UTILITY STUDENT INTERNSHIP

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FINAL REPORT

ARCTIC ENERGY ATLAS - POLICY FRAMEWORK

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INTRODUCTION

In the face of climate change, there is an ever increasing need to transition from fossil fuels to renewable energy sources around the globe. The Arctic is experiencing the impacts of climate change at a more drastic pace than the global average, therefore the energy transition is especially pressing in this region (World Wildlife Foundation, 2021). Arctic nations and communities face unique challenges in terms of energy access including lack of transportation infrastructure, high costs of importing fossil fuels, and the environmental and human impacts of relying on fossil fuel based energy (Mortensen et al., 2017). Despite these challenges, renewable energy projects are being adopted at both the small and large-scale across the pan-Arctic. One way in which the energy transition in the Arctic can be supported is through information and knowledge sharing at the local, national, and international levels. The Arctic Energy Atlas aims to facilitate this.

The Arctic Energy Atlas (AEA) is a product that delivers information on energy resources, infrastructure, and access across the pan-Arctic. The AEA includes a database complete with maps to illustrate transmission systems, the types of energy sources being used, as well as the types of power consumers in regions across the pan-Arctic. It also includes information on road systems, and the proximity to coastlines and rivers to further demonstrate the accessibility of energy in the Arctic. To complement the AEA database, this project seeks to develop a corresponding policy framework to demonstrate differences in governance, utility structure, development priorities, and government programs and policies in each Arctic nation. This framework will provide valuable context for the information found in the AEA, to better illustrate and understand the different energy pathways being taken across the pan-Arctic.

Led by the Alaska Centre for Energy and Power (ACEP), the AEA's project team includes Gwen Holdmann, Erin Trochim, and Dayne Broderson from ACEP, with the support of interns Kate Robb and Noah Faso-Formoso. Additionally, partners at the University of Saskatchewan are led by Greg Poelzer.

PURPOSE

The purpose of the AEA policy framework is to complement the information found in the atlas and database, to provide a more comprehensive picture of how energy systems are being approached in each Arctic nation. The final product will inform policy makers at the local, national, and pan-Arctic levels. Furthermore, it will enable communities and other partners to better understand their own energy systems and those of their neighbours. Finally, the AEA and policy framework will create a foundation for further research relating to energy access in the Arctic.

METHODOLOGY

This project consists primarily of qualitative research, with the main data sources including annual reports from utility companies, peer reviewed literature, and other government and research-

based reports. Such data was gathered by creating a list of utility companies in the Arctic, and gathering their annual reports from their websites. Peer-reviewed literature and reports were provided by different members of the project team who have expertise in this area. Additional materials were found through key word searches online and in academic databases.

The first step was to develop a policy framework through which data from countries across the pan-Arctic could be assessed to illustrate how they are approaching energy development. The framework consists of six categories that were developed through a grounded approach. In reviewing the annual reports from utility companies across the Arctic, as well as key pieces of literature, common themes were identified. These themes informed the development of the framework categories. One framework category, government instruments, needed to be subdivided into multiple smaller categories in order to better organize and understand the data collected. To do so, we looked to the literature for guidance. First, to classify each nation's government instruments, categories identified by Leonhardt et al. (2021) were used. Their study analyzed the current scholarly research on government instruments for community energy, and identified 19 types in existence across the literature. For a higher level overview of energy policy in the Arctic, we then sought to aggregate these 19 categories into fewer broad groups. Research by Vallecha et al. (2021) identified seven broad dimensions encompassing common barriers and enablers for community energy: economic, environmental, social, political, market, infrastructural, and technological. These dimensions, with infrastructural and technological being combined into one group, were used to categorize the instruments identified by Leonhardt et al., and subsequently the data collected in this research.

Following the finalization of the framework categories, each Arctic nation included in the scope of the AEA project was assessed according to each category. Summaries were written for each country, and can be found in Appendices B-H. Due to the international nature of this project, there are inconsistencies in the type and amount of data available from each country. For example, utility companies in different countries disclose different information in their annual reports. Additionally, some countries such as Greenland do not have information available in english. Due to these considerations, the results of this research are based only on the information available and easily accessible to the general public, therefore there are likely to be gaps.

RESULTS AND DISCUSSION

Framework

The first output of this project is the framework itself. The framework consists of six categories that are to be used to analyze each Arctic nation's approach to energy. This will help create an understanding of how and why each country is following a unique pathway in terms of its energy system. The six categories are defined as:

1) **Ownership Structure**: The type of ownership structure in place for a country's utility companies. Examples include:
    a) State-owned, a utility owned by the state or national government (e.g. Crown Corporations, or other state-owned companies);
    b) Municipally-owned, a utility owned by a municipality;
    c) Co-operatives, a utility owned by its customers;
    d) Privately-owned, private companies owned by and individual or group such as a tribal government;
    e) Public company, owned by shareholders and traded publicly.

