflect the demographic, cultural, and ecological needs of the community, as well as the geographical/climatic influences. Community design can help ensure that homes meet these needs and tackle the priorities identified by the community, as shown by these case studies. Design that is responsive to these factors can help preserve traditional practices, help ensure housing suitability and adequacy, and foster a sense of ownership over the homes. Together, these factors help ensure long-term home durability. Yale and Seabird First Nation, along with the senior development in Welland, all had community meetings which inspired design. On the other hand, it was not indicated whether Keewaywin community members contributed to the design process, but community engagement in project designs are highly encouraged for future shipping container projects.

Relationships with Private Partners

The success of these projects hinged in large part on the nature of each First Nation communities' relationship to private partners in the project. On one end, Seabird has private partner relations that are transient and leave much to be desired. Relationships were sometimes even ended during the project, which significantly impeded the desired community outcome of capacity building. External partners also tried to control some aspects of the design, adding unnecessary complexity to the homes that impeded their success. At the other end, Yale formed a relationship with Britco in the early stages of the project that lasted well beyond completion of the project. This allowed Yale to get assistance or advice on issues that may have arisen after project completion, and to get guidance on future projects from experienced industry members. Britco also had experience designing and building in a First Nations context, which was deemed important by those who worked on the project. From Yale's perspective, the project could not have been completed without building this collaborative relationship with Britco. Mod Box additionally indicates there will be collaboration with the community in the on-site construction phase of the project, including hiring local workers and using community equipment. Therefore, when engaging in innovative housing development, it is important that long-term collaborative relationships be fostered with private partners that have experience designing and building in Indigenous contexts.

Community Education

The introduction of innovative technologies into the home should be accompanied by strong efforts to educate future tenants within the community. At Yale, there were extensive efforts to provide comprehensive tenant education, which helped ensure the appropriate use of passive technologies and novel appliances in the home. More than this, community education efforts were made to foster community buy-in for the use of passive house, modular, and multi-plex construction models. At Seabird, due to shortcomings in relationships with private partners, there was a lack of tenant education. Like in Welland, this impeded the use of the complex technologies applied in the home, impeding their ability to help achieve energy goals and causing broader negative impacts within the home. To maximize positive outcomes and benefits of integrating novel technologies, a significant emphasis should be placed on tenant education.

Passive Technologies

It appears that passive technologies should be focused on in the pursuit of energy-saving outcomes. At both Seabird and Yale, the major energy savings came from the passive elements of the home, like the high-performance building envelope, triple glazed windows, and low energy appliances and fixtures. Active-use technologies saw less success, as they proved too complicated to operate for residents where there was little tenant education. Passive technologies need limited resident manipulation, helping to overcome capacity issues that may be present in First Nations communities.

Internal Project Championing

It is important that projects are championed from within the community. In the case of Seabird Island, much of this was done by individuals and groups external to the community, which impeded the achievement of the community's desired outcome of capacity building and skill transfer through self-construction. Additionally, it led to the addition of complex technologies that were ineffective for residents. On the other hand, the Yale project was strongly championed by both the housing manager and community leadership. This helped to convince the community of the positive benefits, garnering support for the project among the membership—having leadership involved in championing was considered key for the achievement of these outcomes. It also ensured that the project responded directly to the needs and desires of the community.

Conclusion

Though unique community needs and circumstances can lengthen the design and construction process, the above case studies prove it is important when rolling out large-scale infrastructure projects in these First Nations, and even non-Indigenous infrastructure projects. Basic build infrastructure projects are not conducive to long-term growth or success; specifically tailored designs must be sought through community input, and when possible, built through community-led construction. As demonstrated above, durable, culturally appropriate, environmentally conscious housing infrastructure is a possibility for communities. Though the process may result in longer project timelines and/or higher upfront costs, the long-term benefits of innovative infrastructure, done correctly, should far outweigh initial setbacks.

References

AANDC. "First Nations Profiles: Seabird Island First Nation." Government of Canada, April 2019b. Accessed on November 12, 2020. Available online at https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Search/FNMain.aspx?BAND_NUMBER=581&lang=eng.

