NUNAMIUTUQAQ KNOWLEDGE MOBILIZATION

A report on workshop proceedings May 30th-June 3rd, 2022

We receive from the land, and we know that. The land, the people, and the animals live harmoniously with each other. And if you respect the land, and the animals, and the water, they will in turn respect you.

–Emily Angulalik, Executive Director of
Pitquhirnikkut Ilihautiniq/Kitikmeot Heritage Society

RETHINKING ARCTIC SUSTAINABILITY

The concept of sustainability—and its connotations of reciprocal respect between people, wildlife and the surrounding natural word—has long been a driving culturally force for Inuinnait, a regional subgroup of Inuit living in the Central Canadian Arctic. In contrast to western understandings of the term, Inuinnait visions of sustainability—as indicated through Emily Angulalik's quote above—are less oriented to future progress than the tasks of cultivating and maintaining an enduring state of balance and understanding between human and natural worlds. It is within such a balanced ecosystem that the unique identity, language and values of Inuinnait culture has resided for hundreds of years, and upon which its continuation depends.

Sustainability of the built environment has traditionally not been of significant concern to Inuit. For centuries, Inuinnait were a nomadic people literally at home on the land, with the physical landscape providing all materials needed to not only survive, but also to thrive, in the extreme climate of the Arctic. Winter houses, igluit, were made of snow. Summer tents, tupiit, created from the skins of caribou and other animals that sustained Inuinnait with food. The tree line at the southern edge of their territory provided wood needed to frame tents, buildings and transportation. As with many Indigenous groups, sustainability lay not as much in the enduring quality of materials used, but in the access and sharing of cultural knowledge required to negotiate with the landscape through the sourcing, harvest, and manufacture of the materials it provided.

The 1950s saw the start of a major infrastructure program by the Canadian and American governments to introduce a chain of continental defense radars known as the Distant Early Warning Line along the entire length of the Arctic, from Alaska to Greenland. This process fast-tracked the arrival of non-Inuit and a federal sense of ownership over the Canadian Arctic. Many Inuit were coerced into moving off the land and into urban settlements, where administration of their lives was easier to enforce. Residential schooling removed our children from their families and systematically weakened the generational transfer of knowledge and language. Buildings became imposed on Arctic landscapes, people and cultures, rather than integrating them in their design. This results in many problems including overcrowding and mold, heat loss and high energy consumption, and discordance with cultural activities and intended use. Nunamiutuqaq (Building from the Land) is an Inuit-led program designed to re-align architecture

with the northern environment, people, and language to consider how Inuit-driven priorities for sustainability–of coherence and respect between human and natural environments–can be bridged with the material realities of northern infrastructure. In 2019, Pitquhirnikkut Ilihautiniq (PI/KHS)--an Inuit-directed cultural center based in Cambridge Bay, Nunavut-- teamed up with the Southern Alberta Institute of Technology's (SAIT) applied research group called Green Building Technologies Access Center (GBTAC) to better understand how traditional Inuinnait building design and priorities for the environment can inform energy efficient infrastructure in the North. Along with Qillaq Innovations, Aurora Energy Solutions, and CHOU Consulting & Development of Cambridge Bay, Nunavut, we began collaborating on the design of a new cultural facility for Cambridge Bay, which could serve as a highly experimental work space dedicated to the documentation, revitalization, and mobilization of Inuinnait knowledge. This interdisciplinary project bridges Inuit traditional knowledge with cutting edge materials and technologies to focus Inuit concepts of *hilamut ingattaqtailidjut iglughamik* (green building design) and to develop buildings that are integrated with the Arctic environment and supportive of the lifestyle and culture of the people who inhabit it.

"It is our intention for this building to genuinely emerge from the land we live in, aligned with its environment, its people, and its priorities for an Inuinnait future. As we move forward with this ambitious project, we walk in the footsteps of our ancestors and will continue to rely on the innovation and ingenuity of our culture to solve climate and building challenges in the North."