    Ownership structure and the type of corporate governance system in place may impact a utility's operations. The different types of ownership structure have both pros and cons. For example, while cooperatives may reflect the interests of customers (who are also owners) and avoid the costs associated with large monopolies, issues with management may arise due to a lack of oversight and monitoring by consumer-owners (Thomas et al., 2018). According to the literature, state-owned utilities can provide citizens with greater control over their energy systems, as they are more responsive to pressure from the public versus private companies (Homsy, 2018). Ownership structure can also impact the scale of projects a utility can undertake. Ritcher (2012) explains that larger business-focused utilities typically undertake fewer large-scale projects, while smaller customer-focused utilities may undertake many smaller projects. It is therefore important to be aware of the different forms of utility ownership in place to understand the direction of a jurisdiction's energy system.

2) **Leadership**: Leadership and the organizational culture it creates is among the most important drivers for sustainability decision-making (Epstein et al., 2010). Examining the top-down effects of leadership in the energy sector can provide insight into a jurisdiction's direction. Leadership is difficult to measure, but on the utility side a good starting point is the companies' Board of Directors and whether they are elected and appointed. Gathering information on utility Boards of Directors is foundational for future analysis into the role of leadership in the energy sector.

3) **Policy Strategy**: An overarching policy or framework guiding the direction of energy. Examples include:
    a) Government frameworks or plans related to energy;
    b) External frameworks that can be adopted such as the Sustainable Development Goals.

4) **Development Priorities**: Key areas of development that are being prioritized in an energy system. Examples include:
    a) Expanding the grid to connect communities or industrial activities;
    b) Renewable energy projects;
    c) Refurbishing existing infrastructure;
    d) Expanding generation capacity for export.

5) **External Communication and Transparency**: The type of information about a country's energy development and utility company activities that is disclosed to the public. This includes information found on utility websites and in annual reports, as well as government websites and documents.

6) **Government Instruments**: Programs and policies supporting energy. Government instruments are classified into the following categories adapted from previous work done by Leonhardt et. al, 2021 and Vallecha et al. 2021[1]:
    a) Economic:
        i) Financial Supports (grants, loans), Fiscal Incentives (tax rebates/deductions), Power Purchase Agreements, Renewable Energy Auction or Tender, Feed-in Tariff, Feed-in Premium.
    b) Environmental:
        i) Climate Change and GHG Mitigation, Environmental Planning.
    c) Technology & Infrastructure
        i) Energy Efficiency, Energy Storage.
    d) Market:
        i) Net Metering, Grid Services, Renewable Energy Standards and Certificates
    e) Political
        i) Energy Planning.
    f) Social
        i) Capacity Building, Support to Intermediaries.

These instruments identified above help to understand government support for energy development from a whole-system perspective, as they cover a range of areas within the supply chain. To further identify similarities and differences across jurisdictions, this scope can be narrowed down to focus specifically on constituents (both citizens and industry) and the rates that they pay for electricity. Due to the similar geographic environments across Arctic nations, energy rates may be assumed to be similar in different countries. However,

[1] Full definitions of each instrument are found in Appendix A.

governments often use subsidies[2] as a tool to lower or equalize the rates paid by consumers. Gaining an understanding of government subsidies and how they are used differently can help to better illustrate the different contexts across the pan-Arctic, and the actual costs of energy compared to the rates paid by consumers.

Country Results

The second output is summaries of each country explaining how they are approaching energy according to the framework categories[3]. The summaries are found in Appendices B-H Accompanying figures are found in Appendix I to demonstrate differences between countries in a visual way.

It is difficult to compare countries across the pan-Arctic due to countless contextual differences, but this project attempts to identify avenues through which to do so. Within the framework, three of the categories stand out in terms of providing an opportunity to make preliminary comparisons between countries. These categories are Utility Ownership & Leadership, Government Instruments, and Development Priorities. While this research included Canada, Alaska, Russia, Greenland, Iceland, Svalbard, and the Faroe Islands, the results presented in this paper focus on the first four areas listed.

