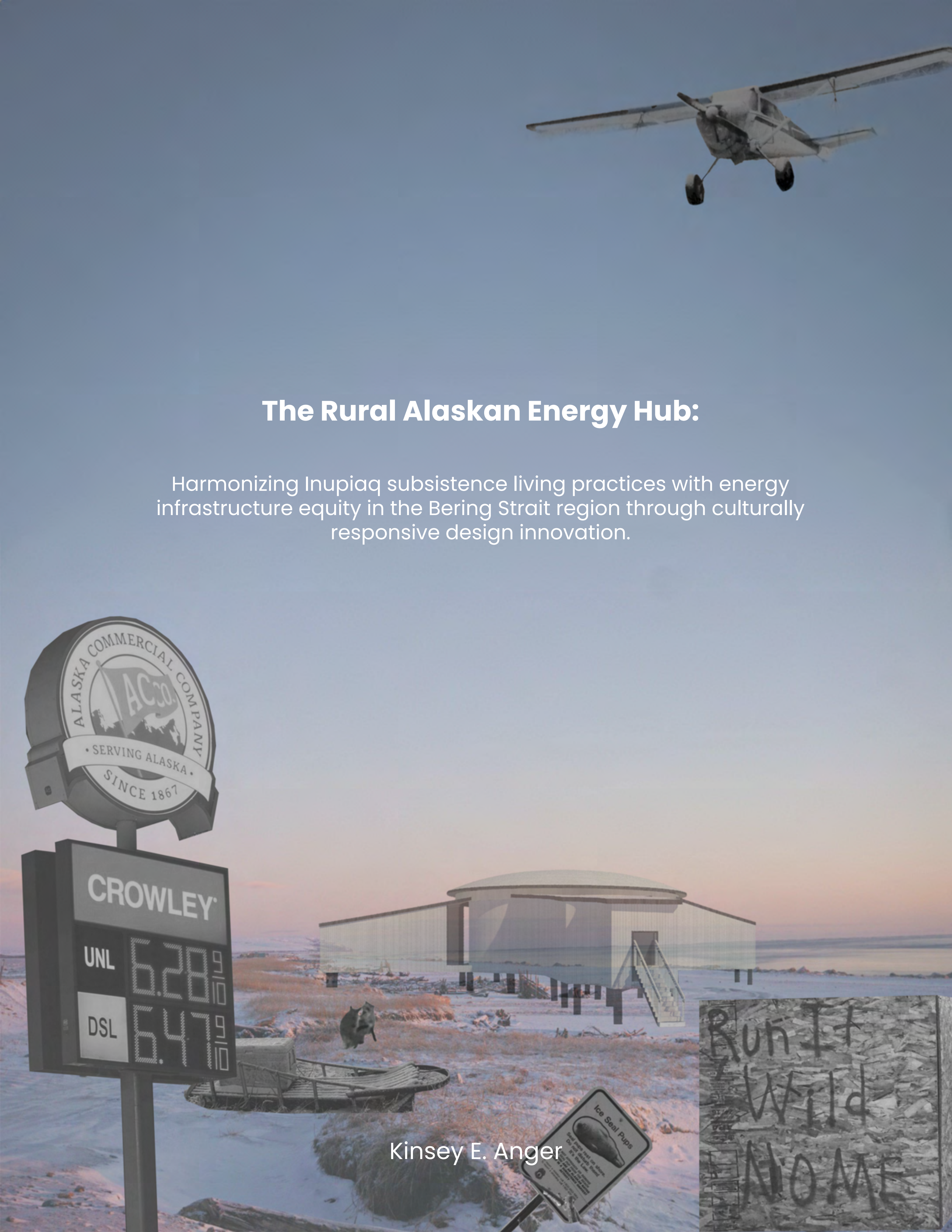
The Rural Alaskan Energy Hub:

Harmonizing Inupiaq subsistence living practices with energy infrastructure equity in the Bering Strait region through culturally responsive design innovation.



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Latin Honors Project 2025

Title: The Rural Alaskan Energy Hub:

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Honors Committee

Zannah Matson : Primary Advisor
Brandon Anderson : Outside Advisor
Nathan Jones : Honors Committee Representative

Research Question

How are energy infrastructure networks in Nome, Alaska and surrounding areas impacted by the lingering afterlives of colonialism and urgent impacts of climate change, and what culturally grounded building and community practices can inform the design of more equitable energy networks?

Aknowledgement:

I dedicate this project to the residents of Nome, Alaska—may your resilience and sense of community be an inspiration to us all.

I would also like to thank my advisors, Zannah Matson, Brandon Anderson, and Nathan Jones for the continued support and invaluable feedback throughout this process. Your expertise truly guided me throughout this experience.

Lastly, I am thankful for my friends, family, and my kitten who have been there cheering me on every step of the way.

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Abstract

Spanning 36,000 square miles across western Alaska, the Bering Strait Region, including Nome and its surrounding 15 remote villages, is home to approximately 8,000 Alaska Natives of primarily Inupiaq heritage. Colonial history in Alaska, imposed by Russian and American powers, disrupted traditional ways of living and limited the infrastructural mobility necessary to respond to the increasingly detrimental environmental changes. In response to these challenges, this project explores how energy infrastructure in the Bering Strait Region can be redesigned to align with traditional Inupiaq practices while addressing the need for energy infrastructure reform.

Using a mixed-methods approach—including key informant interviews, spatial analysis, site visits, and design as research—I am proposing a multi-functional energy hub and community center that supplements Nome's existing energy infrastructure network. Inspired by the Inupiaq traditions of subsistence living and seasonal hunting and gathering cycles, this hub offers energy resources such as geothermally powered batteries to be used by the community. Beyond providing technical solutions, the hubs echo the idea of a subsistence freezer, where necessities like geothermally-charged batteries can be gathered in the summer and stored for as-needed use during the winter to offset some of the high energy costs that the community experiences.

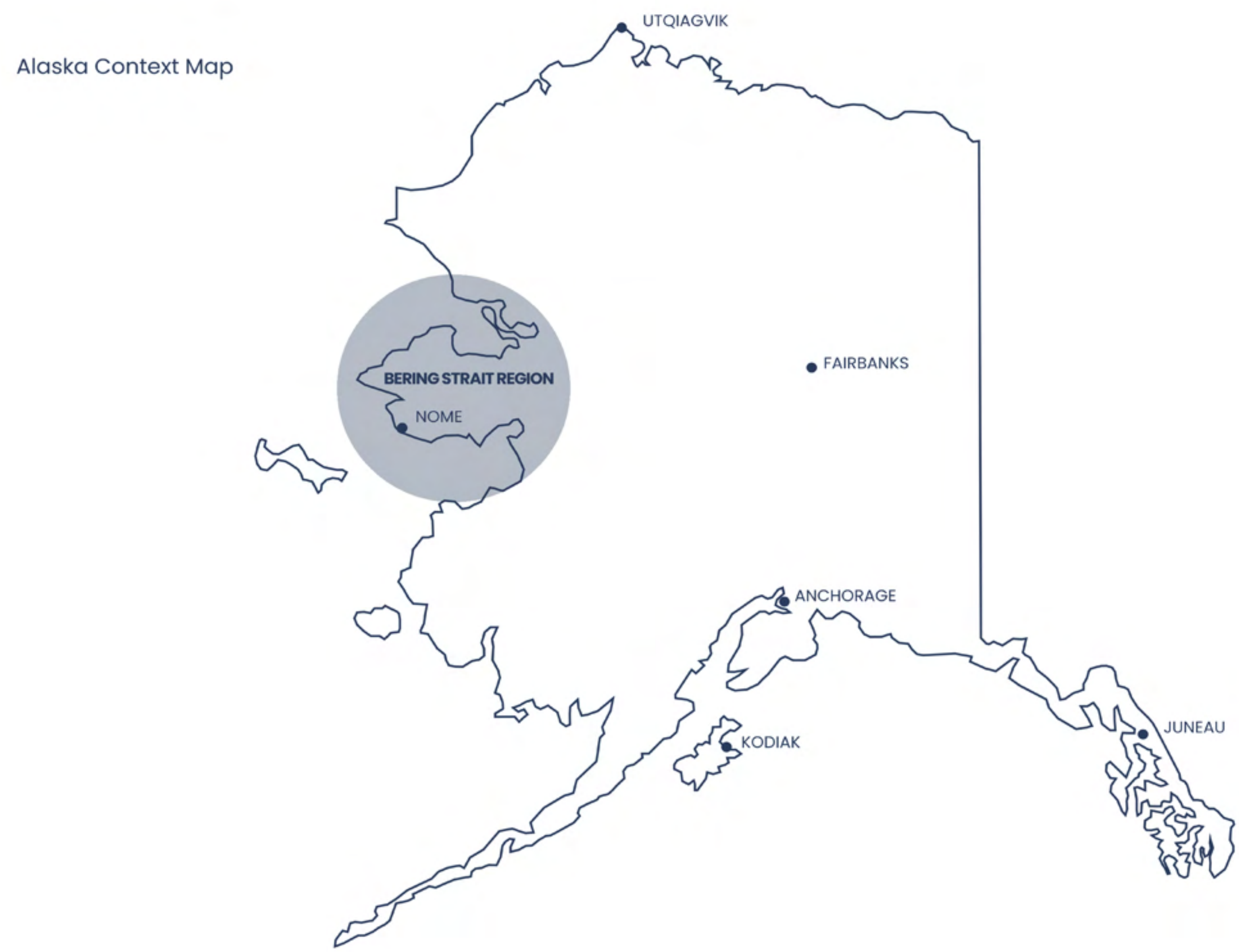
This project argues for a reimagining of energy infrastructure that reflects the cultural and environmental realities of the Bering Strait Region. By bridging traditional subsistence practices and modern design, these hubs present an opportunity to enhance energy infrastructure equity and resilience in the face of climate change. Ultimately, this work reframes infrastructure as a tool not only for survival but also for cultural preservation and socio-political empowerment, offering a model for addressing the lingering afterlives of colonialism in rural Alaska.

Introduction

One late summer morning in a small community adjacent to Nome, Alaska, I stood in a small fishing boat anchored along a bend of the Niukluk River. The rain drizzled fervently, but we were unbothered by it as the elders in town told us that morning how fish enjoy the rain. The family I was with told me how they frequent this specific bend in the river every summer, as it has never failed them with its supply of silver salmon. As we cast our lines, the river rippled with movement, carrying the fish upstream in their annual migration. After pulling in our catch, we brought the salmon back to camp, where we filleted them with ulus—curved knives used by the Alaska Native community—and carefully hung the fillets on the drying rack. This ritual was more than just food preparation; it was an act of continuity, ensuring that the nourishment of summer would sustain us through the long winter months. This practice, deeply embedded in Inupiaq subsistence living, reflects a broader understanding of harvesting—one that extends beyond merely taking from the land. It is a cyclical relationship, a way of engaging with the environment in a manner that respects its rhythms and ensures sustainability for future generations.

Harvesting, within the framework of Inupiaq culture, is not just about gathering resources but about maintaining balance. It encompasses seasonal mobility, ecological awareness, and reciprocal stewardship—values that have guided Indigenous survival in the Arctic for millennia. However, colonial settlement patterns and imposed infrastructure systems have disrupted these traditional ways of life. Fixed energy grids, centralized resource distribution, and reliance on imported diesel fuels have forced communities into rigid systems that clash with their historically adaptive practices. These infrastructural limitations are now compounded by climate change, which threatens existing energy networks and heightens the need for solutions that align with the cultural and environmental realities of the Bering Strait Region.

The Bering Strait Region of western Alaska is defined by its vast tundra, harsh climate, and geographic isolation, presenting unique challenges for energy infrastructure development. Integral to the culture of the region, Inupiaq ways of life such as subsistence living and seasonal mobility are deeply rooted in the land and shaped by an intimate understanding of the environment. However, colonial histories and the imposition of American policy and infrastructure systems have disrupted these practices, creating systemic inequities that persist to this day.



This context map situates the Bering Strait Region within Alaska, highlighting Nome as a focal point for energy infrastructure analysis The labeled cities provide reference points for understanding Nome's relative remoteness and the logistical complexities of resource access in the region.

Colonial settlement patterns introduced static, centralized energy infrastructure systems that are ill-suited to the dynamic needs of rural Alaska Native communities. These systems were designed to support resource extraction and settlement rather than the adaptive practices of the region's Indigenous people. Today, this contrast is amplified by the accelerating impacts of climate change, which include dangers such as permafrost thaw, rising sea levels, and unpredictable weather patterns. These environmental changes exacerbate the already precarious state of energy infrastructure in the region, exposing its vulnerabilities and revealing the need for more resilient, culturally informed infrastructural solutions.

In my research, I analyze how energy infrastructure networks in Nome and the surrounding villages are impacted by the lingering afterlives of colonialism and the urgent effects of climate change. I also explore how culturally grounded building and community practices can inform the design of more equitable energy networks. Central to this inquiry is the recognition that energy systems are not only technical constructs but are also woven into the social, cultural, and political realities of the communities they serve. By understanding these intersections, my project seeks to reimagine energy infrastructure as a tool for cultural preservation, environmental resilience, and community empowerment.