BRIDGING NORTH AND SOUTH

One of the major challenges to developing new and enhanced strategies for construction in the Canadian Arctic is distance. Remote geography complicates travel, shipping, supply chains and access to materials and technologies. More importantly, however, distance isolates people and their knowledge. In 2021, following two years of remote engagement due to covid-19, PI/KHS and GBTAC began looking for new, and more physically engaged, ways to explore the challenges of developing long-term, sustainable infrastructure for the Canadian Arctic. It was recognized that a key component to successful design lay in the bridging of people, cultures and knowledge in a manner that promotes stronger relationships and mutual understanding. A week-long Knowledge Mobilization Workshop was organized in Calgary to bring project participants together through presentations, discussions and workshops, and to share ideas in person. The workshop accordingly brought together northern and southern experts from multiple backgrounds—from engineering, technical trades, and renewable energy design to Inuinnaqtun culture and language expertise, northern logistics managers, and those with decades of practical experience of living in, using, and repairing northern homes using traditional and modern methods. To support northern industry's capacity for building design and construction, local contractors responsible for designing, constructing, repairing and maintaining the final building were in all in attendance.

The event was additionally envisioned as an interactive opportunity for Nunavut-based construction workers, tradespeople and industry professionals to learn about systems integration and commissioning of the future facility structure from southern perspectives, researchers and material manufacturers prior to the construction of a new building. Having the Cambridge Bay consortium in Calgary would in turn allow a reciprocal knowledge uptake for all event participants. The virtual engagement of Cambridge Bay Elders would further allow for alignment of architectural design with understanding and needs of an Inuit culturally-supportive space.

BY THE NORTH, FOR THE NORTH: APPROACHING KUUGALAK'S DESIGN

While formalized in 2019, the Nunamiutuqaq program began its design of a highly customized building called Kuugalak in 2021. The name Kuugalak refers to the waterway beside the intended building site; one local Elders say used to run wide and deep, but has since reduced to a small creek through climate change. With dual focus on climate mitigation/adaptation and language/culture revitalization, the new building and its surrounding campus will enable Inuinnait knowledge and connection to land to flow deeply through our community again. In bringing team members for this project together in Calgary, the workshop focused on building from a foundation of three key research directions set by PI/KHS for the project.

EXPLORING INUIT ARCHITECTURE:

Since 2016, PI/KHS has been recovering and documenting Inuinnait architectural concepts, principles and terminology through conversations and workshops with local Elders, land users, and knowledge holders. What lessons can we learn from the history of Indigenous architecture in the Arctic? Inuit and their ancestors have occupied the Canadian Arctic for 4500 years. Throughout this time, their dwellings have consistently evolved in response to changing social and natural environments, yet also maintained architectural features critical to sustaining culture and comfort. Can time-tested features and values of Inuit architecture be used as cultural templates for contemporary construction in a replicable and scalable manner?

CREATING INFRASTRUCTURE THAT FITS:

How can Inuit-led infrastructure change how we live in the North? Over the last century, Arctic infrastructure—from buildings to land development and energy grids—has heavily relied on concepts imported from the South, leaving little space for Inuit and local populations to express their priorities and knowledge for the creation of living, learning and working environments. How to create new spaces genuinely needed and wanted by community members; built and maintained by local companies and experience; and using Arctic-based innovation and experience to pilot new directions for architecture in the North?

LANDSCAPE SUSTAINABILITY AND STEWARDSHIP:

Inuinnait highly value environmental sustainability and stewardship (Avatimik Kamattiarniq). In what ways can this respect inform the ways that we think about northern infrastructure as a tool for climate adaptation and mitigation? From the use of local construction materials to traditional strategies for energy efficiency, Inuit built environments merge with, and support, their surrounding landscapes. Can contemporary advancements in sustainable and renewable building technologies be used to maintain this cultural connection to the natural world?

PILOTING NEW AND INUIT-CENTERED DIRECTIONS FOR CHANGE

The Nunamiutuqaq Knowledge Mobilization Workshop was hosted by the Green Building Technologies Lab and Demonstration center located on the SAIT campus in Calgary, Alberta and took place from May 30th-June 3rd, 2022. The workshop brought together a total of 28 participants from North and South to better integrate the teams' respective work to date, transfer technical skills, and to further educate Southern team members in the knowledge and cultural background behind various design concepts and solutions that Inuit and Northerners have implemented over time. The workshop focused on optimizing designs for the Inuit driven build of Kuugalak, a new facility being sought by PI/KHS as a highly customized space to lead culture and language revitalization in the Nunavut community of Cambridge Bay. Sponsorship for the workshop was sourced from SSHRC, with the goal to interweave social sciences with building science to create more sustainable community buildings that reflect the cultural values and environment of their communities. The emphasis of the workshop was on Inuit traditional knowledge and cultural innovation, objectives of cross cultural/disciplinary knowledge transfer, and supporting outcomes-in the form of physical buildings and related programming-that can dramatically shape multiple northern communities' ability to renew and mobilize local culture and language.