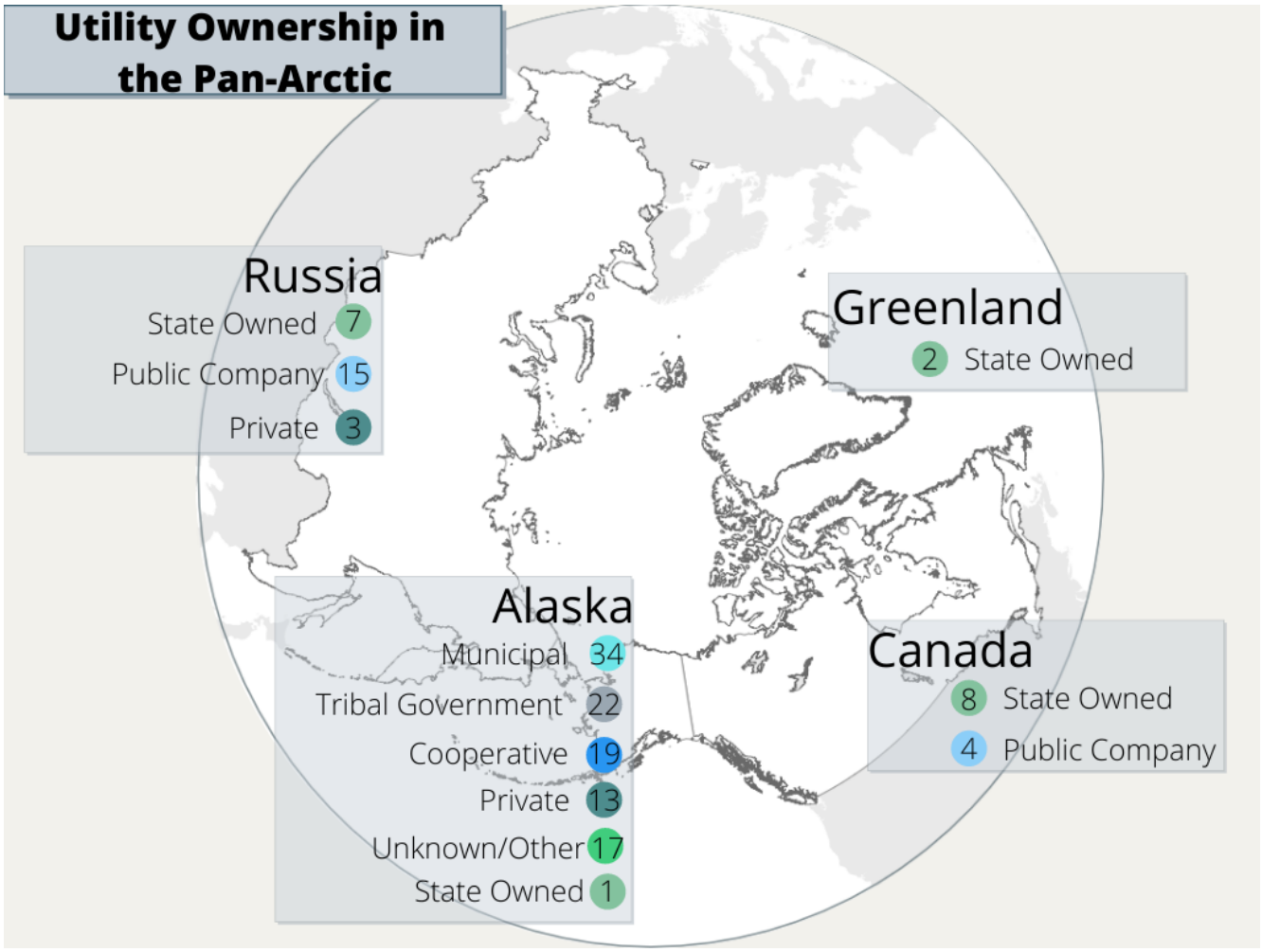
Utility Structures - Ownership, Scale, & Leadership

Utility ownership and leadership differs across the pan-Arctic. The ownership structure and leadership of utilities can provide insight into how energy systems operate, as different business models and company sizes can produce different outcomes (Thomas et al., 2018; Homsy, 2018; Ritcher, 2012). For example, locally owned utilities may have different priorities or levels of capacity compared to large publicly traded or privately owned companies. Similarly, utilities where customers or shareholders elected their board of directors may differ from utilities with boards of directors appointed by the government.

In Alaska, there are many small utilities with ownership including cooperatives, municipalities, tribal governments, and private ownership. In Canada, most utilities are owned by the state with a few publicly traded companies providing utility service in the north. Russia's utility sector consists of many publicly traded companies with some state and private ownership. In Greenland, utilities are owned by the state. An overview of the utility ownership structures of these areas is shown in Figure 1.

[2] The term subsidy is often used to describe many different types of financial support. In this case, we focus on subsidies that directly impact the rates paid by consumers.
[3] The summaries also include additional information such as the country's regulatory structure, and utility budgets.