Nome, the largest community in the Bering Strait Region, serves as the focal point for my research. The city's energy infrastructure is characterized by high costs, limited capacity, and dependence on imported fossil fuels, which intensify its vulnerability to environmental and economic pressures. Surrounding communities experience even greater disparities, with many residents living entirely off-grid or relying on outdated and inefficient systems. For example, residents of Council, Alaska must travel over two hours to Nome to access basic necessities such as fuel and food. This experience highlights the region's dependence on centralized infrastructure and the limitations of this model in addressing the needs of remote communities.

The concept of dynamism is central to my project. Historically, Inupiaq communities relied on seasonal mobility to navigate the challenges of living and harvesting food in a harsh and unpredictable environment. The dynamic way of life was not only a survival strategy but also a cultural practice of subsistence living deeply embedded in their relationship with the land. Equally essential to survival in the Arctic is community connection, as knowledge-sharing plays a crucial role in navigating the landscape and surviving the winter. Community locals collaborate in sharing insights such as where salmonberries are particularly abundant in a given summer, where the fishing luck has been best, and even which areas of the community are experiencing environmental shifts that may affect future harvests.

This map shows the spatial relationships between the Bering Strait region villages, emphasizing Nome's central position and the adjacency of Pilgrim Hot Springs.

However, in Nome, there are currently very few places to facilitate such vital interactions, as gathering spaces in the town are largely limited to bars and churches. The imposition of fixed infrastructure systems has not only restricted physical mobility but has also reduced opportunities for these vital exchanges, further constraining the ability of communities to adapt to changing environmental conditions.

My research argues that restoring a sense of mobility to energy infrastructure by incorporating historic foraging patterns and facilitating community connection can help address current constraints, creating energy networks that are both dynamic and resilient—like the people they are designed to serve. By integrating these elements, my project envisions energy hubs as not only functional energy storage solutions but also as spaces that restore traditional knowledge-sharing practices, strengthening cultural resilience alongside infrastructural adaptation.

In response to the challenges of living in rural Alaska, my project proposes energy hubs as a supplement to the existing energy grid in Nome and its surrounding villages. Inspired by the Inupiaq traditions of subsistence living and seasonal resource cycles, these hubs are designed to provide flexible, community-centered energy solutions that align with the cultural and environmental realities of the region. The hubs would offer resources such as geothermally charged batteries for winter use, vitamin D lights for periods of extended darkness, and other tools tailored to the needs of off-grid living. Energy resources would be gathered in the summer months in places where renewable energy is abundantly available, such as Pilgrim Hotsprings which is at the forefront of geothermal development in the Bering Strait Region. The hubs would be located in the heart of the community, so that they may be easily accessible to the locals who live there year-round. Nome is used in my project as a flagship site for the energy hub proposal, serving as a scalable model that may be replicated in communities throughout the region. The hubs will act as dynamic nodes in a decentralized energy network, enhancing accessibility and resilience while honoring Indigenous knowledge and practices.

My research employs a mixed-methods approach to explore the potential of these energy hubs and to understand the broader systemic factors that shape energy infrastructure in the Bering Strait Region. Key informant interviews with local community leaders and energy infrastructure officials have provided valuable insights into the specific needs and cultural values of the Nome region. These conversations have emphasized the importance of designing solutions that respect and reflect the traditions of the communities they serve, while also addressing the technical and logistical challenges of operating in remote and extreme environments.

Spatial analysis has been another critical component of my research, allowing me to map existing infrastructure networks and identify gaps that disproportionately impact rural villages. For example, mapping the locations of current energy facilities in relation to population centers and subsistence areas has revealed significant inefficiencies in the distribution of resources. These insights have informed the placement and design of the proposed hubs, ensuring that they are accessible and aligned with historic subsistence patterns used by the Indigenous community.

By integrating traditional knowledge with modern design and technology, my project aims to address the systemic inequities in energy access that have long marginalized Alaska Native communities. The energy hubs are not merely technical solutions; they are a reimagining of infrastructure as a tool for cultural preservation and empowerment. By placing control back into the hands of the community, these hubs offer a model for addressing the limitations of centralized energy systems and for creating infrastructure that is both resilient and reflective of local values.

Ultimately, my research contributes to a broader conversation about the role of architecture and design in addressing the challenges of climate change, colonial legacies, and energy inequities in rural Alaska. By bridging the gap between traditional lifeways and contemporary infrastructure needs, this project demonstrates the potential of culturally informed design to promote resilience, equity, and sustainability. In the Bering Strait Region, where the stakes of environmental and social change are particularly high, these interventions offer a path forward that honors the past while building for the future.

Literature Review

Energy infrastructure in rural Alaska is shaped by the complex interplay of critical history, environment, and culture. Colonial legacies, climate change, and Indigenous knowledge converge to define the region's challenges and opportunities. By synthesizing the perspectives of the reviewed literature, my research proposes that culturally informed design can bridge the gap between existing energy systems and the needs of Indigenous communities. This project builds on insights from anthropology, climate science, Indigenous studies, and technical energy reports to propose infrastructure solutions that are not only scientifically sound but also culturally resonant. By reframing energy infrastructure in rural Alaska as dynamic and reciprocal, my project seeks to contribute to the broader field of architectural design while promoting resilience, equity, and sustainability in the Bering Strait Region.

Colonial Histories and Systemic Inequity

Alaska's infrastructural landscape is a direct reflection of its colonial past. Stephen Haycox's Alaska: An American Colony traces two waves of colonization: Russian fur traders driven by extractive capitalism and America's territorial acquisition that entrenched hierarchical governance structures (Haycox, 2006). These systems prioritized resource exploitation over Indigenous needs, establishing long-lasting patterns of inequity. William Iggiagruk Hensley's essay, Why the Natives of Alaska Have a Land Claim, expands on these themes, emphasizing how colonization disrupted subsistence practices and displaced communities. Hensley describes land as a lifeline for Alaska Native peoples, contrasting this with the colonial monetization of resources (Hensley, 2009). Together, Haycox and Hensley illustrate the entrenched colonial frameworks that are not confined to history, but instead shape resource allocation and governance in rural Alaska today.

Energy Infrastructure and Governance

The relationship between governance and energy infrastructure is critical for understanding inequities in resource access. These energy systems in rural Alaska are not just physical networks, but also socio-political tools. Brian Larkin's The Politics and Poetics of Infrastructure frames infrastructure as both technical and symbolic, reflecting societal values and power dynamics (Larkin, 2013). Larkin's discussion of "technopolitics" highlights how infrastructure serves as a subtle mechanism for governance. This framework is particularly relevant to rural Alaska, where energy systems are extensions of colonial governance that perpetuate the marginalization of Indigenous and rural populations.

Similarly, The Promise of Infrastructure, edited by Nikhil Anand, Akhil Gupta, and Hannah Appel, examines how infrastructural failures disproportionately harm marginalized communities, as seen in the Flint water crisis where governmental negligence and systemic disinvestment led to prolonged exposure to contaminated water, disproportionately impacting low-income and minority residents (Anand et al., 2018). (Anand et al., 2018). This perspective resonates with the experiences of Indigenous communities in Alaska, where outdated energy systems often fail to meet the needs of remote villages. These anthropological insights highlight the importance of addressing the technical inefficiencies of energy infrastructure as well as the socio-political structures that shape its implementation.

Both Larkin and the editors of The Promise of Infrastructure inform my understanding of energy systems as complex socio-technical constructs. These insights clarify how infrastructure can reinforce inequality while maintaining an illusion of neutrality.

Geothermal Energy and Pilgrim Hot Springs

Geothermal energy represents a promising avenue for addressing the energy challenges of rural Alaska. Pilgrim Hot Springs, located approximately 60 miles from Nome, has been identified as a potential site for geothermal energy production. The report Geothermal Hot Springs Could Aid Nome highlights the region's geothermal potential, emphasizing its proximity to Nome and the capacity to support local energy needs (Nome Nugget, 1983). The site's potential for renewable energy generation supports broader efforts to develop locally sourced, sustainable power solutions, reducing reliance on external energy sources that pose economic and environmental challenges. In support of this initiative, the U.S. Department of Energy, Unaatuq Energy: Geothermal Technology for Pilgrim Hot Springs, discusses current strategies to harness this resource. The report identifies significant technical challenges, including the cost of infrastructure development and the need for more advanced technology to tap into the geothermal reservoir (DOE, 2023). However, it also highlights the potential benefits, such as reduced energy costs and a lower carbon footprint for the Nome region.

Although the prospect of renewable energy is desirable in the Bering Strait Region, the report The Legal and Institutional Problems Facing Geothermal Development in Alaska outlines structural barriers to renewable energy projects, such as bureaucratic red tape and funding shortages (DOE, 1982). These insights are critical in understanding why renewable energy options like geothermal remain underdeveloped in regions such as Nome, despite the opportunities that exist.

Climate Change and Environmental Challenges

Climate change magnifies Alaska's pre-existing energy infrastructure challenges. Meredith Brown and colleagues' research on climate-induced infrastructure challenges in Alaska identifies specific environmental threats, including permafrost thaw, coastal erosion, and extreme weather events (Brown et al., 2024). These factors place unprecedented stress on energy systems, requiring innovative solutions that can withstand harsh and rapidly changing conditions. Brown et al. emphasize the importance of community-driven adaptation strategies, advocating for flexible federal funding and Indigenous leadership in infrastructure planning.

Elizabeth Marino's Fierce Climate, Sacred Ground: An Ethnography of Climate Change in Shishmaref, Alaska examines how climate change and colonial histories compound challenges for Alaska Native communities. For example, Marino details how Shishmaref's residents face potential relocation due to coastal erosion and thawing permafrost, yet proposed solutions often lack cultural consideration and sufficient funding (Marino, 2015). This research highlights how fixed infrastructure systems, designed without Indigenous input, fail to meet the needs of Arctic communities. Her ethnography demonstrates that adaptation strategies are most effective when grounded in local knowledge. Complementary perspectives from other Arctic regions, such as Leena Cho and Matthew Jull's research in Permafrost Urbanists, show how infrastructure can balance resilience with cultural sensitivity. For instance, their use of layered mappings to analyze resource flows and community dynamics provides a methodological approach for understanding the interplay between human systems and natural forces (Cho and Jull, 2017). These insights guide my proposal to develop energy infrastructure solutions that are both technically sound and attuned to the environmental conditions and cultural practices of rural Alaska.

Indigenous Knowledge and Design

The integration of Indigenous knowledge into infrastructure design offers a pathway to creating energy systems that are both sustainable and meaningful to the communities they serve. Chie Sakakibara's People of the Whales explores the cultural resilience of the Inupiaq people, emphasizing their deep connection to the land and sea through subsistence practices. Sakakibara uses the Inupiaq whaling cycle as a model of sustainability, where every part of the whale is used, and the harvest is guided by a sense of respect and reciprocity (Sakakibara, 2017). Her work highlights how Indigenous practices embody principles of sustainability and environmental stewardship.
The cycle of hunting, gathering, and seasonal mobility is central to Inupiaq subsistence traditions, ensuring that resources are harvested in a way that maintains ecological balance and long-term availability. Similarly, Debby Dahl Edwardson's Whale Snow captures the spiritual dimensions of Inupiaq life through storytelling. Edwardson illustrates

how snowflakes after a whale hunt symbolize the whale’s spirit returning to the earth, reinforcing the cyclical relationship between humans and nature. This concept of circularity directly informs my project, as it highlights the importance of designing energy infrastructure systems that harmonize with environmental rhythms rather than disrupting them.

The article Inupiaq Values in Subsistence Harvesting: Applying the Community Voice Method in Northwest Alaska delves into the values that shape subsistence living, such as cooperation, adaptability, and respect for the environment. These values guide how communities engage with the land and its resources, emphasizing long-term stewardship over short-term gain. These patterns include strategic fishing during salmon runs in the summer, seal, and whale hunting in the fall, and ice fishing or trapping during the winter months. Each practice is carefully timed to align with migration patterns and ecological cycles, ensuring that species are not overharvested and that resources remain available year after year.

These harvesting traditions also support food security in remote regions where store-bought goods are expensive and unreliable. By drawing inspiration from these adaptive cycles, my project seeks to design energy hubs that mirror this seasonality—gathering renewable energy when most abundant and designing infrastructural storage solutions that sustain communities through the darker, colder months.

In reference to communities engaging with the land and its resources, The Arctic Food Network (AFN) by Lateral Office demonstrates how design can align with Indigenous practices to address Arctic challenges. This project established food storage hubs along snowmobile paths in Nunavut, Canada supporting traditional subsistence activities and improving food security (Lateral Office et al., 2011). By integrating infrastructure with cultural practices, the Arctic Food Network highlights the potential of decentralized systems to enhance resilience and resource equity. This approach informs my research on energy hubs, emphasizing solutions that respect the cultural and environmental needs of Inupiaq communities in the Bering Strait Region.

These reviewed sources highlight the potential of Indigenous knowledge to inform innovative, culturally relevant, and environmentally responsive energy infrastructure in rural Alaska. By blending traditional values with modern technologies, this approach not only addresses energy needs but also strengthens community resilience and cultural identity.

Research Methods

To analyze how energy infrastructure networks in Nome, Alaska, and the surrounding villages of the Bering Strait Region are shaped by the impacts of colonialism and the urgent effects of climate change, I employed a mixed-methods approach that includes key informant interviews, site visits, spatial analysis, and design as research. These methodologies were selected to uncover how the infrastructural network can benefit from the integration of Inupiaq cultural practices of subsistence living and historic harvesting patterns.