Nunamiutuqaq recognizes that a more holistic approach is needed for the creation of northern Infrastructure. While this requires the building of more suitable physical structures, it also requires the building of closer relationships between the designers and inhabitants of those same structures. The project accordingly prioritizes opportunities for shared learning, which recognizes multiple types of expertise and seeks to bring them into direct contact and conversation.
This project aimed to create a space for 'two-eyed seeing' to bring Inuit and western knowledge traditions together for a stronger vision of how to achieve Inuit priorities and vernacular in northern building design. The overall goal was the mobilization of Inuinnait knowledge, experiences, and building practices to inform the construction, maintenance, and economic/climatic building considerations in the Arctic and create community connections through the process.

KNOWLEDGE MOBILIZATION WORKSHOP OBJECTIVES:

1) Bridge the innovation and ingenuity of Inuinnait culture with the knowledge of other partners to find new solutions for building design, green and renewable energy, and energy efficient infrastructure in the North.
2) Prepare the construction team local to Cambridge Bay with the knowledge, tools, and connection to the project design necessary to construct the case study building on site in Nunavut.
3) Successful construction of a building that reflects the vision provided by the Elder advisors.
4) Elder advisors and PI/KHS are confident in explaining, using, and maintaining the structure to further enhance their community work.
5) Integrate two-eyed seeing within the architecture and engineering experience.

WORKSHOP SCHEDULE

For the following report, we've decided to isolate several of the main themes explored during our week of conversations at the Knowledge Mobilization Workshop. Workshop sessions ranged from cultural exchanges to blueprints and highly technical training, with many conversations spanning multiple sessions and days. A list of the daily workshop sessions is as follows:

Monday – May 30, 2022

- Introduction
- Bridging Landscape, Culture and Architecture
- Principles of Building Design from Two Perspectives: Northern Traditional and Southern

Tuesday – May 31, 2022 .

- Review of Pilot Building
- Northern and Southern Similarities and Differences between Designs,
- Traditional Materials and Construction Methodologies
- Traditional Inuinnait perspective on the use of buildings and connection to the land

Wednesday – June 01, 2022

- ZS2 Factory Visit and Meeting
- Glenbow Museum and Calgary Public Library Visit

Thursday – June 02, 2022

- Proposed Structure, Design Principles, Functional Components and Space Map
- Mechanical and Electrical Q&A
- Operation and Maintenance in the Arctic, Integrating Renewables and End of Building Life Community Impacts

Friday – June 03, 2022

- Effects and Experience of Climate Change in Cambridge Bay
- Creation of a Story

WORKSHOP PARTICIPANTS

Emily Angulalik (Pitquhirnikkut Ilihautiniq)
Brendan Griebel (Pitquhirnikkut Ilihautiniq)
Sophie Pantin (Pitquhirnikkut Ilihautiniq)
Mary Kaotalok (Pitquhirnikkut Ilihautiniq)
Bessie Omilgoetok (Pitquhirnikkut Ilihautiniq)
Annie Atighioyak (Pitquhirnikkut Ilihautiniq)
Tom Rutherdale (Aurora Energy Solutions)
Sandi Gillis(Qillaq Innovations)
Ryan Gillis (Qillaq Innovations)
Dana Langille (Qillaq Innovations)
Lee Brown (Qillaq Innovations)
Melanie Ross (SAIT)
Kelsey Chegus (SAIT)
Leo Lu (SAIT)
Lillian Pas (SAIT)
Benjamin Hildebrandt (SAIT)
Tyler Willson (SAIT)
Stuart Doiron (CHOU Consulting and Development)
Amanda Doiron (CHOU Consulting and Development)
Alex (Williams Engineering)

Opening ceremonies featured the lighting of the qulliq and drum dancing by Emily Angulalik and her partner Charlie. The two went on to discuss the history of Inuit architecture and the roles that southern visions for buildings and settlement had upon the culture.