Fig 1:

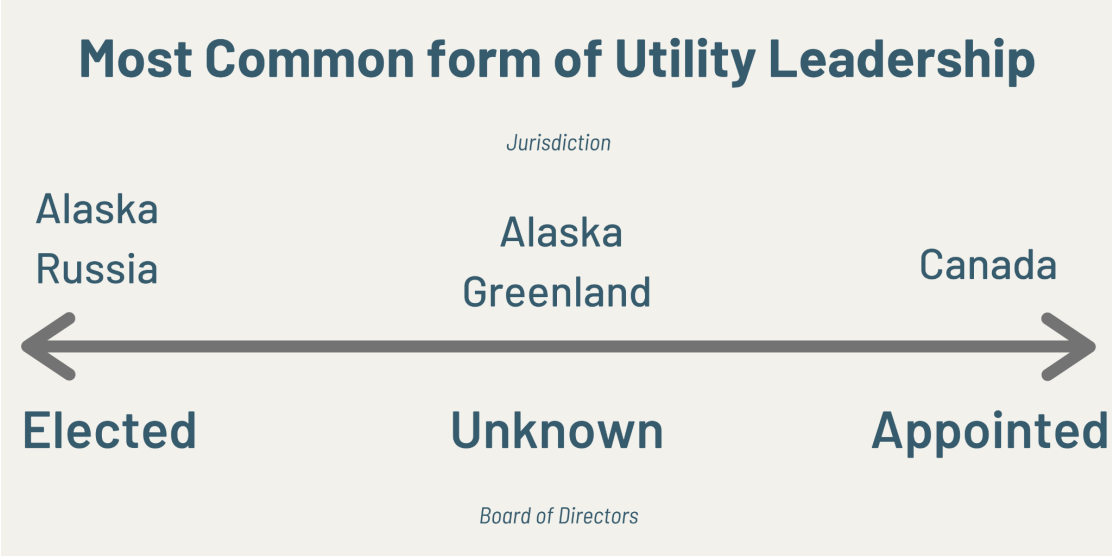


Not only do the different jurisdictions within the pan-Arctic differ in terms of number and type of utilities, there are also differences in terms of the scale of service for those utilities. In Canada, utilities serve regions, often entire provinces or territories. In Alaska, there are some regional utilities, but many more serve at the local level. Utilities in Russia and Greenland provide service at both the regional and national levels.

An important part of a utility's leadership is its board of directors. How the board of directors is elected or appointed may provide insight into its priorities or level of local input into decisions and operations. In Canada, the board of directors for state owned utilities are appointed by the government, while for public companies they are elected by the shareholders. In Alaska, there is a large gap in information available regarding utilities' boards of directors, but the information that is available indicates that board members are elected by members for cooperatives, and shareholders for private companies. It is possible that many of the smaller local utilities in Alaska do not have

boards of directors. In Russia, most boards are elected by shareholders. In Greenland, there is no information available indicating that the utilities have boards of directors. The most common forms of utility leadership in Canada, Alaska, Russia, and Greenland are outlined in Figure 2.

Fig 2:



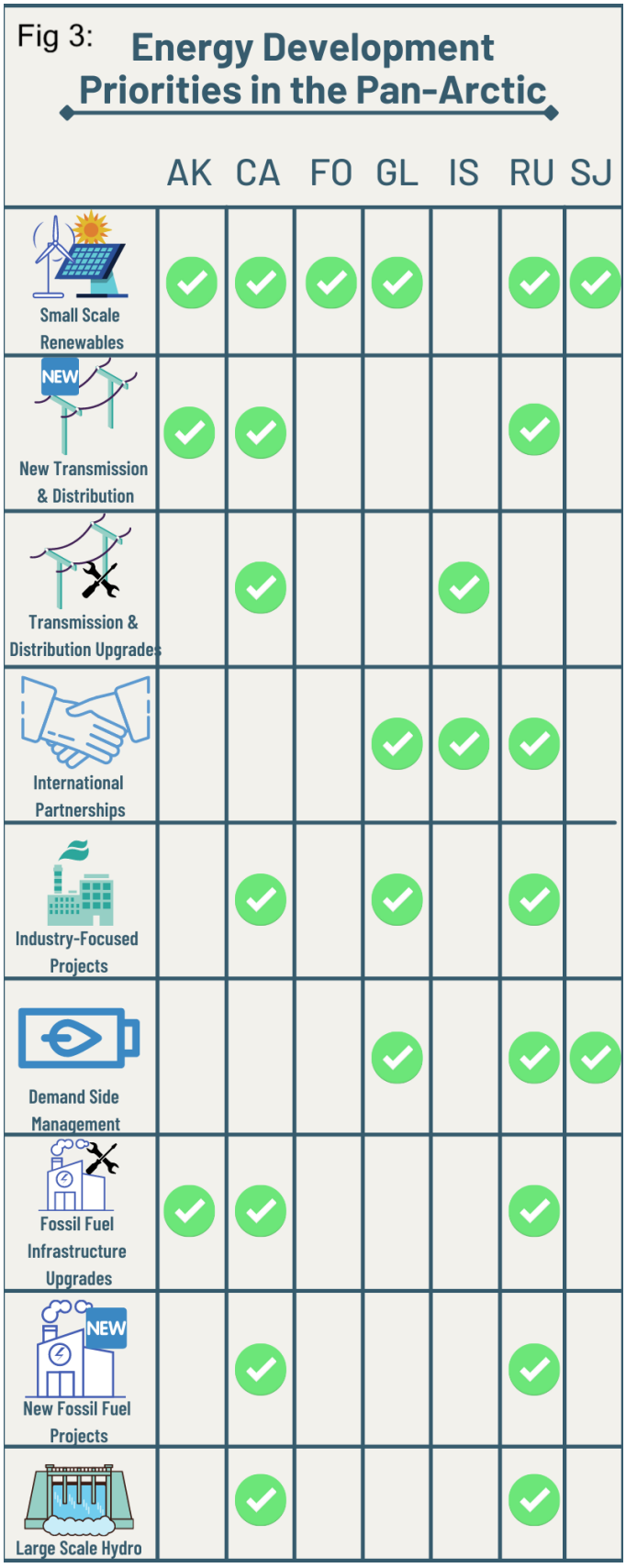
Development Priorities:

A jurisdiction's development priorities refers to its recent investments in projects and initiatives. The majority of this information is identified through annual reports of utility companies. There are a variety of development priorities across the pan-Arctic, with both differences and similarities between jurisdictions. The most common priorities are: small-scale renewable energy projects; new transmission and distribution; upgrades to transmission and distribution systems; industry focused projects; international partnerships and collaborations; demand side management initiatives; upgrades and refurbishment of fossil fuel infrastructure; fossil fuel projects; and large-scale hydroelectric projects.

Small-scale renewable energy projects are current development priorities in Canada, Alaska, Russia, Greenland, Svalbard, and the Faroe Islands. New transmission and distribution infrastructure is being built in Canada, Russia, and Alaska. Upgrades to transmission and distribution systems are being made in Canada and Iceland. International partnerships are a priority in Russia, Iceland, and Greenland. These partnerships include those for sharing knowledge and expertise on renewable energy in the Arctic, as well as for the export of energy to other countries. Demand side management initiatives to improve energy efficiency are among the development priorities in Russia, Greenland, and Svalbard. Upgrading and refurbishing aging fossil fuel infrastructure including diesel and coal power plants is a focus in Canada, Alaska, and Russia. The construction of new fossil fuel based

projects as well as large-scale hydroelectric are occurring in Canada and Russia. Figure 3 illustrates the development priorities across the pan-Arctic.

Fig 3: **Energy Development Priorities in the Pan-Arctic**



Government Instruments:

Government instruments supporting energy include a variety of programs and policies within the economic, political, social, environmental, market, and technology and infrastructure dimensions. Through this research, we sought to identify whether jurisdictions across the pan-Arctic currently have government instruments supporting energy, and whether they are publicly documented. Furthermore, by identifying the type of each government instrument, we will be able to make initial assumptions of each instrument's impact, as well as make comparisons across countries. Lists of each jurisdiction's government instruments collected through this research are found in Appendices B-H. It is possible that additional government instruments exist, but information on them is not easily accessible to the public. Figure 4 illustrates the total number of government instruments identified in the pan-Arctic, while Figure 5 illustrates the breakdown of government instruments by jurisdiction. Preliminary observations include that Canada and Alaska have the most publicly documented government instruments, while Russia and Greenland are lacking information. The most common type of government instrument is economic, and the least common is environmental. Future steps for analysis could include examining and comparing the term

length of funding programs under economic instruments.