Key Informant Interviews

To gather insights into the cultural, economic, and infrastructural challenges faced by the Nome region, I conducted interviews with two local government leaders, an Alaska Native Corporation representative, two engineering professionals, as well as an Alaska senator. These conversations were vital in identifying how energy infrastructure intersects with local governance, cultural practices, and daily life in the region.

Interviews were conducted using a semi-structured format, allowing participants to share their perspectives on energy access, resilience strategies, and the integration of Indigenous knowledge. For instance, during an interview with a representative from the Bering Strait Native Corporation, I was able to assess the current state of the energy infrastructure network and the opportunity for its reform. I recorded and coded these discussions to find key themes from each that I then analyzed for my results section of the thesis. These comments provided a firsthand account that aided in informing the culturally sensitive design solution presented in this project, where a dynamic alternative to the fixed infrastructure is proposed.

Site Visits

Site visits to Nome in both the Summer and Winter were integral to grounding my research in the physical and cultural realities of the region. I conducted two site visits, one during the summer and one during the winter, to observe seasonal variations and their impacts on energy infrastructure. These visits provided a sensory and spatial understanding of the environmental and logistical challenges inherent in Arctic construction and maintenance.

During the visits, I documented existing infrastructure through photographs, sketches, and field notes, focusing on elements such as permafrost damage, insulation efficiency, and structural resilience. Observations included raised building foundations designed to mitigate permafrost thaw and the use of locally available materials in construction. These field experiences enriched my understanding of how climate conditions influence infrastructure performance and informed the design strategies tailored to the unique challenges of the region.

Spatial Analysis

Mapping served as a critical tool for visualizing disparities in energy access and understanding the broader geographic and environmental context of the Bering Strait Region. Using QGIS software, I created layered maps to visualize the spatial distribution of energy infrastructure, the proximity of Indigenous communities, land use patterns, and environmental hazards such as coastal erosion zones. This method allowed me to identify patterns of inequity and prioritize areas where energy infrastructure interventions could have the most significant impact.

For example, mapping distances between remote villages and their nearest energy sources revealed the systemic isolation faced by communities like Council, Alaska, which relies heavily on Nome for essential services. Inspired by GIS methodologies discussed in GIS Applications in Climate Change: How GIS Transforms Our Climate Response (University of Southern California, 2024), I also incorporated the identification of coastal erosion zones to assess potential risks to existing infrastructure. These maps provided a data-driven foundation for proposing dynamic energy solutions that enhance resilience and accessibility.

Design as Research

By employing a design-as-research methodology, I translated historical, cultural, and environmental insights into actionable architectural proposals. This approach aligns with Research Through Designing (RTD), which positions designing as an integral research method capable of generating new knowledge by bridging conceptual ideas with practical applications (Lenzholzer, Duchhart, and Koh, 2013). As Lenzholzer et al. explain, "Landscape architecture has to articulate 'research through designing' (RTD) methods to strengthen its methodological foundation and academic legitimacy". My project adopts this approach by embedding cultural and environmental considerations into architectural design, ensuring that infrastructure solutions align with the lived experiences and values of Indigenous communities in the Bering Strait Region.

This design methodology emphasizes the importance of community engagement and lived experience in shaping research outcomes (Lenzholzer, Duchhart, and Koh, 2013). This idealology is crucial in my project, where design is not only a tool for problem-solving but also a participatory process that acknowledges Indigenous knowledge as a valid and critical component of infrastructure planning. By integrating Research through design my approach allows for the refinement of energy solutions that reflect subsistence-based lifestyles.

The concept of rural Alaskan, community-centered energy hubs emerged from this process, inspired by traditional subsistence practices and seasonal mobility. These hubs are designed to act as gathering spaces that offer resources such as renewable energy-charged batteries, portable vitamin D lights, and even insulation materials. Drawing on the precedent of the Arctic Food Network project, which strategically placed food shelters along snowmobile paths in Nunavut, Canada, I adapted this culturally-driven approach to address energy needs in Alaska. Sketches and renderings of the energy hub incorporate elements of Inupiaq cultural identity, ensuring that the designs resonate with the communities they serve.

By engaging with these methods, my research bridges the gap between modern energy infrastructure and Indigenous cultural practices. The integration of key informant insights, field observations, spatial data, and design experimentation provides a holistic framework for addressing systemic inequities and inspiring resilience in rural Alaska's energy networks. This mixed-methods approach reflects a commitment to cultural preservation, ensuring that the proposed solutions are sustainable and locally relevant.

Results

Key Informant Interviews

I conducted and coded interviews with Civil Engineer Caitlynn Hanna from the National Renewable Energy Laboratory (NREL), Glenn Brady, P.E. and founder of PanAlaska LLC, Alaska State Senator Mike Shower, as well as two informants who work directly with energy development in Nome. Through these discussions, a strong consensus emerged on the need for renewable energy solutions that integrate with the cultural and logistical realities of rural Alaska. These conversations shed light on existing energy challenges, infrastructure limitations, and the potential for innovative, culturally responsive solutions. The themes that surfaced reinforce the rationale for my proposed energy hubs, which aim to decentralize energy access, provide community gathering spaces, and incorporate adaptive strategies governed by traditional practices.

Infrastructure Limitations

Both Hanna and Brady emphasized the severe limitations of rural Alaska's existing energy infrastructure. My informants from Nome added on to that stance by explaining how energy infrastructure limitations directly affect the community's cost of living. The interviewees in Nome explained how the current system is almost entirely diesel-dependent, a model that is both costly and vulnerable to supply chain disruptions. Hanna, who is also familiar with this system in rural Alaska, explained, "The annual delivery of diesel fuel by barge creates vulnerabilities, as disruptions in supply can leave communities without energy during the harsh winter months." The region's reliance on these bulk fuel deliveries means that any logistical delays—due to weather, transportation failures, or funding shortfalls—can leave communities in crisis.

Senator Shower expanded on this issue, describing how since rural Alaskan communities can only receive fuel during the ice-free months, energy security becomes a year-round concern. He also noted that aging transmission infrastructure is an additional burden, explaining, "We are reaching a point where energy production, the methods for doing so, and how we supply it to people is a very challenging task." Infrastructure maintenance remains an ever-present challenge, as Brady states, "In these parts of Alaska, it's not a question of if the power will go off, it's just a question of when and for how long." Without robust backup systems or alternative energy sources, the rural communities of the Bering Strait Region face extreme energy insecurity, particularly during the winter months.

Decentralizing Energy Grids

One of the strongest themes emerging from these interviews is the need for decentralized energy systems in rural Alaska. Interviewees agreed that the traditional model of large, centralized grids is not viable in remote regions due to vast distances and rugged terrain. Specifically, Brady noted that distributed microgrid architecture could provide a more resilient alternative, stating, “With localized storage, every unit can have solar panels on the house itself, linking to demand-side management and allowing communities to function with more autonomy.” local government leaders in Nome echoed a similar viewpoint on this topic, discussing how solar and wind energy initiatives are crucial to mitigating the cost of the community’s current energy system.

Hanna further discussed the opportunity for microgrids to supplement existing systems rather than attempting to fully replace diesel overnight. She pointed to projects such as the Pilgrim Hot Springs geothermal initiative as proof that alternative energy sources can work in isolated regions. However, funding challenges and federal restrictions on microgrid-compatible technology have created barriers to implementation. According to Hanna, grants often require the purchase of U.S.-made energy infrastructure designed for large-scale grids rather than microgrids, making it difficult to find appropriately scaled technology for Alaska’s unique energy landscape. This disconnect between policy and on-the-ground needs reflects a broader challenge in adapting national energy strategies to rural Arctic communities.

Senator Shower added that while renewable energy sources like solar and wind are being explored, they face efficiency issues in Alaska’s extreme environment. “No matter how much solar and wind you put out, if there’s no wind, there’s no power. For six months out of the year up here, we don’t have a lot of sun, and then things are covered with snow.” He emphasized that a diversified approach is necessary, incorporating a mix of solar, wind, hydro, geothermal, and potentially small nuclear reactors, stating, “I look at it as an all-hands-on-deck approach.”

Climate Change and Its Impact on Infrastructure

Another key issue discussed in the key informant interviews was climate change and its accelerating impact on Arctic infrastructure. Both Hanna and Brady confirmed that rising temperatures, permafrost thaw, and coastal erosion are making existing infrastructure even more fragile. Brady described the challenge bleakly: “Stuff’s washing away and sinking in the mud as the permafrost thaws, and coastlines are moving.” This phenomenon creates a direct threat to energy infrastructure, as shifting ground and flooding compromise roads, fuel storage sites, and electrical systems.

Hanna and the local officials of Nome further discussed these concerns, explaining how Nome has already seen severe damage from storms and erosion. Hanna recalled speaking with residents who had witnessed entire homes being swept away by recent hurricanes. These rapid environmental changes make fixed infrastructure increasingly unreliable, further reinforcing the argument that adaptive energy solutions are necessary to maintain resilience in a shifting landscape.

The Role of Renewable Energy

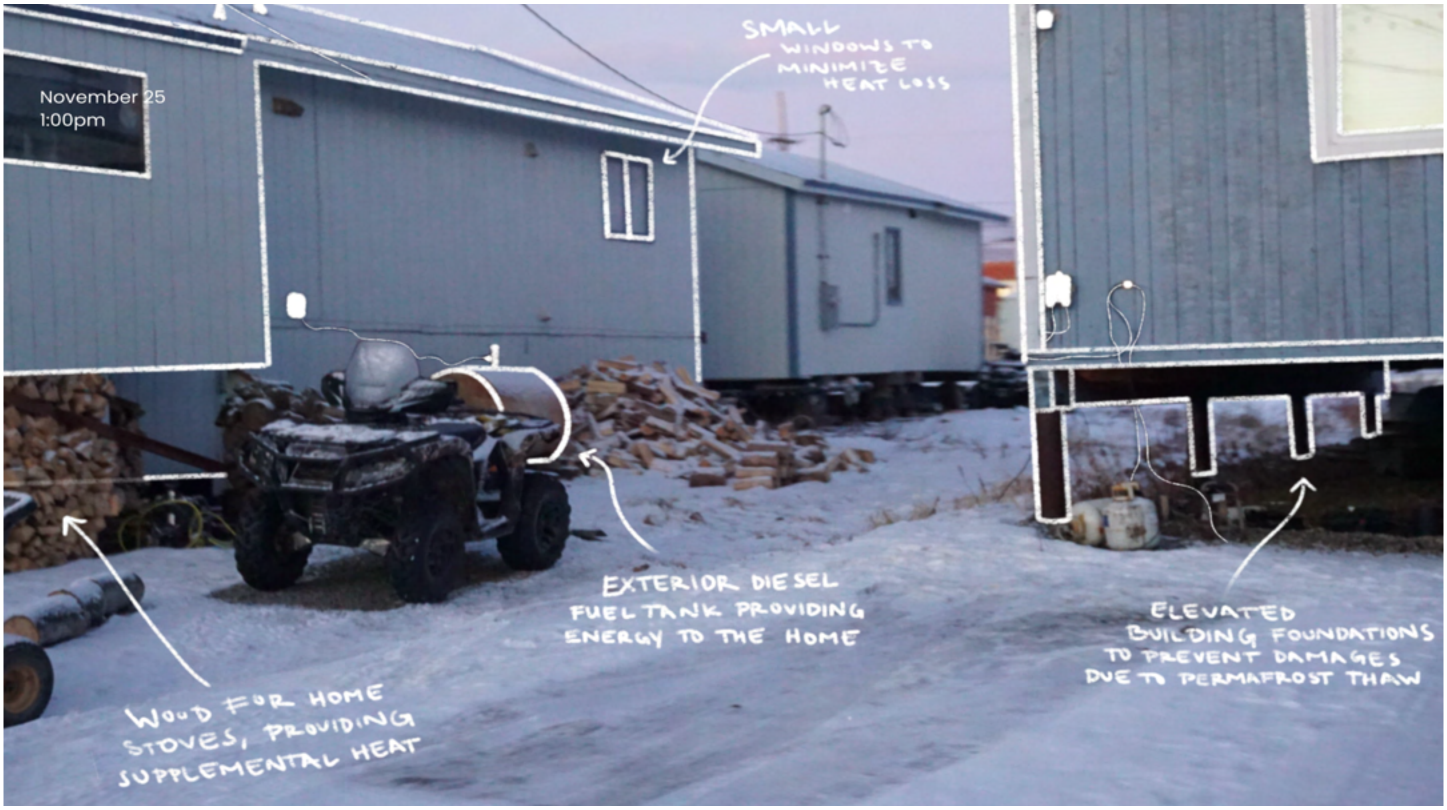
While renewable energy sources such as solar and wind hold promise, experts agreed that successful implementation will require a combination of diverse energy sources, improved infrastructure, and community-driven solutions. Hanna pointed out that geothermal energy presents an exciting opportunity, particularly in areas like Pilgrim Hot Springs, where natural heat sources could be harnessed for electricity and heating. However, she cautioned that renewable systems must be carefully designed to function within Alaska's microgrid context, with sufficient storage and backup capacity to ensure reliability.

Senator Shower also emphasized the potential of hydropower, noting, "We have no lack of water in Alaska, so hydro is a great one. We're expanding a few dams in some remote areas for extra power." He highlighted that small nuclear reactors are also being explored as a potential long-term solution, explaining that modern designs are far safer and more compact than older models, making them viable for remote villages. However, cost and community acceptance remain significant barriers.