ARCHITECTURE AND ITS CONNECTIONS TO ARCTIC REALITIES AND CULTURE

The realities of the Arctic are significantly challenging due to the nature of its environment. Inuinnait, however, have thrived in the area for thousands of years. Archaeological findings and oral history exemplify the many ways that the culture has become highly adapted to changing conditions of the area. While populations have lived in the Canadian Arctic for roughly 4500 years, Inuit migrated into the area approximately 800 years ago. Like their Alaskan ancestors, Inuit originally built large and elaborate year-round houses, commonly employing the bones from bowhead whales–an animal central to Arctic food economies at that time. The earliest of these houses followed building templates from the comparatively wood-rich shores of Alaska, with separate rooms to cook food over an open fire. With the cooling of the Arctic around 1450 AD–a period known as the "little ice age"--sea ice increased to an extent that whale hunting became an increasingly unreliable pursuit. Driftwood supplies became increasingly scarce. Inuit architecture adjusted. During winters, Inuit transitioned into snow houses on the sea ice, focusing their economies on seal hunting which provided both food and source of fuel to be burned in soapstone lamps. During summers, inland caribou hunting became increasingly popular, with larger collectives of Inuinnait nucleating into single family groupings to follow the harvest in smaller, mobile camps using caribou-skin tents

Inuinnait began to be exposed to western culture in 1910, and by the 1920s, the first built settlements--in the form of churches, trading posts, and RCMP headquarters--began to appear in the region. By the 1950s, Inuinnait were being encouraged to settle in these growing communities, with the Government using incentives of education, wage labour and healthcare to assimilate Inuit into western housing and ways of life. With the foundations of Inuinnait culture being embedded in migratory hunting and travel, this sedentization changed important aspects their world. Seasonal migrations were traditionally practiced, allowing the natural recovery of the land and wildlife resources that occupied it. Seals, muskoxen and caribou played critical roles in local diets and material culture, being used for everything from food, to clothing and tool making. Natural resources surrounding settled communities diminished, and Inuinnait became further reliant on western materials and wage economies.

Architecture needs to be designed not only to physically fit a community and its landscape, but to further support the maintenance of culture. The continuance of Inuit culture and worldview are not reliant on the physical materials being used in a building, but on how that building shapes the activities, quality of life and aspirations of those that live inside of it. Inuinnait believe in community, in sharing knowledge and passing it on to the next generations. As such, the design of Kuugalak must aim to provide affordances to Inuinnait culture and language and support its continuation.

PRINCIPLES OF BUILDING DESIGN FROM TWO PERSPECTIVES

These sessions explored how Inuit and southern building traditions can be bridged through the innovative use of specific material solutions. A tour through SAIT's Green Building Technologies research lab to better understand how material and technology choices can not only support Inuit values of enviornmental sustainability, but serve as innovative ways to address the many construction challenges that are present in an Arctic environment. The tour emphasized innovative waste and water processing, green roofing, renewable energy, and multiple strategies for energy efficiency.

Planning issues are always present when building in the Arctic, hence the need for replicable and feasible technologies and techniques. Transportation of materials can be expensive and experience significant delays. Many standard materials applied in the South, such as concrete, pose significant challenges to construction in the Arctic as there is only a brief and unreliable window of seasonality where it can be applied. Prefabricated structural panel systems such as those selected for Kuugalak, can diminish these logistical challenges, as they allow for off-site manufacture and shorter on-site building periods, which also cheapens the project cost. Prefabricated systems such as the MgO ZS2 panels selected, are mold-resistant and can improve both the overall quality of the building structure and the quality of life it affords.

Our discussions focused on how projects need to take into consideration that building in the Arctic consists of adapting to the extreme climate. Various solutions for the Kuugalak building were discussed including in-floor heating as a temperature distribution strategy. Cambridge Bay builders provided insights into the many components of Arctic housing that have to be adapted to suit extream weather, including creating extra-long vents to deal with the cold and intense winds of the Arctic. Also highlighted is the importance of ease of installation and operability when selecting northern construction materials, as human error accounts for many of the product failure issues being experienced. Ventilation was outlined as a key concern. Rewables also featured prominantly in the conversation. Despite solar and battery storage becoming increasingly popular energy solutions, there still are few instances where it has been applied and monitored in Arctic conditions. This creates insecurity in cost-effective analysis.