Fig 4: Government Instruments Supporting Energy - Overall

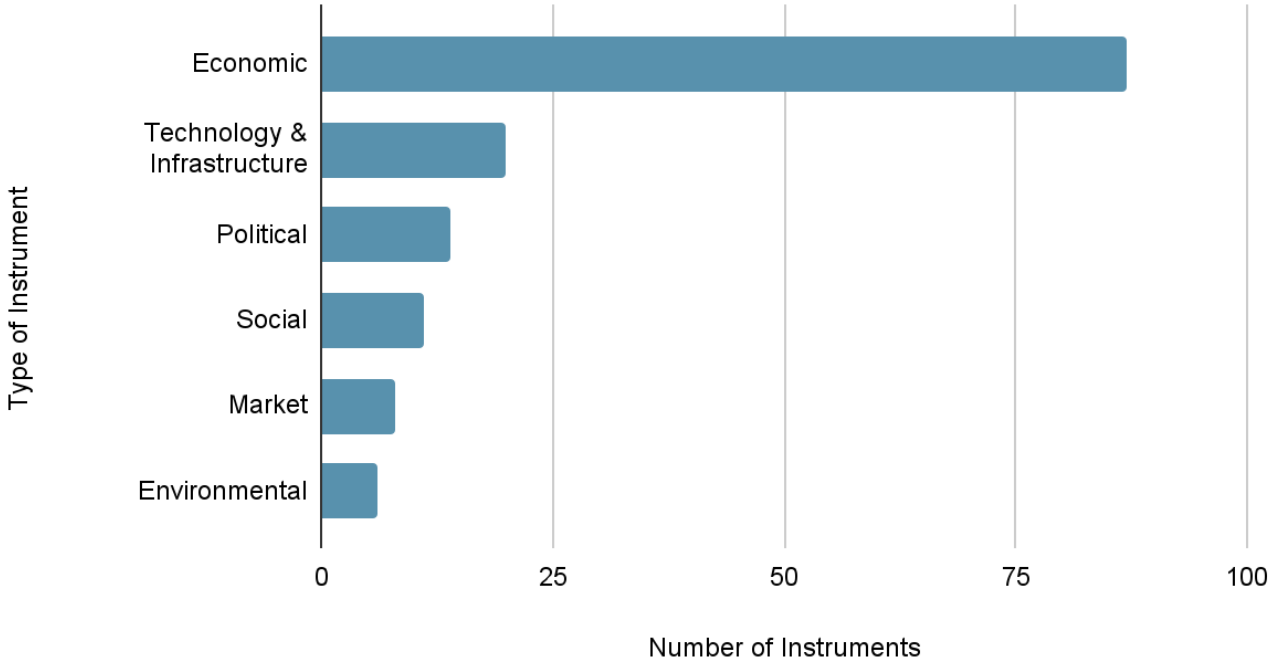
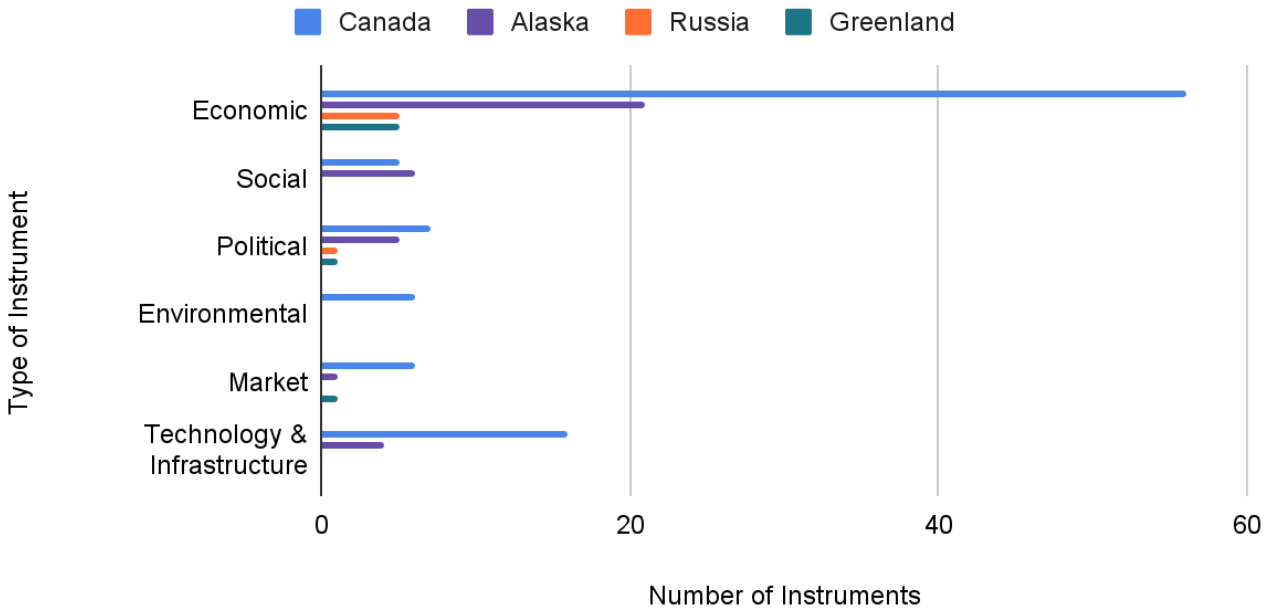


Fig 5: Government Instruments Supporting Energy - Country Breakdown



Key Subsidies:

Subsidies are an important form of government instrument as they impact consumers as well as the energy market, and help to understand the differences in rates paid by different population segments. This section identifies the primary subsidies or subsidy environments in Alaska, Greenland, Russia, and Canada. Figure 6 outlines some of the differences and similarities between areas.