As a supplement to the technical considerations of energy infrastructure, Brady emphasized the importance of integrating Indigenous knowledge and community expertise into renewable energy projects. He states that successful energy transitions will depend on local engagement and knowledge-sharing to create systems that align with cultural and environmental realities. This aligns with the overarching argument of my research: that energy infrastructure in the Bering Strait region must be reimagined not only as a technical solution but as a cultural exchange of knowledge and resources. The proposed energy hubs would provide a physical space for this exchange, reinforcing the idea that resilient infrastructure is rooted in both innovation and tradition.

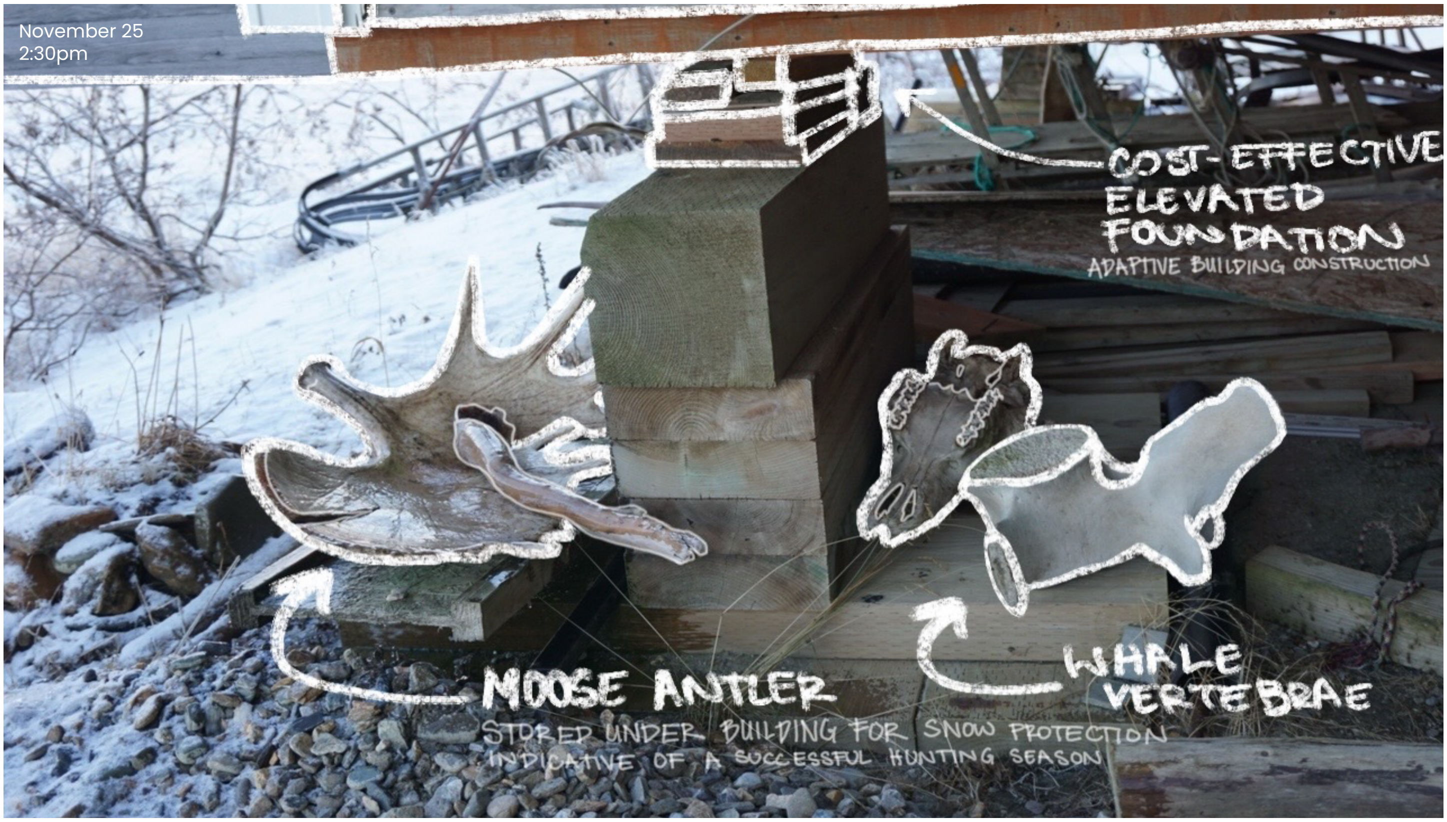
Field Work

Conducting field work in Nome allowed me to better understand the environment in which my project takes place. Here, I saw the importance of local elements such as elevated building foundations, subsistence storage, and the bulk fuel distribution system. Buildings in Nome consistently utilized elevated foundations as a response to permafrost and flooding risks. These environmental risks directly shape the built environment, and contribute to the fixed nature of Nome's infrastructure. Two other consistencies that I noted while doing field work in Nome was the implementation of subsistence storage and fuel tanks. Both of these elements are utilized to get residents through the winter. Subsistence freezers hold a variety of food, each with their own nutritional benefits. The exterior fuel tanks adjacent to the built structures in Nome store a different kind of good– diesel fuel. Diesel is stored at a local "tank farm" and then delivered house to house as needed. Through my fieldwork I found that fuel availability in Nome is nearly as essential to survival as food is, as the fuel is what provides heat, electricity, and power to the community.



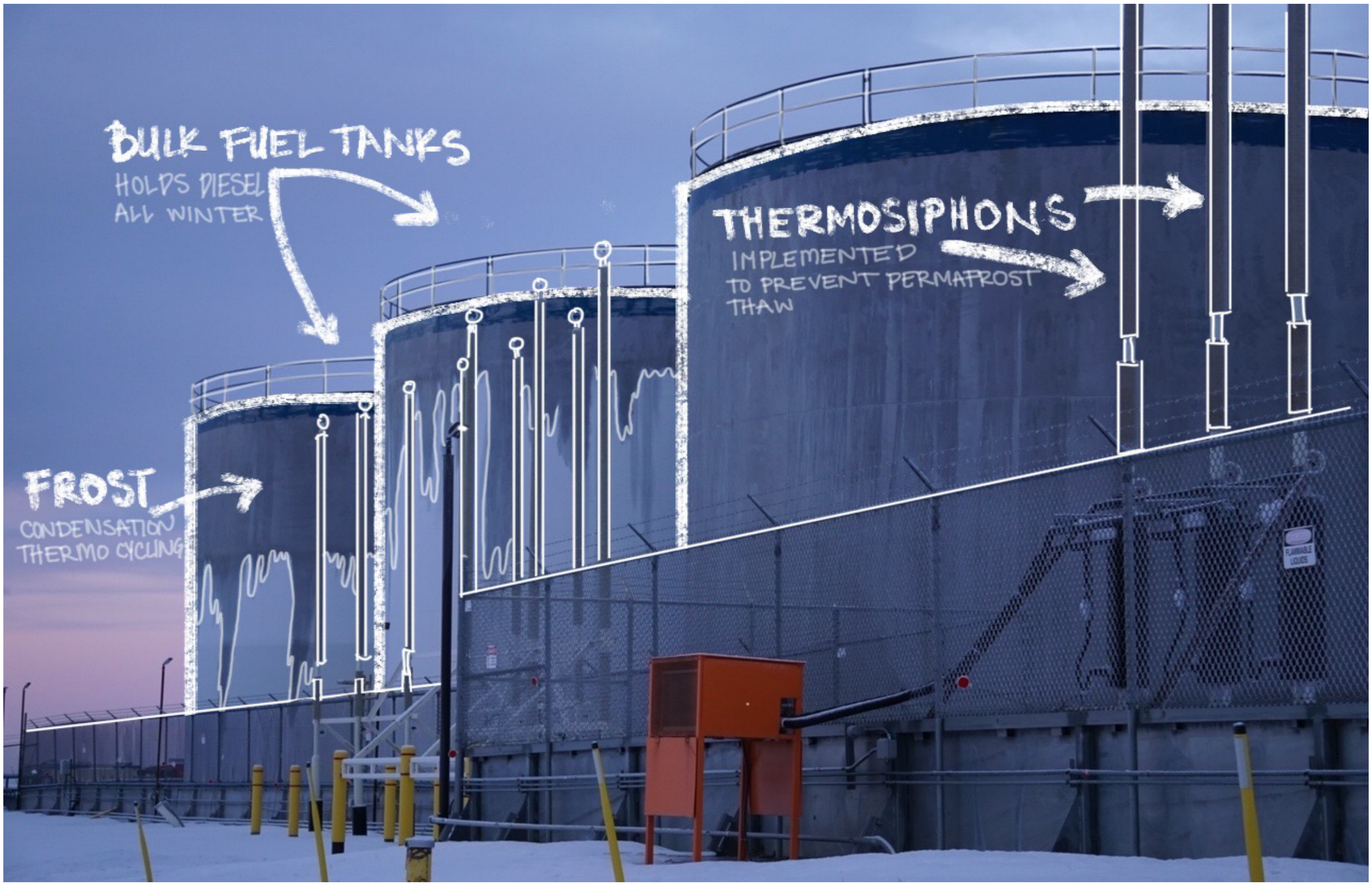
These field notes document key features of residential infrastructure in Nome, Alaska, highlighting adaptations to the extreme climate, including elevated foundations to combat permafrost thaw and small windows to minimize heat loss. The reliance on exterior diesel tanks and supplemental wood stoves illustrates the region's dependence on multiple heating sources for resilience in harsh winter conditions.

This annotated image of a subsistence freezer in Nome, Alaska, illustrates the value of preserving locally harvested foods essential for survival through the winter. The variety of meats, all with their own unique nutritional value, reflects the deep connection between subsistence practices and food security in Inupiaq communities.



This analysis highlights adaptive building techniques and subsistence practices in Nome, Alaska, showcasing elevated foundation strategies that mitigate permafrost instability in a cost-effective way. Beneath the foundation, various skeletal remains are stored for preservation, demonstrating the integral role hunting has in Inupiaq culture.

This image captures the unique profile of Nome's Arctic landscape, where seasonal changes shape the built environment. The small house, perched on shifting ground near the Bering Sea, is at risk of being swept down the shore due to the challenges of coastal erosion, permafrost thaw, and extreme weather conditions that impact infrastructure in Nome.



This analysis shows Nome's bulk fuel storage system aka the "tank farm", which is essential for maintaining diesel energy security throughout the winter. The thermosiphons visible on the tanks prevent permafrost thaw, ensuring structural stability of the tanks, while frost patterns on the exterior illustrate the thermal cycling effects of extreme Arctic conditions.

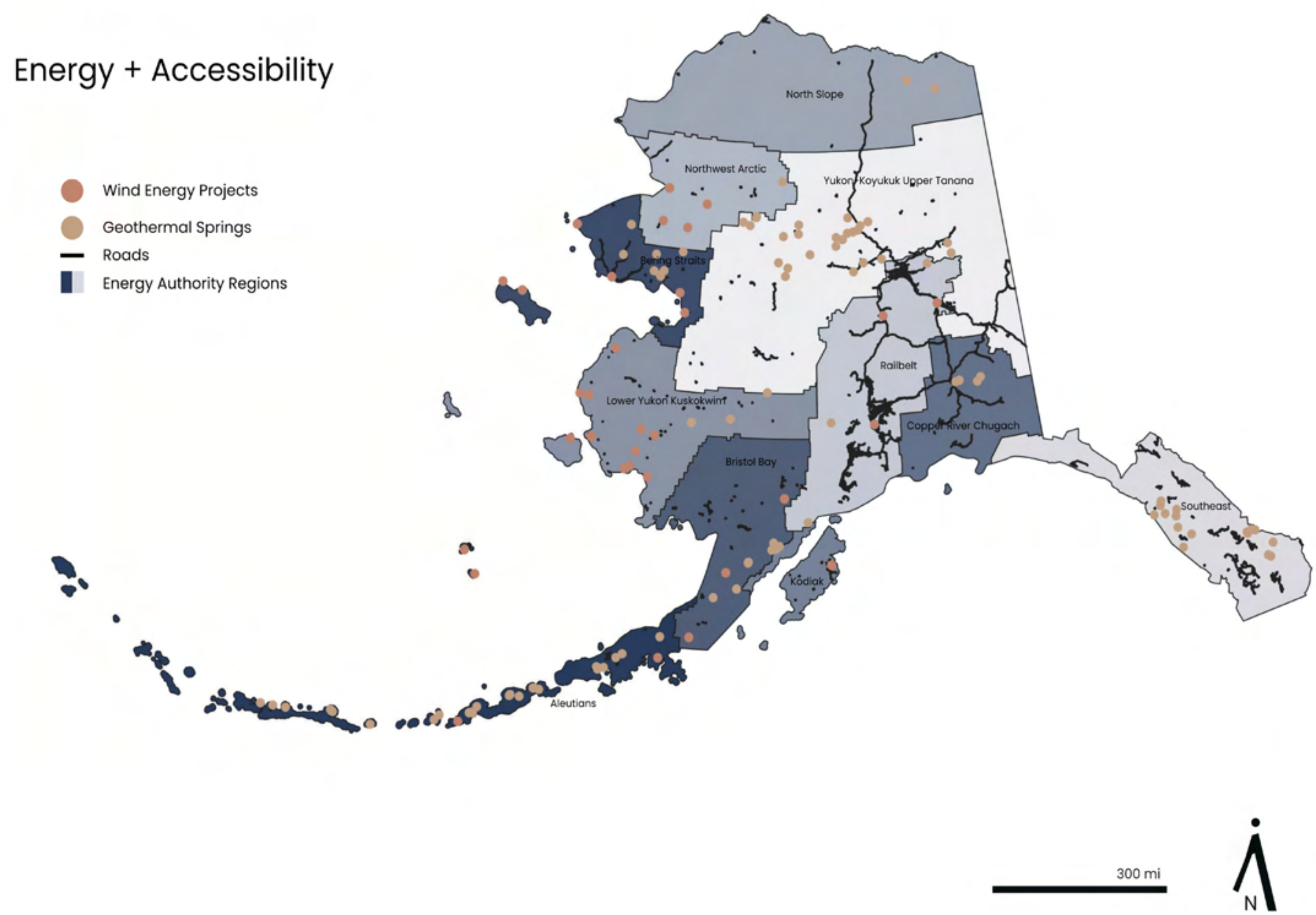
My on-site observations record some of the challenges and adaptive strategies that define energy infrastructure and housing in rural Arctic communities, specifically within the context of Nome, Alaska. These observations further illustrate key elements that reflect both resilience and vulnerability: elevated building foundations to combat permafrost thaw, exterior diesel fuel tanks to provide essential heating and electricity, and small windows designed to minimize heat loss. Together, these features demonstrate the community's reliance on static infrastructure systems that are costly, environmentally unsustainable, and prone to disruption due to the region's isolation and harsh climate conditions.