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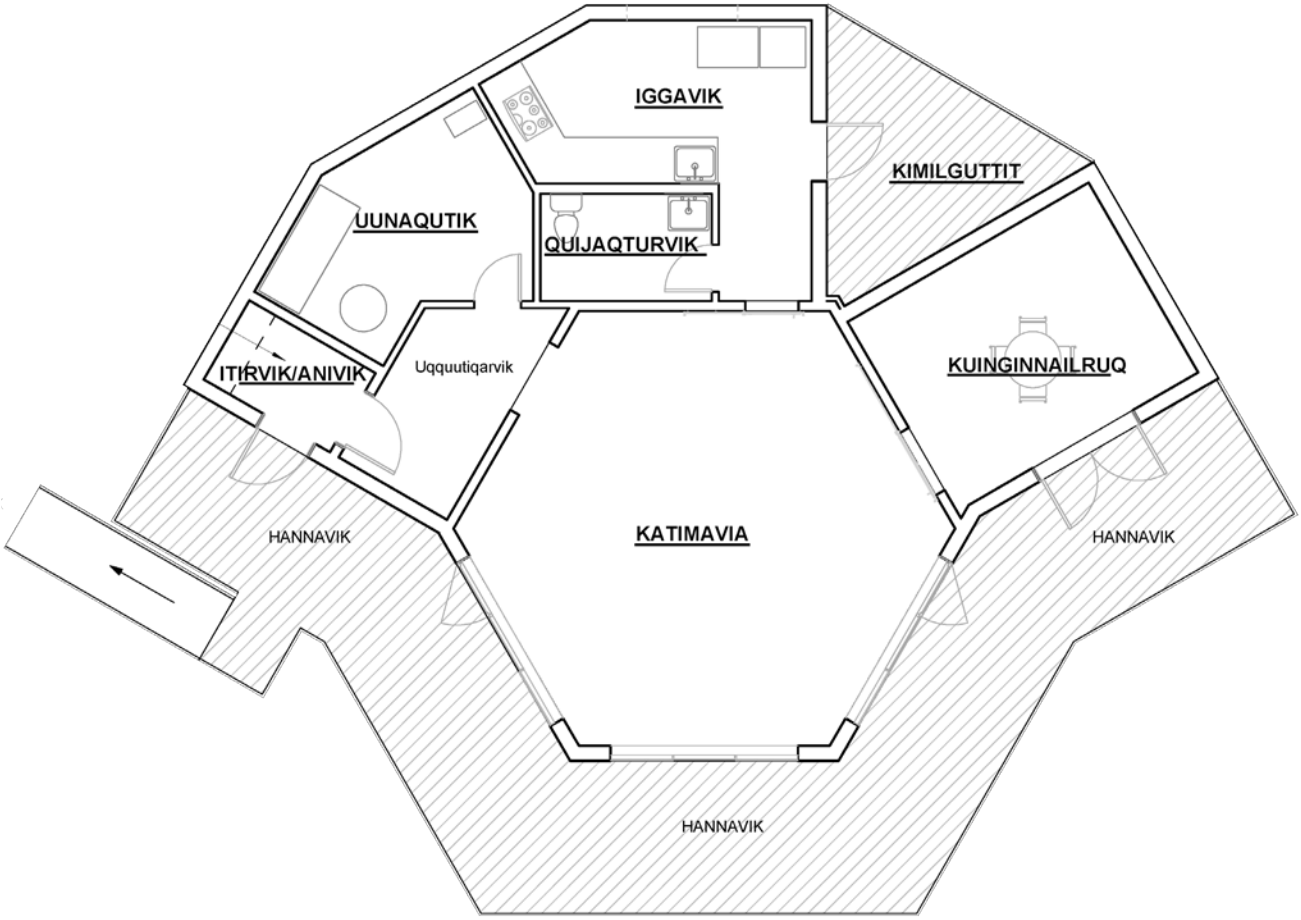
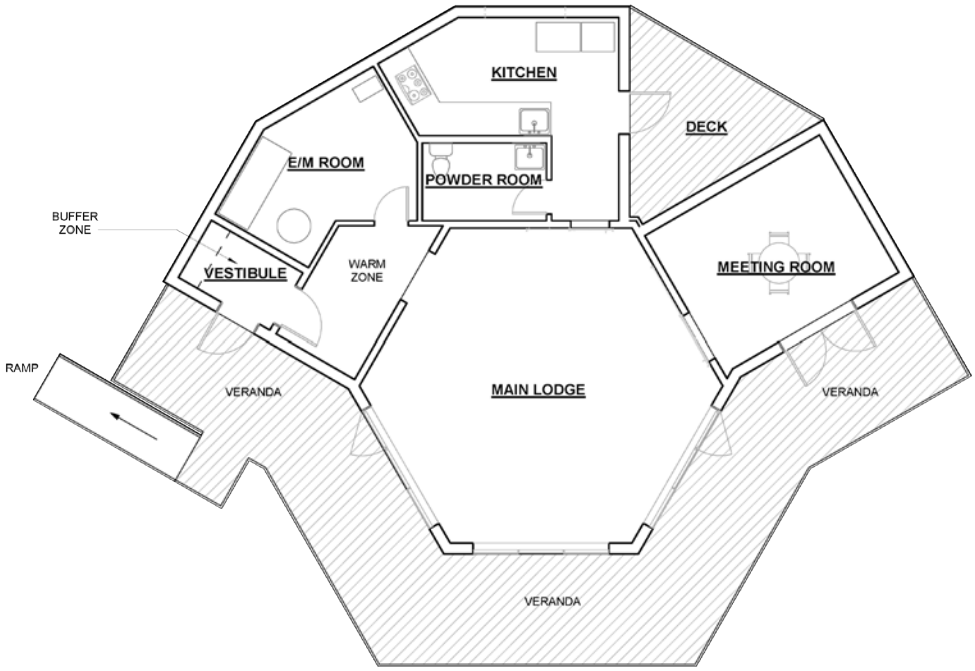