BC Housing. "Spotlight on housing with the Yale First Nation." BC Housing – Indigenous, July 2018. Available online at https://www.youtube.com/watch?v=_02EmC_eUsc.

Canada. "First Nations Profiles: Yale First Nation." Indigenous and Northern Affairs Canada, April 2019. Accessed on November 9, 2020. Available online at https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Search/FNMain.aspx?BAND_NUMBER=589&lang=eng.

Canadian Mortgage and Housing Corporation (CMHC). 2006. "Seabird Island Monitoring Final Report." Available online at https://eppdscrmssa01.blob.core.windows.net/cmhcprodcontainer/sf/project/archive/research_2/e_98_d9_c66_2006.pdf.

Canadian Mortgage and Housing Corporation. "Seabird Island Monitoring: Research Report." Ottawa: Canadian Mortgage and Housing Corporation, Policy and Research Division, Socio-economic Series; 09-011, February 2009. Available online at https://www03.cmhc-schl.gc.ca/catalog/productDetail.cfm?cat=151&itm=3&lang=en&fr=1308742885210.

CMHC. "Passive House 6-plex Energy & IAQ Monitoring Study: Final Report." RDH Building Science, April 2020. Available online at https://62540b51-ae36-4713-b6c4-b791fe3d00f8.filesusr.com/ugd/6896ba_cf8c2daf306d4cf8a50c88c0b29c613e.pdf.

CMHC. "Yale Sixplex: A First for Passive House in Canada." Canadian Mortgage and Housing Corporation, October 2018. Accessed on November 9, 2020. Available online at https://www.cmhc-schl.gc.ca/en/housing-observer-online/2018-housing-observer/yale-sixplex-first-passive-house-canada.

Casault, Andre. "House Hunting or I've Never 'Lived' In My House." JSSAC 28 no. 2, 2003. 31-42. Available online at https://dalspace.library.dal.ca/bitstream/handle/10222/70847/vol28_1_2_31_42.pdf?sequence=1&isAllowed=y.

CBC News. "Could a new approach to First Nations housing be a game-changer?" CBC News: The National, November 2017. Available online at https://www.youtube.com/watch?v=UpRyv5VzmjA&feature=emb_title.

Diaczuk, Doug. "Shipping container homes landing in Northwest." Thunder Bay, Ontario: TBNewsWatch.com, April 2018. Available online at https://www.tbnewswatch.com/local-news/shipping-container-homes-landing-in-northwest-886897.

Dobie, Allan and Rob Sieniuc. "Integration + Innovation: The Seabird Island Project." The Journal of Architectural Institute of British Columbia, Fall 2003. Available online at http://www.broadwayarchitects.com/downloads/Integration-Innovation-SeabirdIslandProject.pdf.

EnergySave. "First Nations Home EnergySave Community Success Story: Investing in Passive Housing at Yale First Nations." British Columbia: Fraser Basin, 2018. Available online at https://www.fraserbasin.bc.ca/_Library/CCAQ_First_Nations_EnergySave/FNHES-Case-Studies-Yale.pdf.

Federation of Canadian Municipalities (FCM). "Case study: New build achieves financial sustainability, social and environmental benefits." Ottawa, Ontario: Federation of Canadian Municipalities, n.d.a. Accessed on February 2, 2021. Available online at https://fcm.ca/en/case-study/gmf/case-study-new-build-achieves-financial-sustainability-social-and-environmental-benefits.

FCM. “Seniors enjoy much-needed sustainable addition to community housing.” Ottawa, Ontario: Federation of Canadian Municipalities, n.d.b. Accessed on February 10, 2021. Available online at https://fcm.ca/en/programs/green-municipal-fund/compendium/compendium-case-studies/seniors-enjoy-much-needed-sustainable-addition-community-housing.

Francis, Annette. “Tour a family home in Kashechewan that is filled with love – and mold.” APTN, November 2016. Available online at https://www.aptnnews.ca/national-news/tour-a-family-home-in-kashechewan-that-is-filled-with-love-and-mold/.

Hutter, Kristy. “’How can we live like this?’ Prokect aims to do away with colonial-style housing for Ontario First Nation.” CBC News, November 2017. Accessed December 1, 2020. Available online at https://www.cbc.ca/news/canada/nibinamik-pilot-project-home-design-1.4374183.