Field observations from Nome also highlight the current energy paradigm's inefficiencies and risks, particularly the dependence on diesel fuel, which is expensive to transport and store, and environmentally harmful. It illustrates the necessity for adaptive, community-centered spaces that can provide renewable energy resources while providing space for continuity connection, and resilience. The reliance on external resources like firewood and diesel further emphasizes the urgency of designing energy systems that leverage local renewable resources, such as wind and geothermal energy, to reduce dependence on external supply chains.

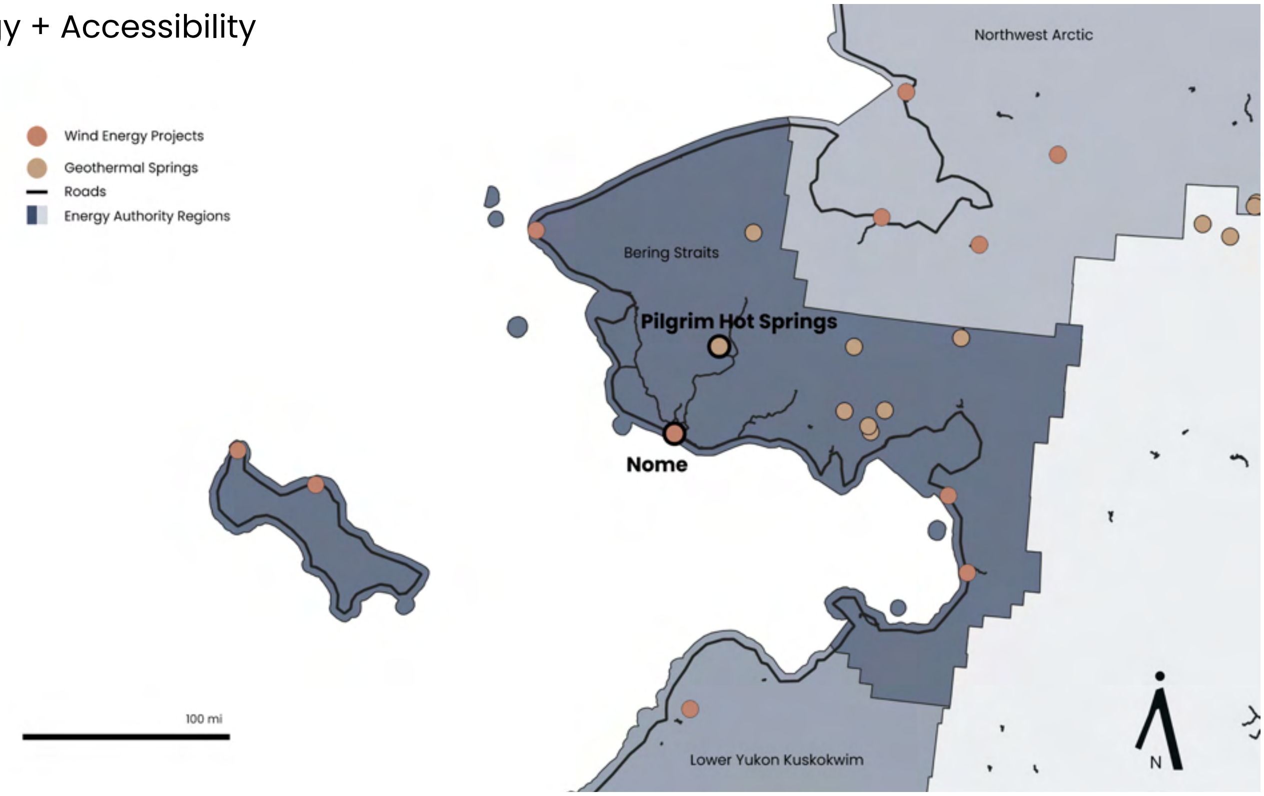
Overall, my fieldwork encapsulates the core argument of my thesis: that culturally informed, decentralized energy infrastructure is essential to address the unique challenges faced by rural Arctic communities. By reflecting on the limitations and adaptive strategies visible here, my project aims to propose energy hubs that not only mitigate these vulnerabilities but also enhance community cohesion through shared spaces for energy access and knowledge exchange. In the context of the results of my thesis project, the fieldwork I did reinforces the need for dynamic, decentralized energy solutions that align with both the environmental and cultural realities of Inupiaq communities.

Spatial Analysis

In terms of spatial analysis, I used QGIS to create layered maps that visually demonstrate the relationships between energy infrastructure, Indigenous communities, and environmental factors. For example, as my key informants advocated for primarily wind and geothermal energy opportunities, I overlaid those renewable energy sites with both energy authority regions and the Alaskan road network to better understand energy accessibility.



Local Energy + Accessibility

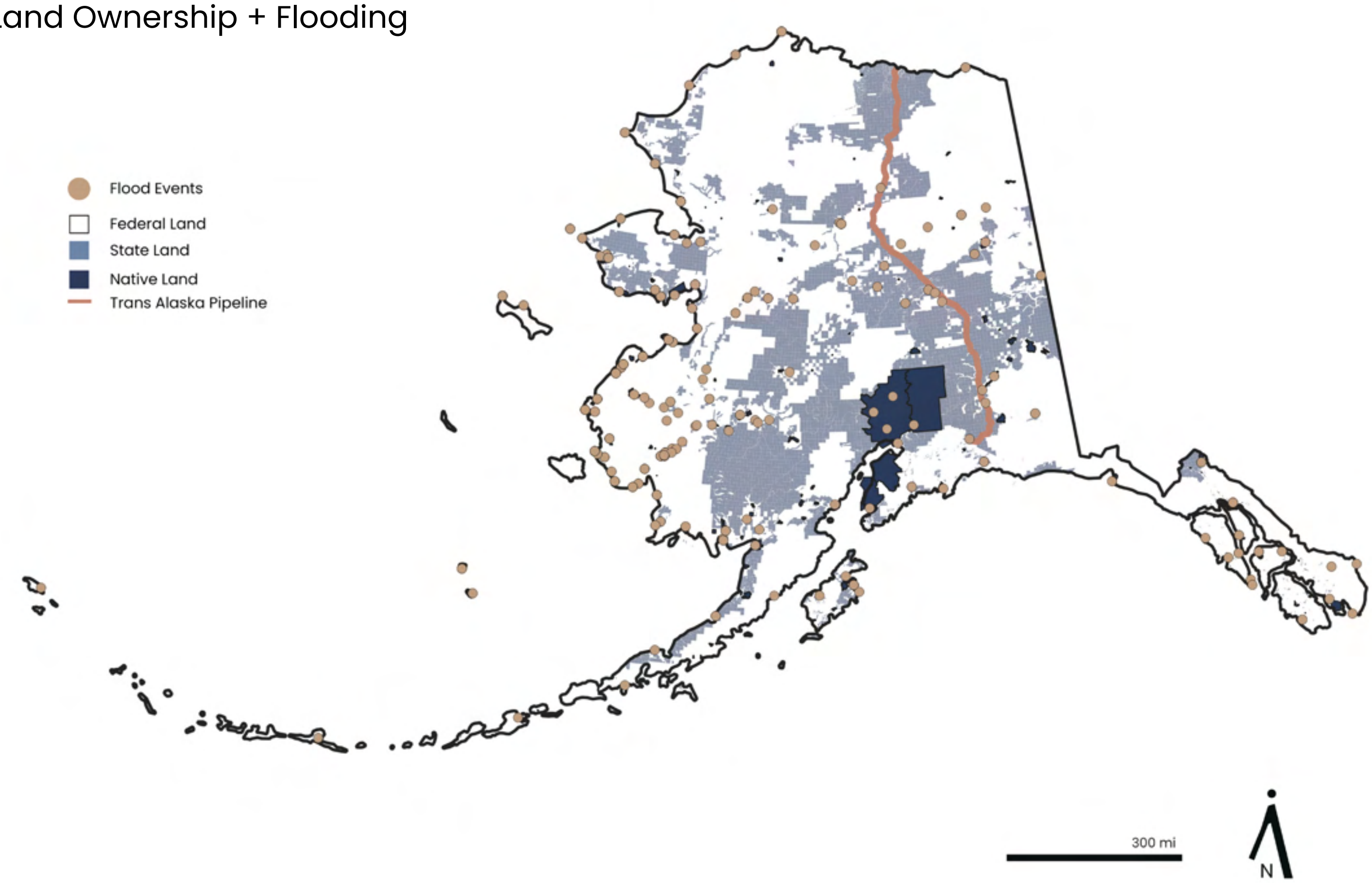


These maps highlight the relationship between renewable energy accessibility and geographic distribution in Alaska, emphasizing the reliance on decentralized energy solutions in road-inaccessible regions. The presence of wind and geothermal projects showcases efforts and potential to supplement traditional diesel-dependent systems with renewable alternatives.

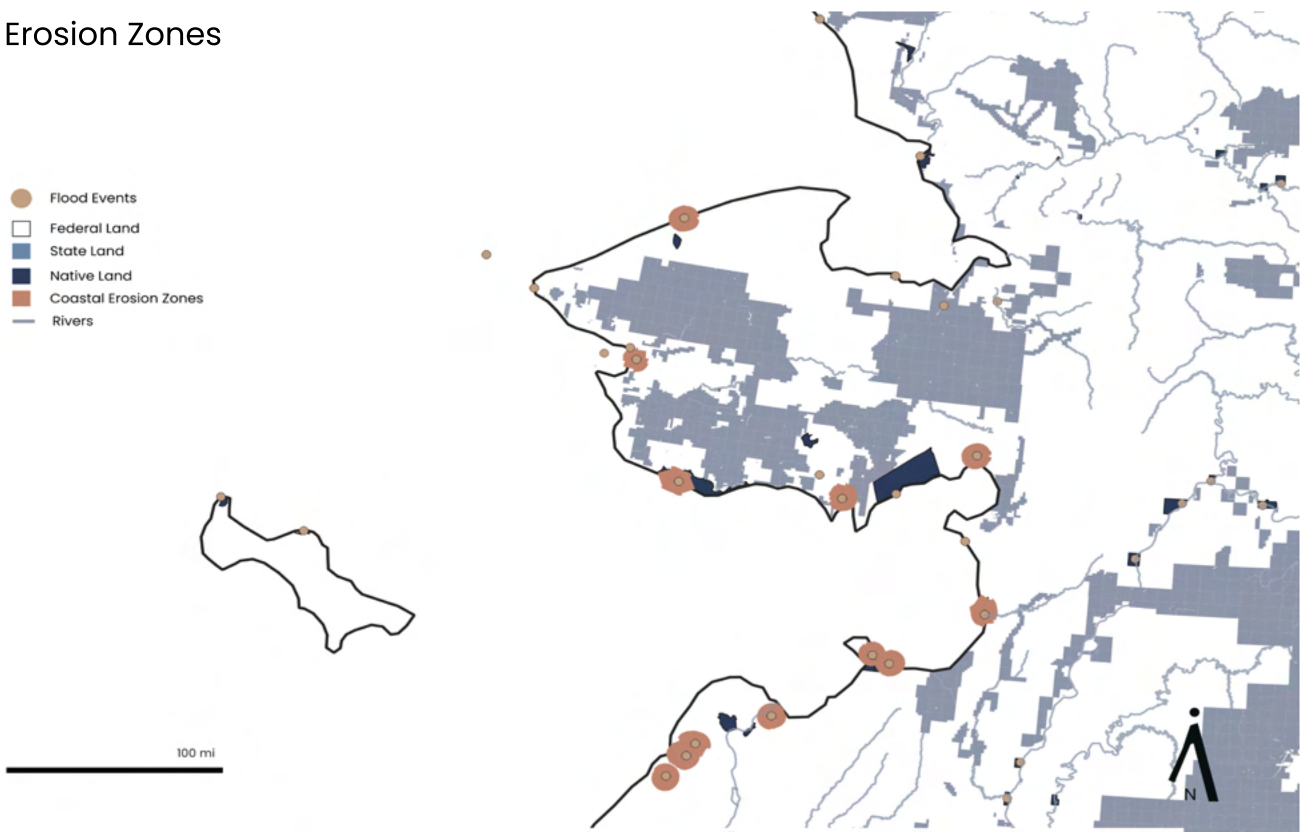
This spatial analysis reinforced the urgency of rethinking energy infrastructure in the Bering Strait Region, particularly in relation to the seasonal rhythms of subsistence living. By mapping the distances between remote villages and their nearest energy sources, it became apparent that communities like Council, Alaska, experience severe infrastructural isolation, relying almost entirely on Nome for essential services. This dependency creates heightened vulnerabilities during winter months when travel becomes difficult and supply chains are strained. Additionally, overlaying environmental hazard data with existing infrastructure revealed that many energy facilities are located in areas at high risk of permafrost thaw and coastal erosion, making them increasingly unstable.