A floorplan of the Kuugalak workspace. From initial design phases, Inuinnaqtun terminology has been used to define the spaces and activity areas.



INCORPORATING TRADITIONAL MATERIALS AND CONSTRUCTION METHODOLOGIES

Inuinnait Elders fondly remember the traditional buildings they grew up in. They often speak of them as animate dwellings: spaces that actively shape daily life, and that need, in turn, to be cared for. These buildings breathe and communicate with the outside world, absorbing sunlight and fresh air, while keeping out dampness and cold. Like the weather and animals, they are an integral and intimate companion to human existence.

Northern communities primarily relied on two types of constructions depending on the season: Igluit were winter dome-shaped dwelling made of pukaangajuq (hard snow). Averaging 3 to 3.5 meters high, and 3.5 to 4.5 meters in diameter, those dwellings would normally house a family, but could be bigger to accommodate more during community gatherings. To deal with moisture, an air vent would be opened on the roof of the dwelling. This air vent could be covered with caribou skin, and once the conditions inside were more comfortable, they would close the vent. Tupiit are simple tents used as summer dwellings during warmer seasons when people travelled extensively for hunting and fishing, Made of caribou, seal, or other animals' skin, supported by whale bones and rocks as weights, tupiit were perfect portable structures. Understanding and keeping those traditions alive is important to guide new projects into design choices that have been proven to work and to maintain traditional knowledge and culture.

In alignment with these architectural values, conversations during these sessions focused on how Kuugalak's design aspires to be a part of its human and natural environment. The building responds to the natural features and topography of its landscape. The building's southeastern facing position and large solar awning have been designed to actively absorb the sun's heat and light during colder months, and to minimize passive solar overheating during the warmth of summer. The building's design centres on a large circular room for collective activity in homage to qalgiit, traditional snow houses built to accommodate community gathering. Three walls of windows bring in natural light and create a space that minimizes physical barriers between the indoors and outdoors. The building's entrance has been designed as a buffer between the outdoor temperatures and the inner main room, functioning much like the 'cold trap' entrance of traditional igluit. Equal attention has been given to the ways in which the building's temperature intersects with the cultural activities that will occur there, with colder areas designated for work with meat and hides, and warmed floors for Elders and community members to conduct their work. The building specifically allows for different temperatures to store skins, fabrics, tools, etc., each of which has their own optimal temperature profile.