Hyslop, Katie. “NC First Nation Gets Active about Passive Housing.” The Tyee, January 2017. Accessed on November 10, 2020. Available online at https://thetyee.ca/News/2017/01/09/First-Nation-Active-Passive-Housing/.

Indigenous and Northern Affairs Canada. “Registered Population: Kee-Way-Win.” Accessed June 26, 2021. Available online at https://fnp-ppn.aadnc-aandc.gc.ca/fnp/Main/Search/FNRegPopulation.aspx?BAND_NUMBER=325&lang=eng.

Indigenous and Northern Affairs Canada (INAC) and Canadian Mortgage and Housing Corporation (CMHC). “Building a Sustainable Future: Seabird Island First Nation – Sustainable Community Demonstration Project.” Canadian Mortgage and Housing Corporation: CMHC Archives, n.d. Available online at http://www.broadwayarchitects.com/downloads/Building-A-Sustainable-Future.pdf.

Kask, Tiffany. “Innovative Housing Project Will Benefit First Nations.” Elements Online Environmental Magazine, July 2004. Accessed on November 20, 2020. Available online at https://www.elements.nb.ca/theme/building/seabird/firstnations.htm.

Kyser, Johann. “Improving Aboriginal Housing: Culture and Design Strategies.” University of Calgary, October 2012. Available online at https://prism.ucalgary.ca/handle/11023/303. doi:10.11575/PRISM/26484

Kyser, Johann. “Sustainable Aboriginal Housing in Canada: A Case Study Report.” London: University of Western Housing Intern and Scholar Programme, December 2011.

Laco, Lisa. “Superior Morning: ModBox.” CBC News Thunder Bay, February 2021. Available online at https://www.cbc.ca/listen/live-radio/1-391/clip/15823894.

Luck, Shaina. “Years of leaks and mould, and finally a promise that repairs will be done right.” CBC News, September 2020. Available online at https://www.cbc.ca/news/canada/nova-scotia/ns-indigenous-housing-group-carrying-out-repairs-on-problem-plagued-buildings-1.5725095.

Luck, Shaina. “Tenants of N.S. Indigenous housing group decry deplorable building conditions.” CBC News, January 2020. Available online at https://www.cbc.ca/news/canada/nova-scotia/tawaak-housing-association nova-scotia-tenants-rental-problems-1.5425085.

McCartney, Shelagh. “Design of Everyday Places and Homes Can Heal Wounds.” Ryerson University, TEXxRyersonU, June 2017. Available online at https://www.youtube.com/watch?v=kF2WI42WIAE&feature=emb_title.

ModBox. “ModBox.” Thunder Bay, Ontario: ModBox NWO Inc, n.d. Accessed on Febuary 10, 2021. Available online at http://thinkmodbox.com/.

NAN and Together Design Lab. “Nishnawbe Aski Nation Response to the First Nations National Housing and Infrastructure Strategy.” Nishnawbe Aski Nation, Ontario, September 2018. Available online at https://www.togetherdesignlab.com/nan-housing-strategy.

Niagara Regional Housing (NRH). “235 Fitch Street, Welland.” Niagara, Ontario: Niagara Regional Housing, n.d. Accessed on February 10, 2021. Available online at http://www.nrh.ca/scripts/find-a-unit.pl?unit=200.

NRH. “235 Fitch Street (East Building) Fact Sheet.” Niagara, Ontario: Niagara Regional Housing, 2013. Available online at http://www.nrh.ca/pdf/2013/fitch-street-fact-sheet.pdf.

NRH. “2015 Annual Report.” Niagara, Ontario: Niagara Regional Housing, 2016. Available online at https://pelham-pub.escribemeetings.com/filestream.ashx?DocumentId=1380.

Olsen, Sylvia. “Making Poverty: A History of On-reserve Housing Programs, 1930-1996.” University of Victoria, 2016. Available online at https://fnhpa.ca/_Library/KC_BP_1_History/Making_Poverty.pdf.

Ontario. “Celebrating New Affordable Rental Housing in Niagara.” Municipal Affairs and Housing, June 2017. Available online at https://news.ontario.ca/en/bulletin/45418/celebrating-new-affordable-rental-housing-in-niagara-region.