These findings highlighted the need for decentralized energy hubs positioned in locations that are both environmentally secure and culturally aligned with the mobility of subsistence practices. Rather than reinforcing a rigid, centralized grid, spatial analysis supported the argument for a more flexible, community-oriented approach that ensures consistent energy access while respecting traditional land use patterns.

Land Ownership + Flooding

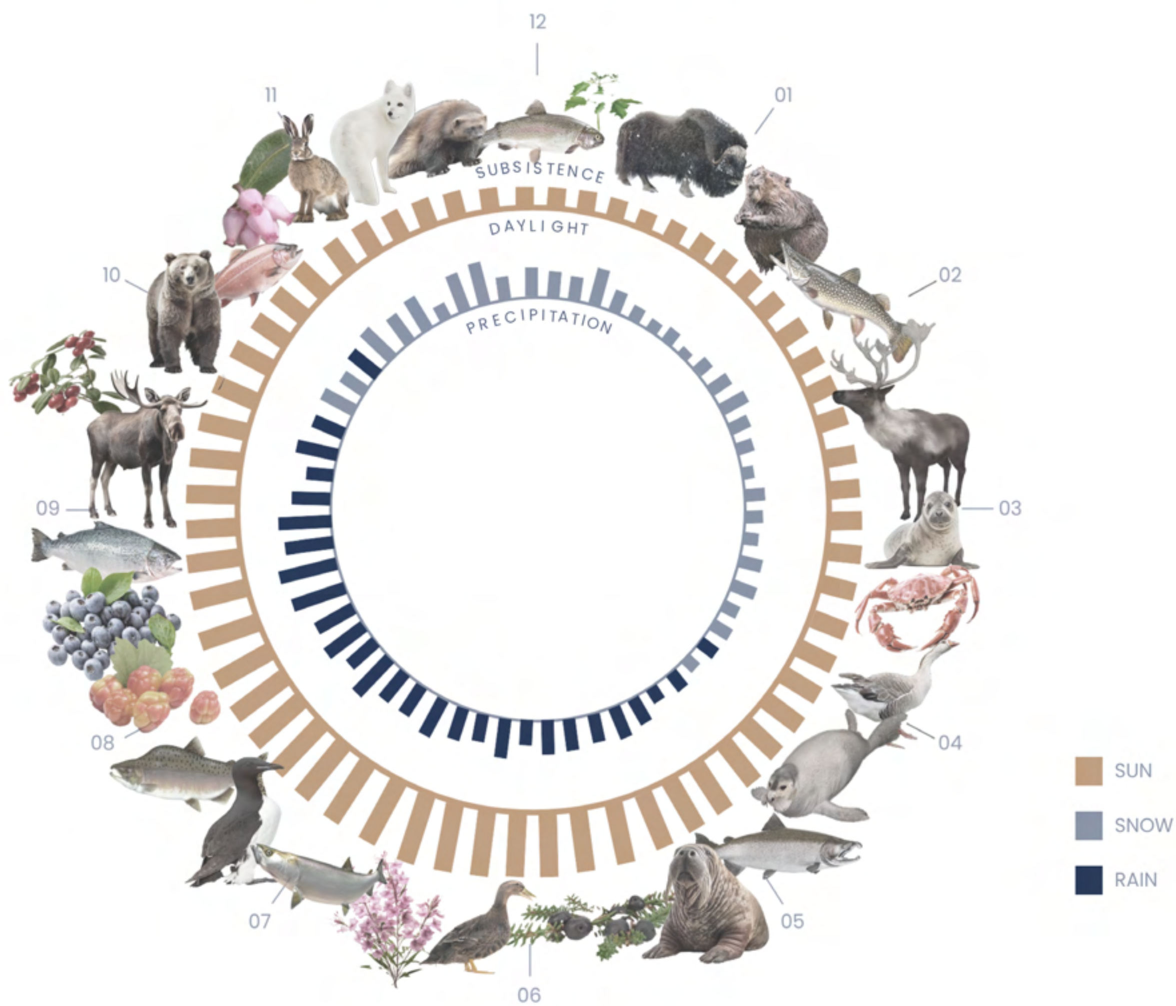


Coastal Erosion Zones



These maps show the relationship between land ownership and environmental risks in Alaska. Not only do these maps illustrate land ownership, but they demonstrate the proximity of flood and erosion zones to inhabited land areas, emphasizing the potential impact on surrounding communities.

Cyclical Subsistence Calendar

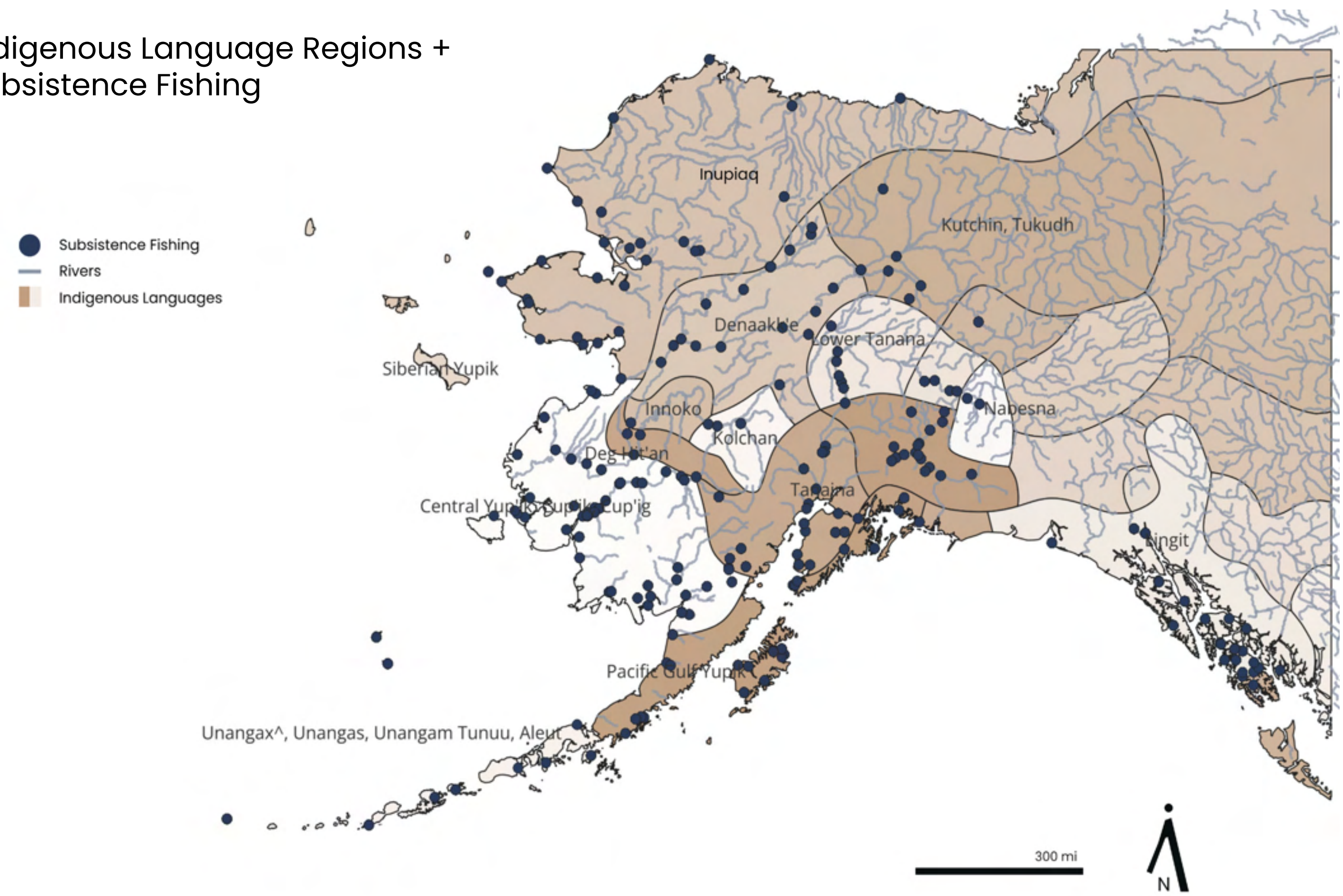


While specific foraging routes are not published to protect the livelihoods of Indigenous communities, a temporal analysis provided a complementary temporal way of understanding the seasonal rhythms of subsistence activities. The subsistence cycle, which includes key periods for hunting, fishing, and gathering, is intricately linked to the patterns of daylight and precipitation throughout the year. For instance, summer months with extended daylight hours support salmon runs and berry harvesting, while the harsh winter season, marked by limited daylight and freezing temperatures, requires reliance on stored resources of plants and animals that were harvested during their given hunting season. A visual tool like the subsistence calendar illustrates these cycles, emphasizing the overlap between ecological availability and cultural practices. By incorporating this temporal approach alongside spatial mapping, I was able to identify critical seasonal windows that influence energy use and storage patterns in the region.

The temporal analysis added an essential layer of cultural understanding to my mapping efforts. For instance, while summer activities like fishing and berry harvesting may require energy for storage and preservation, winter demands energy-intensive heating and lighting solutions to offset the limited daylight. These hubs would be positioned at central locations informed by temporal and spatial data, for example, in the heart of Nome so that it may cater to the entire community. These energy hubs would not only provide renewable energy resources but also act as community gathering spaces, so having them in easily accessible locations is crucial.

Ultimately, this mapping and analysis process highlights the interconnectedness of environmental, cultural, and infrastructural factors in the Bering Strait Region. It ensures that proposed interventions, such as the energy hubs, are not only technologically viable but also adaptive to the rhythms of subsistence practices. By bridging the temporal dynamics of harvesting with the spatial realities of energy inequity, this approach promotes a design strategy that respects Indigenous knowledge while supporting sustainable development in the region.

Indigenous Language Regions + Subsistence Fishing



This map shows the intersection of Indigenous language regions, major rivers, and subsistence fishing sites across Alaska, emphasizing the relationship between language, land, and traditional food systems. The distribution of subsistence fishing sites highlight the continued reliance on river and coastal ecosystems for cultural and nutritional sustenance within Indigenous communities.

Incorporating subsistence patterns into the design of these hubs is vital for ensuring their cultural relevance and functionality. For example, a community's shared knowledge about resource locations—such as where salmonberries are abundant in a particular year or which fishing spots have yielded the best results—could be facilitated and strengthened through gatherings at the hubs.

By aligning the hubs with these seasonal subsistence activities, these hubs could serve as central points for processing and preserving fish during the season of the salmon runs, while in winter, they could offer heating solutions, vitamin D lighting, and stored energy for critical needs.

Design

This cultural context collage merges historical imagery with the present-day landscape, illustrating the long-standing relationship between Inupiaq communities and the land

The wind howled against the insulated walls of Nome's very own energy hub, as a young woman stepped inside, brushing the snow from her coat. It was mid-winter in Nome, a season defined by relentless darkness, freezing winds, and heavy snowdrifts that crept higher against buildings each day. The air outside was brittle and sharp, but inside, the hub radiated warmth, lit by soft LED fixtures designed to mimic the sunlight the region lacked this time of year. A group of elders sat together, exchanging stories about the days when they preserved fish in smokehouses by the shore. Across the room, two fishermen discussed where they had found the largest salmon runs this past summer, sharing coordinates that had been passed down for generations.

This vision is what the energy hubs could provide: a means of decentralizing Nome's energy reliance while revitalizing cultural traditions of reciprocal exchange. They are designed to meet both the immediate and long-term energy needs of the community, providing a sustainable alternative to Nome's expensive, outdated, and vulnerable diesel-dependent system. As it stands today, Nome's community gathering spaces are few and far between—limited mostly to bars and churches, neither of which provide a dedicated setting for knowledge exchange about subsistence strategies or climate adaptation. By contrast, the energy hubs are conceived of as places where practical needs intersect with cultural and social exchange, reinforcing community resilience in a rapidly changing Arctic.

Design Inspiration and Cultural Roots

The design of these energy hubs is deeply rooted in Inupiaq subsistence practices, particularly the concept of a subsistence freezer—a vital resource that ensures survival through the harsh winter months. Just as these freezers store fish, game, and berries gathered during the summer for use in the winter, the energy hubs function as repositories of both energy and knowledge, sustaining the community through seasonal cycles. Following this model, geothermally-charged batteries are "harvested" by community members in Nome, and transported from Pilgrim Hot Springs —a site rich with untapped geothermal potential—back to the energy hub for use during the winter. This process mirrors the traditional practice of seeking out and gathering resources at peak abundance to sustain life through the leaner months. By providing a stable and renewable energy source, these batteries not only reduce reliance on diesel but also enhance community resilience, ensuring that residents are less vulnerable to supply disruptions caused by extreme weather and logistical challenges in the dark winter months.