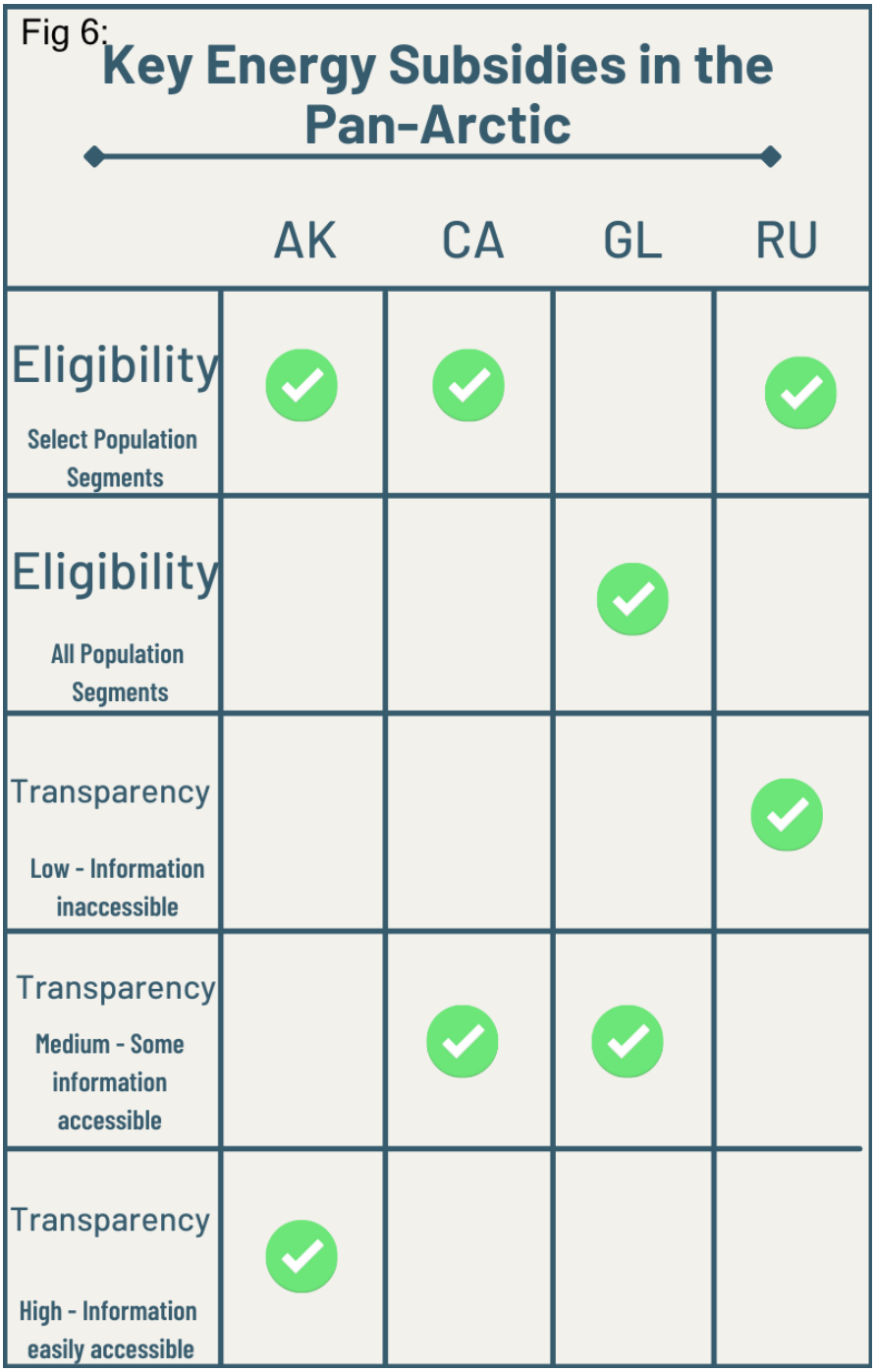
Alaska:

The main subsidy program in Alaska is the Power Cost Equalization (PCE) program. The purpose of the PCE is to provide economic assistance to those living in rural areas of Alaska where the cost of electricity can be three to five times higher compared to urban areas (Alaska Energy Authority, n.d.). The PCE program is funded by the PCE Endowment Fund, and administered by Alaska Energy Authority (AEA) and Regulatory Commission of Alaska (RCA). The PCE is administered through the utilities, as the RCA determines eligibility and reimbursement rates. The utilities then pass on the credits to its customers so that they pay prices comparable to those in urban areas. Over 82,000 people in 193 communities receive support from the PCE.