TECHNOLOGIES AND CONSIDERATIONS

Some materials and technologies are more difficult to use in the Arctic. These workshop sessions brought northern industry workers together with southern engineers to outline a series of material challenges distinct to Artic environments. Some of the key issues brought up during these sessions are as follows:

- Concrete can only be applied on very strict time frames.
- Mold and moisture resistance is crucial due to the Arctic environment.
- Extreme weather conditions neccessitate an additional series of considerations, such as ice building on chimney and sewer stack, which must be maintained during winter.
- Chimneys must be closer to the edge of the roof for easier access in case maintenance is necessary
- High concentrations of snow may cause snow-fences to be necessary.
- Boilers work year-round, which may cause excessive heat in the building.
- A defective zone valve can cause heat to stop being produced.
- The use of carpets is not advised due to the accummulation of dust, which is ubiquitous during the Arctic summers. Flooring solutions must be easy to maintain.
- Newer techniques such as MgO boards as structural insulated panels (SIP) which are pre-built and shipped off are being adopted and are expected to provide superior performance as well as make construction simpler, quicker, and more effective.

ONSITE TRAINING

Inuit traditions favour the transfer of knowledge through first hand and practical experience. In accordance with this value, the Knowledge Mobilization workshop sought to create opportunities for participants to engage directly with materials and methodologies selected for Kuugalak's construction that are otherwise unavailable to them in Arctic contexts. This session was designed to not only familiarize participants with the materials for construction purposes, but also to ensure they have the onsite knowledge to repair and maintain the building in the longrun.

One session was hosted at the manufacturing facilities of ZS2 Technologies, the creators of the innovative SIPs (structurally insulated panels) that make up a large portion of the building's envolope. The company specializes in the development and manufacture of pre-fabricated panels that are fire-resistant, non-toxic, anti-microbial and mould resistant, and low carbon. While designed for ease of use, these panels require basic training to understand how they can be joined, cut and sealed. This is was especially important given the Cambridge Bay construction team's unfamiliarity with the material. Our morning session brought together workshop participants with ZS2 engineers and technicians to review and discuss the detailed structural plans created for our new building with the Cambridge Bay-based carpenters and industry team who will oversee its onsite construction. A subsequent tour of the facilities allowed participants to understand the manufacturing process for the panels, and brainstorm how this process might be undertaken directly on-site in Nunavut for future builds. Our afternoon session divided our team of participants, with industry-focused members staying onsite at ZS2 to practice working with the materials, and our cultural delegation travelling to the Glenbow Museum and Calgary Public Library to work wtih their Indigenous teams to better understand correlations between architecture, material selection and cultural design.

CLIMATE CHANGE AND ITS EFFECTS ON THE ARCTIC ENVIRONMENT

A critical component of the Knowledge Mobilization workshop was a focus on human perception and response to climate change. The impacts of climate change are increasingly evident and critical in Arctic communities. This series of sessions brought together academic and experience-based expertise on the current and future toll of Arctic climate change to determine the best path forward for creating suitably resilient and enduring buildings. Initial conversations reviewed archaeological evidence for past climate changes to the Arctic and Inuit architectural strategies for coping with these changes. A group of Elders from Cambridge Bay was virtually connected to our workshop to discuss climate change as directly observed over the course of their lifetimes. They highlighted the fact that these changes pose a threat to traditional knowledge and the active pursuit of traditional lifeway. More open waterways are present during the coldest months, and unusual species of animals starting to appear. Ancestral knowledge about the landscape, which has been in place for centuries, is increasingly having to be requestioned. Changes in thickness of ice, for example, has created unsafe situations in areas which have long been used for travelling and hunting.