This site map emphasizes the energy hub's central location in Nome, positioned near the town's main street to ensure accessibility for community gatherings and events. The building's orientation is optimized in relation to the sun's seasonal paths, maximizing natural light during the dark winter months.

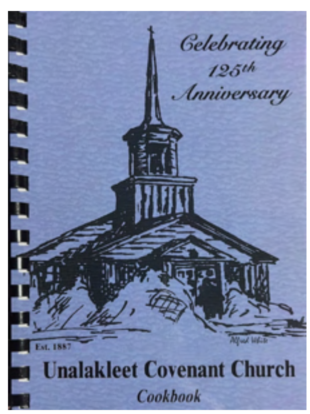
Additionally, the hubs are thoughtfully designed to address both the environmental and social needs of the Bering Strait region. The inclusion of portable, renewable energy-charged batteries helps alleviate the financial burden of high energy costs in the winter, providing a reliable and sustainable alternative to diesel. However, these hubs are more than just energy storage facilities—they serve as valuable connection spaces for the community. In their design, I aimed to reflect the reciprocity inherent in Inupiaq subsistence practices, where resources are shared, knowledge is passed down, and collective well-being is prioritized.

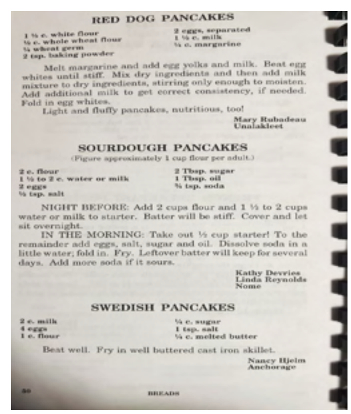
The south side of the building features large doors that open onto an exterior courtyard, creating a flexible gathering space where community members can come together during significant cultural and seasonal events, such as the Iditarod finish or the midnight sun festival. This intentional connection between interior and exterior spaces reinforces the hub's role as a center for community connection year-round. In addition to this design choice, windows are strategically placed in a southeastern orientation to maximize natural daylight during the limited sunlit hours of winter, ensuring that the space remains illuminated while reducing the need for artificial lighting.

The battery wing design emphasizes features such as curved shelving for geothermally charged batteries, responding to the overall building form and a warm, as well as a wood-lined interior that creates a comfortable, clean environment. The adjacent windows illuminate the area to ensure ease of use for all generations.

The energy hub is designed to be used throughout the year, and since in the winter there is such little sunlight, it is important to keep the interior and exterior space illuminated when in use. Additionally, the hub's elevated foundation aligns with local building practices, minimizing heat transfer to the ground to prevent permafrost thaw while also enhancing flood resistance.

One of my sources of inspiration, the Unalakleet Covenant Church Cookbook, provided a powerful metaphor for the design of the hubs. This cookbook, a collection of recipes shared by community members from around the region, reflects the way knowledge is passed down and preserved. Its recipes, featuring ingredients such as salmon, berries, and seal oil, highlight not just subsistence practices but also the cultural significance of food as a tool for connection. Similarly, the energy hubs aim to serve as spaces where practical knowledge—about foraging routes, weather patterns, and even food—is shared and preserved.





RED DOG PANCAKES

1 ½ c. white flour
¼ c. whole wheat flour
¼ wheat germ
2 tsp. baking powder

2 eggs, separated
1 ½ c. milk
¼ c. margarine

Melt margarine and add egg yolks and milk. Beat egg whites until stiff. Mix dry ingredients and then add milk mixture to dry ingredients, stirring only enough to moisten. Add additional milk to get correct consistency, if needed. Fold in egg whites.

Light and fluffy pancakes, nutritious, too!

Mary Rubadeau
Unalakleet

SOURDOUGH PANCAKES

(Figure approximately 1 cup flour per adult.)

2 c. flour
1 ½ to 2 c. water or milk
2 eggs
½ tsp. salt

2 Tbsp. sugar
1 Tbsp. oil
½ tsp. soda

NIGHT BEFORE: Add 2 cups flour and 1 ½ to 2 cups water or milk to starter. Batter will be stiff. Cover and let sit overnight.

IN THE MORNING: Take out ½ cup starter! To the remainder add eggs, salt, sugar and oil. Dissolve soda in a little water; fold in. Fry. Leftover batter will keep for several days. Add more soda if it sours.

Kathy Devries
Linda Reynolds
Nome

SWEDISH PANCAKES

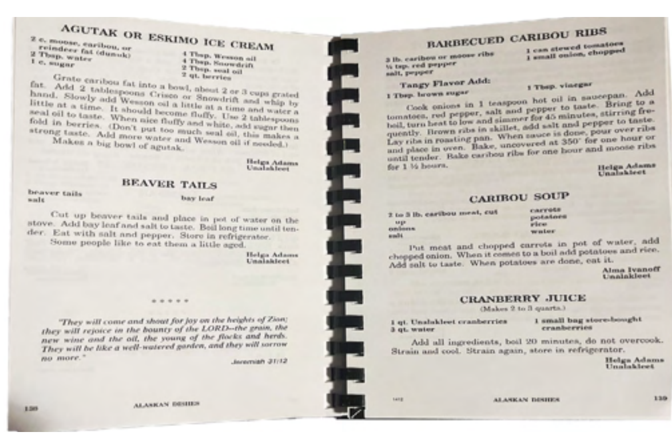
2 c. milk
4 eggs
1 c. flour

¼ c. sugar
1 tsp. salt
¼ c. melted butter

Beat well. Fry in well buttered cast iron skillet.

Nancy Hjelm
Anchorage

BREADS



AGUTAK OR ESKIMO ICE CREAM

2 c. moose, caribou, or reindeer fat (dunuk)
2 Tbsp. water
1 c. sugar

4 Tbsp. Wesson oil
4 Tbsp. Snowdrift
2 Tbsp. seal oil
2 qt. berries

Grate caribou fat into a bowl, about 2 or 3 cups grated fat. Add 2 tablespoons Crisco or Snowdrift and whip by hand. Slowly add Wesson oil a little at a time and water a little at a time. It should become fluffy. Use 2 tablespoons seal oil to taste. When nice fluffy and white, add sugar then fold in berries. (Don't put too much seal oil, this makes a strong taste. Add more water and Wesson oil if needed.)

Makes a big bowl of agutak.

Helga Adams
Unalakleet

BEAVER TAILS

beaver tails
salt

bay leaf

Cut up beaver tails and place in pot of water on the stove. Add bay leaf and salt to taste. Boil long time until tender. Eat with salt and pepper. Store in refrigerator.

Some people like to eat them a little aged.

Helga Adams
Unalakleet

* * * * *

"They will come and shout for joy on the heights of Zion; they will rejoice in the bounty of the LORD--the grain, the new wine and the oil, the young of the flocks and herds. They will be like a well-watered garden, and they will sorrow no more."

Jeremiah 31:12

ALASKAN DISHES

BARBECUED CARIBOU RIBS

3 lb. caribou or moose ribs
½ tsp. red pepper
salt, pepper

1 can stewed tomatoes
1 small onion, chopped

Tangy Flavor Add:

1 Tbsp. brown sugar

1 Tbsp. vinegar

Cook onions in 1 teaspoon hot oil in saucepan. Add tomatoes, red pepper, salt and pepper to taste. Bring to a boil, turn heat to low and simmer for 45 minutes, stirring frequently. Brown ribs in skillet, add salt and pepper to taste. Lay ribs in roasting pan. When sauce is done, pour over ribs and place in oven. Bake, uncovered at 350° for one hour or until tender. Bake caribou ribs for one hour and moose ribs for 1 ½ hours.

Helga Adams
Unalakleet

CARIBOU SOUP

2 to 3 lb. caribou meat, cut up
onions
salt

carrots
potatoes
rice
water

Put meat and chopped carrots in pot of water, add chopped onion. When it comes to a boil add potatoes and rice. Add salt to taste. When potatoes are done, eat it.

Alma Ivanoff
Unalakleet

CRANBERRY JUICE

(Makes 2 to 3 quarts.)

1 qt. Unalakleet cranberries
3 qt. water

1 small bag store-bought cranberries

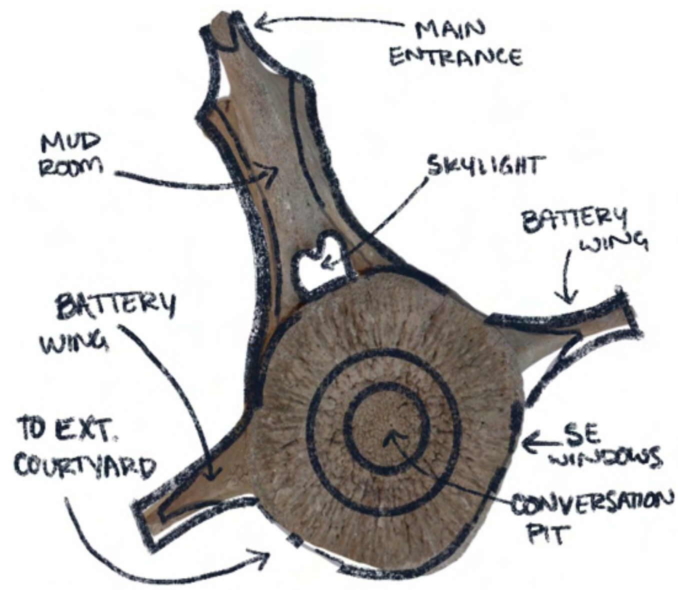
Add all ingredients, boil 20 minutes, do not overcook. Strain and cool. Strain again, store in refrigerator.

Helga Adams
Unalakleet

ALASKAN DISHES

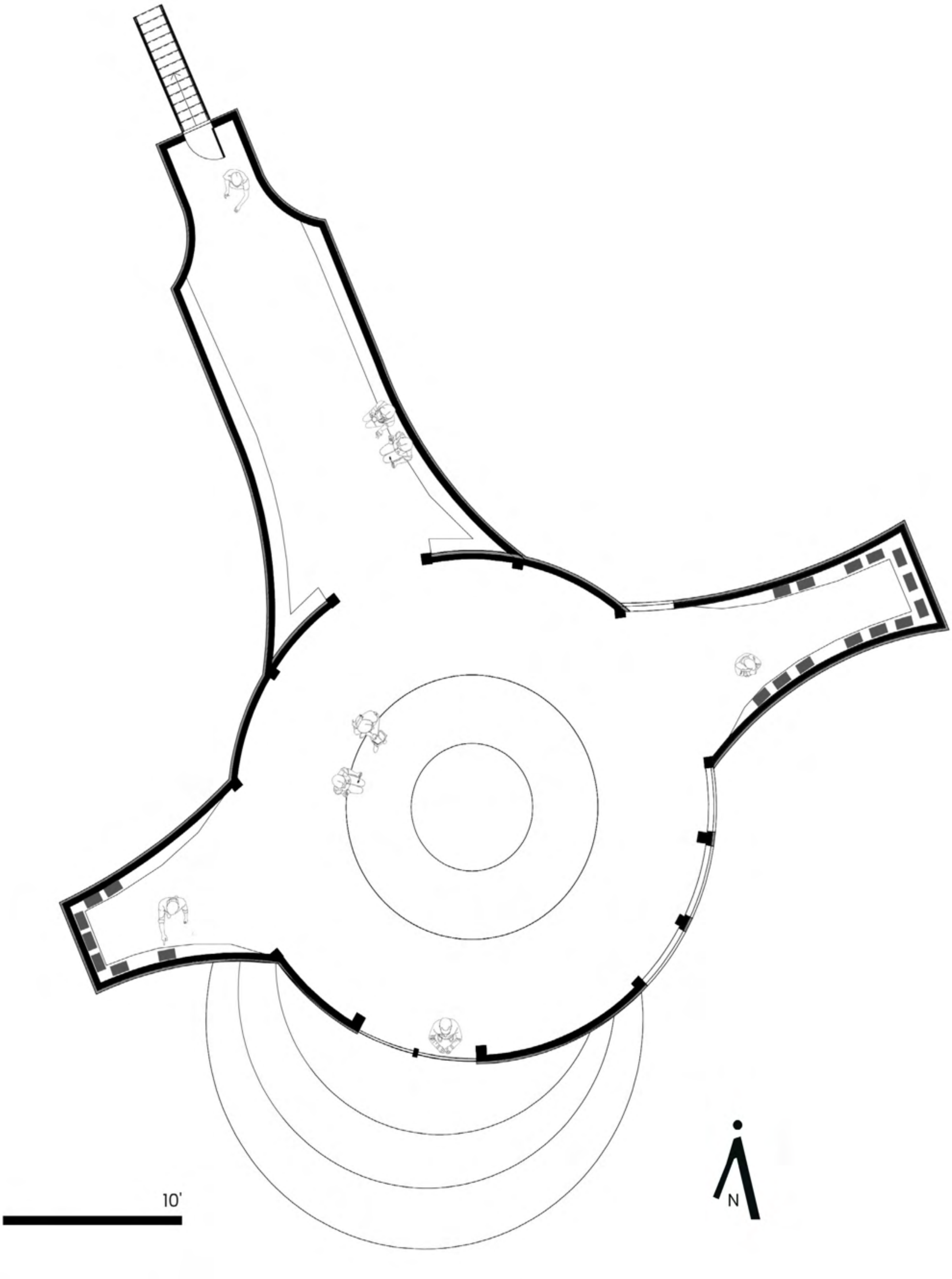
Much like the Unalakleet Covenant Church Cookbook preserves the culinary traditions of the community, the energy hubs are envisioned as spaces for cultural exchange, embodying core Inupiaq values of reciprocity and shared knowledge. These hubs incorporate human-centered design elements that reflect the communal nature of Inupiaq life, where collaboration and storytelling play a crucial role in sustaining traditional practices.