Passive House Institute. “Criteria for the Passive House, EnerPHit and PHI Low Energy Building Standard.” Passive House Institute, 2015. Available online at https://www.passivehousecanada.com/wp-content/uploads/2017/02/Passive-House-and-EnerPHit_building_criteria.pdf.

Patterson, Dennis and Lillian Dyck. “Housing on First Nation Reserves: Challenges and Successes.” Senate of Canada, February 2015. Available online at https://sencanada.ca/content/sen/Committee/412/appa/rep/rep08feb15b-e.pdf.

Pope, Alan. “Report on the Kashechewan First Nation and its People.” N.A. October 2006. Available online at https://central.bac-lac.gc.ca/.item?id=kfnp_e&op=pdf&app=Library.

Royal Architecture Institute of Canada (RAIC). “Highlight Report: RAIC International Indigenous Architecture and Design Symposium.” Ottawa, RAIC, May 2017. Available online at https://raic.org/sites/raic.org/files/highlightreport_english_1.pdf.

Sharma, Meeshika. “Nibinamik First Nation get to design their own homes in pilot project” PTC Punjab Networki, November 2017. Accessed on January 22, 2021. Available online at https://ptcnetwork.ca/nibinamik-first-nation-get-design-homes-pilot-project/.

Statistics Canada. “Census in Brief: the housing conditions of Aboriginal people in Canada.” Statistics Canada, October 2017. Available online at https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016021/98-200-x2016021-eng.cfm.

Tawaak Housing Association. “Housing Urban Aboriginal Peoples.” 2012. Available online at https://tawaakhousing.org/.

Walters, Jeff. “Modbox rebuilds shipping containers for camps, homes in Thunder Bay.” CBC News Thunder Bay, August 2019. Available online at https://www.cbc.ca/news/canada/thunder-bay/thunder-bay-modbox-1.5243948.

Walters, Jeff. “Thunder Bay’s ModBox to send 4 homes to Keewaywin First Nation.” CBC News Thunder Bay, February 10, 2021. Available online at https://www.cbc.ca/news/canada/thunder-bay/keewaywin-modbox-shipping-containers-1.5907664.

Zeng, X.Y. “Yale First Nation’s new passive houses promising community and shelter.” Hope Standard, April 2017. Accessed November 9, 2020. Available online at https://www.hopestandard.com/news/yale-first-nations-new-passive-houses-promising-community-and-shelter/.

About Northern Policy Institute

Northern Policy Institute is Northern Ontario's independent, evidence-driven think tank. We perform research, analyze data, and disseminate ideas. Our mission is to enhance Northern Ontario's capacity to take the lead position on socio-economic policy that impacts our communities, our province, our country, and our world.

We believe in partnership, collaboration, communication, and cooperation. Our team seeks to do inclusive research that involves broad engagement and delivers recommendations for specific, measurable action. Our success depends on our partnerships with other entities based in or passionate about Northern Ontario.

Our permanent offices are in Thunder Bay, Sudbury, and Kirkland Lake. During the summer months we have satellite offices in other regions of Northern Ontario staffed by teams of Experience North placements. These placements are university and college students working in your community on issues important to you and your neighbours.

Related Research

Chasing Paper: Forms over Function in First Nation Administration
Caitlin McAuliffe

Lessons from the Yukon for Northern Ontario? First Nations, Tourism and Regional Economic Development
Justin Ferbey

Places to Grow: Best Practices for Community-based Regional Economic Development in Ontario's North
Jamie McIntyre

Rebuilding First Nations Through Sustainable Prosperity; Nation Rebuilding Series
Various Authors

To stay connected or get involved, please contact us at:
info@northernpolicy.ca www.northernpolicy.ca

NORTHERN POLICY INSTITUTE | INSTITUT DES POLITIQUES DU NORD

Giwednong Aakomenjigewin Teg
ᑲ ᐃᑕᕇᐧᐊᓂᐧᐊᐠ ᑭᐁᐧᑎᓄᐠ ᐊᑐᓭᐃᐧᑲᒥᐠ
Institu dPolitik di Nor
Aen vawnd nor Lee Iway La koonpayeen

northernpolicy.ca