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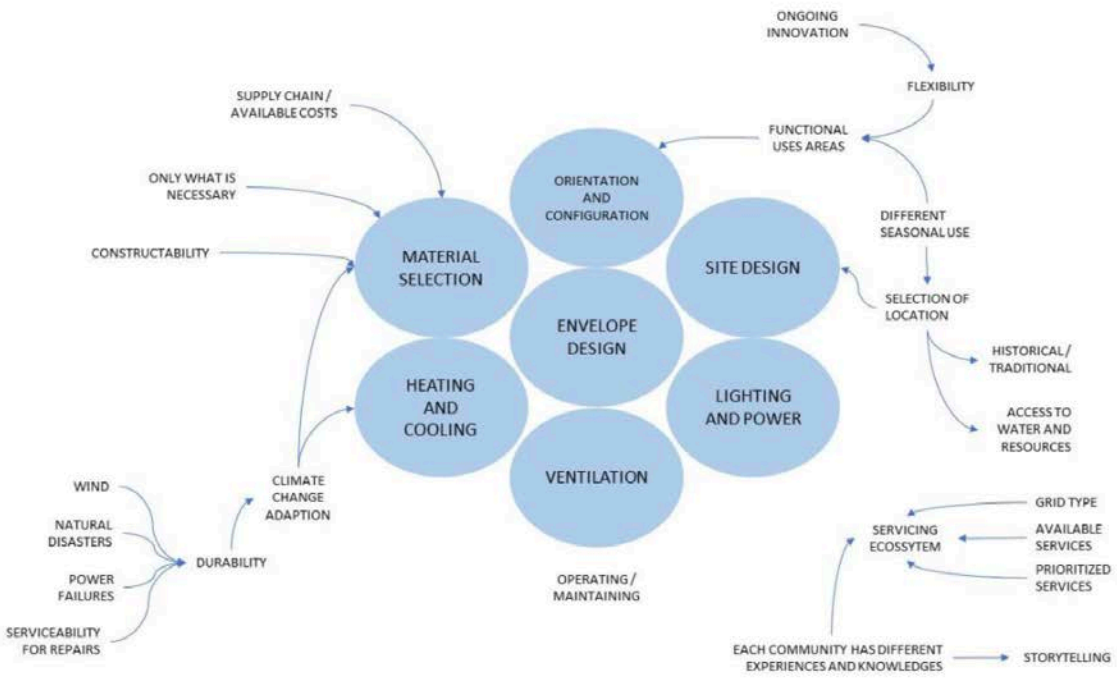
Climate change also impacts building technology and sustainability science. The mitigation of anthropogenic climate change effects becomes increasingly important. Reduction of the carbon footprint with more energy efficiency, minimal impact materials, geographical positioning, and smart design are all tools that can be used to support efforts into both the mitigation of, and adapation to, climate change. One of the main research questions driving the building of Kuugalak is how to create more climate resilient, energy efficient buildings for the Canadian Arctic. Research has been carried out with an objective of being highly energy efficient, exceeding current community construction standards and setting a precedent for high performance buildings in the North. This includes a reduction in electricity consumption and heating fuel, and renewable energy (solar PV) production. High building envelope performance includes structurally insulated wall panels (SIPs) made from magnesium oxide (MgO) and R-60 flat roof, high performance windows, and increased airtightness with minimized thermal bridging. Energy efficient systems include boilers, HRV, plumbing, mechanical, electrical, and lighting in order to reduce energy demands. Space has been included to add batteries in future years to contribute to energy storage and building resiliency. Key concepts were sourced from traditional Inuit architecture–including passive solar and solar shading techniques, building orientation, fenestration, and foundation and permafrost considerations.



BUILDING STORIES

Storytelling is an important aspect of Inuinnait culture. It is a way of sharing language, culture, and teachings. As the Kuugalak project develops its shape and personality, it has also become a story; one informed by multiple experiences and interactions, and through the bringing together of different skills and realities. The goal for the SSHRC supported Knowledge Mobilization Workshop was to draw out, listen to, and document these important stories about the North.

We hope these stories continue to spread, with other communities investigating this project as an example of how they can achieve similar goals and learn from its successes and mistakes. The goal of the project is to serve a wider community. Ease of construction, performance, comfort, and respect for the land, are all aspects of the project which are always in mind when conducting research and developing further the architecture and technology behind it all. The will to create a pilot for the Arctic region which at the same time has the memory and knowledge of the Inuinnait is pivotal to creating solutions for everyone still at an affordable price.

The Knowledge Mobilization Workshop draws on research supported by
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SSHRC CRSH
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

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