Additionally, the form of the energy hub's floor plan takes direct inspiration from the cross-section of a whale vertebra, an element that holds both practical and symbolic meaning in the context of my project. Whales have long been central to Inupiaq subsistence and cultural life, providing food, tools, and material resources essential for survival in the Arctic. The vertebrae of a whale serve as the structural foundation of the animal, supporting its movement and strength—qualities that parallel the function of the energy hubs as pillars of community resilience. By mirroring this organic structure, the floor plan embodies a sense of connectivity and interdependence, much like the whale itself sustains the community.



This conceptual floor plan shows the initial sketching and ideation process of creating the energy hub design.

The open, radial organization of the hub reflects the organic shape of the vertebrae, creating a space where people naturally gather, share, and circulate—much like the vital exchanges that occur within Inupiaq communities. This design approach emphasizes fluidity and adaptability, reinforcing the idea that energy, resources, and knowledge should move dynamically between people, rather than being confined to rigid systems.



This floor plan showcases the energy hub's layout, drawing inspiration from the form of a whale vertebra. The central gathering space supports community interaction, while the branching extensions provide designated areas for battery storage.

Human-Centered Design Approach

A key component of the design is the creation of a comfortable and inviting atmosphere. In regions where temperatures can plunge far below freezing, and daylight hours are scarce, warmth and light are not just physical necessities but emotional ones as well. To this end, the hubs are designed with insulated flooring, regionally sourced wood interiors, and a conversation pit that encourages dialogue among locals. The space is intentionally versatile, accommodating everything from small family meetings to larger community workshops.

For example, during berry season, families could use the hubs to process their harvests, sharing tools and techniques while working side by side. In winter, the hubs could host workshops on ice fishing or lessons on preparing traditional foods like dried salmon or seal oil. The community space may also be used for simple rest and relaxation, a sanctuary from the harsh winter. By creating safe, comfortable spaces that encourage community interactions, the hubs reinforce the idea that the way people interact with each other is a cultural exchange of knowledge, one that strengthens community ties and resilience.

This central gathering space of the energy hub is designed for both comfort and cultural continuity. The sunken conversation pit encourages storytelling and knowledge exchange, while the library shelves provide a space for preserving and sharing written histories, reinforcing the hub's role as a community anchor.

Another essential design element is the inclusion of a mudroom, a practical feature tied to life in rural Alaska. Given the region's harsh climate, where snow, ice, and mud are ever-present, the mudroom serves as a crucial transition space, preventing cold drafts and excess moisture from entering the main gathering area. This design choice reflects the realities of Inupiaq daily life, where gear such as heavy parkas, boots, and gloves must be properly stored and dried.

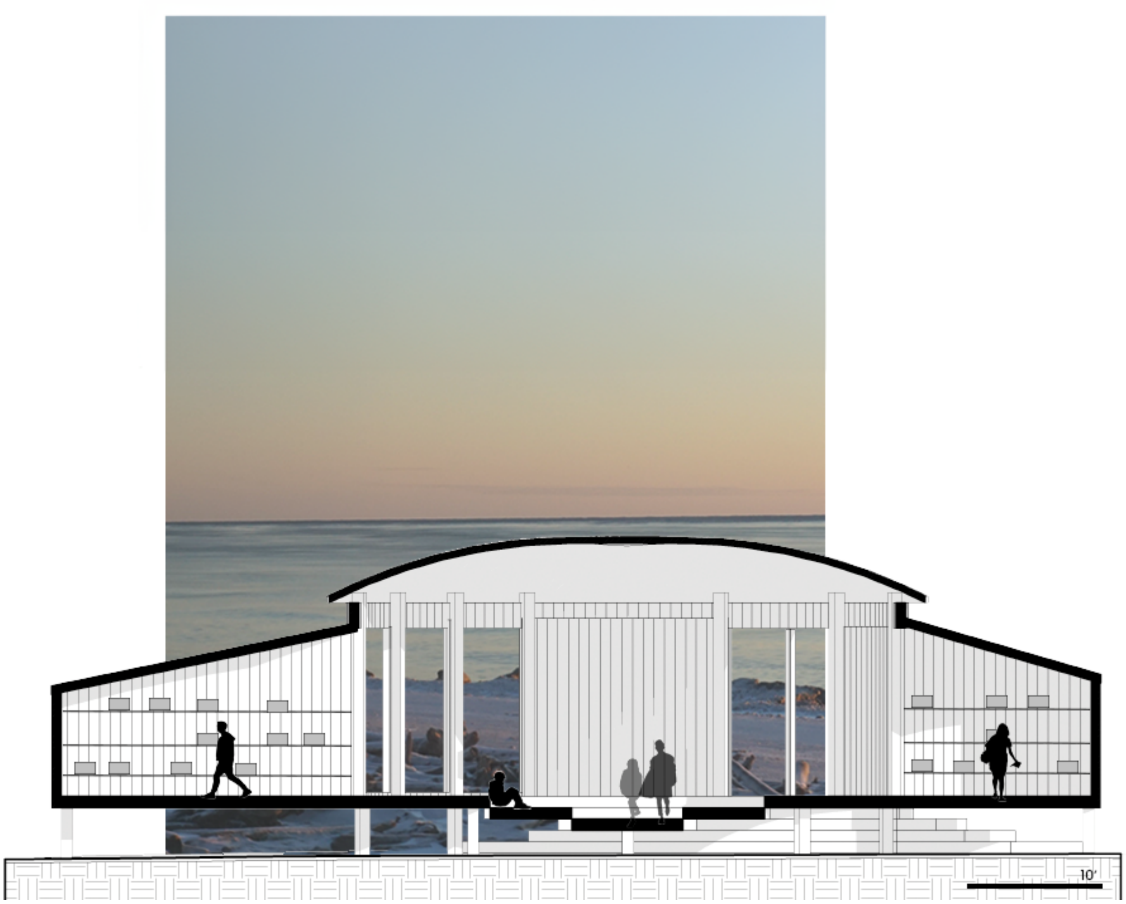
Additionally, the mudroom acts as a place of social transition—just as one sheds the elements before entering the warmth of the hub, they also prepare to enter a space of shared learning and exchange as they pass through the skylight-lit hallway and into the common space.

The energy hub's mudroom serves as a vital transitional space, balancing practicality with social connection. Built-in benches offer a comfortable place to shed bulky outer layers before entering the main gathering area, while the sculpted skylight floods the space with natural light, creating a warm and inviting passage into the heart of the community hub.

This idea is further reflected by the variance in ceiling heights within the hub. The mudroom and battery storage wings have intentionally lower ceilings, reinforcing their function as transitional and utilitarian spaces, respectively. These areas are meant to feel protective and enclosed, emphasizing their role in buffering the harsh external environment. The shorter ceilings on the battery storage wings allow the area to maintain a compact and efficient layout, ensuring the stored energy remains well-insulated and accessible during winter months.

In contrast, the central community space features a taller ceiling, evoking a sense of openness and light. The vertical expansion of the main space generates a sense of inclusivity and shared purpose, mirroring the way Inupiaq knowledge and resources are exchanged within the community. Much like a qargi, the traditional Inupiaq gathering house, this elevated space serves as a cultural and social anchor, allowing for storytelling and collaboration. The gradual progression from the enclosed entry spaces to the expansive core reflects the hub's purpose—not only as a site for energy accessibility, but as a place where the community can come together, share wisdom, and sustain one another through the changing seasons.

This building section shows the energy hub's gradual height transition, with lower ceilings in the entry and battery storage areas leading to a more open central gathering space. The sloped roof follows this progression, and is designed to shed winter snow accumulation. The elevated foundation further protects the structure from permafrost thaw and coastal flooding, ensuring long-term resilience in the Arctic environment.



This section highlights the battery storage wings, which provide accessible and organized spaces for charging and distributing portable renewable energy sources. Positioned on either side of the central gathering space, these wings integrate energy infrastructure with community use, ensuring reliable off-grid power while maintaining a culturally responsive design.

Scalability and Regional Needs

While the initial hub is designed for Nome, the concept is inherently scalable, with adaptations possible for surrounding villages such as Unalakleet, Council, and others in the Bering Strait region. Each hub would be tailored to the specific needs of its community. For instance, while Nome's hub might prioritize energy storage and gathering spaces, a hub in Unalakleet could focus on food preservation or water access, depending on their local subsistence practices. This flexibility ensures that the hubs are not just one-size-fits-all solutions but dynamic systems that respond to the unique challenges and strengths of each community.

The scalability of these hubs also aligns with broader regional goals. By creating a network of interconnected hubs, the region could develop a decentralized energy infrastructure system that reduces reliance on diesel while building local capacity for renewable energy use. This decentralized approach is particularly important in a region where vast distances and harsh climates make centralized systems inefficient and vulnerable to disruption.

The Union of Tradition and Innovation

Ultimately, the energy hubs represent a combination of both traditional knowledge and modern technology. By incorporating geothermally-powered batteries, the hubs utilize cutting-edge renewable energy solutions. Yet, their purpose goes beyond technology; they are designed to reflect the values and practices of the Inupiaq people. By creating spaces where energy and knowledge are shared, the hubs reinforce cultural traditions of reciprocity and adaptability while addressing the practical challenges of living in the Arctic.

In the face of climate change and ongoing social and environmental pressures, these hubs offer a model for resilience and sustainability. They are more than just infrastructure—they are symbols of how communities can adapt to change while remaining rooted in their traditions. The hubs provide not just energy but also a sense of connection, belonging, and shared purpose, ensuring that the communities of the Bering Strait region thrive in the face of uncertainty.

Conclusion

This project brings to light the profound connection between energy infrastructure design, cultural preservation, and environmental resilience in the Bering Strait Region. Through an in-depth examination of Nome's energy infrastructure and the broader challenges faced by its surrounding communities, this research has illuminated the critical need for culturally informed, adaptive systems that honor Indigenous knowledge while addressing the pressing demands of climate change. By integrating traditional subsistence practices—such as seasonal harvesting and resource stewardship—into modern infrastructure design, this thesis advocates for an innovative approach that not only meets technical requirements but also enriches community identity and resilience.

This work also contributes to the growing recognition of Indigenous subsistence living as a vital component of modern design and climate adaptation strategies. Traditional practices, rooted in centuries of observation and interaction with the land, provide invaluable insights into sustainable living within an ecosystem. By incorporating these principles into infrastructure design, this thesis challenges the colonial paradigms that have historically marginalized Indigenous communities and their ways of life. Instead, it positions Indigenous knowledge as a cornerstone of resilience, demonstrating how traditional practices can guide contemporary solutions.

The proposed energy hubs are the embodiment of this philosophy, blending renewable energy solutions with the principles of community exchange and sustainability. Designed with the form of a whale vertebrae as inspiration, the hubs symbolize the interconnectedness of Inupiaq life, where cultural knowledge and arctic survival intersect. The hub's layout reflects this idea, with lower ceilings in the mudroom and battery storage areas—representing spaces of transition and preparation—while the main gathering space is expansive and open, mirroring the role of traditional qargi spaces as centers of collective knowledge and storytelling.

Beyond their architectural significance, the hubs are designed to reduce dependence on diesel-based systems, which are costly, environmentally detrimental, and unreliable in the face of Alaska's increasingly volatile climate. Batteries are charged at the geothermal facilities at Pilgrim Hot Springs and are harvested and brought back to Nomemuch like subsistence food is gathered and stored for the winter months. These batteries provide energy independence, reduce the risks of supply chain disruptions, and ensure that communities are equipped to face the long, dark winter months without fear of complete power outages. That being said, these hubs serve more than just a technical function—they act as cultural gathering spaces where cultural knowledge is exchanged, such as the best berry-picking locations or shifting migration patterns of caribou and fish. The inclusion of a conversation pit facilitates these discussions, ensuring that intergenerational wisdom remains at the core of community resilience.

In the broader context, this thesis has implications far beyond the Arctic. As Glenn Brady noted in a key informant interview I conducted, “If it works in the Arctic, it’ll work anywhere.” The Arctic represents one of the harshest environments on the planet, where design must account for unpredictable weather, permafrost thaw, and the logistical challenges of isolation. Solutions that succeed here—such as decentralized energy grids, geothermally charged batteries, and culturally integrated design—can serve as models for other remote or resource-constrained regions. Whether applied to island nations facing rising sea levels or rural communities in the lower 48 states struggling with energy insecurity, the principles developed in this thesis offer a framework for building systems that prioritize adaptability, equity, and sustainability.

This thesis is not just about energy infrastructure reform—it is about reintegrating the strategies that govern how Indigenous communities in rural Alaska interact with their environment, their energy resources, as well as each other. Energy is not just about technology or policy, but instead revolves around the people it serves. The Inupiaq people have long understood that survival in the Arctic depends not only on the resources at hand, but on the knowledge passed between generations and the strength of communal ties.

By centering the reform of energy infrastructure on this understanding, my thesis offers a vision of a future where power—both electrical and cultural—remains in the hands of the community.

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