Greenland:

Prior to 2018, citizens in Greenland paid different prices for electricity depending on their location (The Ministry of Industry, Labour, Trade, and Energy, 2018). Under this pricing system, those living in urban areas with easy access to energy supply paid low prices, while those living in rural areas where the cost of production and transportation is higher paid higher prices. Recognizing the impact of this pricing scheme on those living in rural areas, who typically have lower incomes, the government of Greenland sought to reform its electricity pricing system. All customers now pay the same price for electricity, regardless of their location. The cost of the lower electricity prices resulting from the reform was offset in part by a reduction in the annual construction loans to Nukissiorfiit, Greenland's main utility, from the government.

Fig 6:



Russia:

Russia's subsidy system is quite complicated compared to Alaska and Greenland. Russia uses cross-subsidies, a means of price equalization between different consumer segments or types of energy production. There are eight types of cross-subsidization in the Russian system, based on both technological and social aspects:

- Subsidization of electricity production through the production of thermal energy at combined heat and power plants;

- Subsidization of the costs of providing electric power reserves at the expense of the costs of electricity;
- Subsidization of the costs of providing thermal capacity reserve at the expense of the cost for producing thermal energy;
- Subsidization of socially valuable consumers (voters) on the principle of “everyone at the expense of all”;
- Subsidization of remote consumers at the expense of consumers in close proximity to energy source;
- Subsidization of new consumers at the expense of “old” ones; and
- Subsidization of new and energy-saving technologies (Iakovleva, 2017)

In 2015, the Russian Federation signed a decree to gradually phase out cross-subsidization in Yakutia, with 95% of the cross-subsidies financed by the federal government initially, but decreasing to zero within 12 years (Iakovleva, 2017). However, it is unclear whether action is being taken to phase them out, as a recent KPMG report analyzing the state of cross subsidies in the Russain power market indicates that the amount of cross-subsidies has increased by 220% from 2015 to 2020 (Savin, 2021).

Canada:

Similar to Russia, subsidies in the Canadian market are complicated compared to those in Alaska and Greenland. As energy provision is a provincial/territorial responsibility in Canada, subsidies vary across jurisdictions and utilities. Additionally, the federal government provides subsidies in some cases, such as for First Nations who rely on diesel, which further complicates the system. One example of subsidies in Canada is in Nunavut, where all 25 remote communities rely on diesel fuel (Lovekin et al., 2016). In order to keep rates affordable, the territorial government operates the Nunavut Electricity Subsidy Program, which subsidizes rates to approximately $0.60 per kWh. Additionally, the government operates a program for those living in public housing (52% of Nunavut’s population) where electricity rates are capped at $0.06 per kWh. This system in Nunavut where subsidies are provided by the territorial government differs from other jurisdictions, such as Maniotba where diesel subsidies for remote communities are provided by both the utility and the federal government. Evidently, subsidies in Canada are not uniform across the board.

Policy Strategy

A country’s policy strategy refers to overarching frameworks or policies that guide the direction of energy. Policy strategies across the pan-Arctic take many forms. In Canada, it includes federal climate change and northern policies, provincial/territorial energy strategies, as well as policies and agreements relating to working with Indigneous nations (Government of Canada, 2016; Government of Canada, 2019; Heerema & Lovekin, 2019). Alaska’s policy strategy includes the state

energy plan, legislation relating to tribal lands, and the federal government's Energy Policy Act (Alaska Energy Authority, 2010; United States Energy Information Administration, 2021; United States Environmental Protection Agency, n.d.). In Greenland, the main components of the government's policy strategy is the government's Sector Plan for Energy and Water, as well as the Coalition Agreement, which includes directions such as implementing the Sustainable Development Goals (Inuit Ataqatigiit, 2021 & Naalakkersuisut, 2017). In Russia, the government has an energy strategy, and many utilities have adopted the Sustainable Development Goals to guide their actions (Novak, 2020). Iceland and the Faroe Islands also have climate and energy strategies (Government of the Faroe Islands Ministry of Trade and Industry, 2011 & Government of Iceland, 2020). The policy strategy for Svalbard is unclear, but the Norwegian government has stated that it is planning to release an energy plan for Svalbard in 2022 (Government of Norway, 2021). Future work may seek to compare the policy strategies of Arctic nations to the Sustainable Development Goals as a common metric for comparison.

External Communications and Transparency:

The quantity and quality of information available about each Arctic nation varies, making this type of project challenging. By gaining an understanding of what information is and isn't available, recommendations can be made to improve access to information in the future. Some countries such as Russia have extremely detailed information from the utilities, but less easily accessible information from the government. Conversely, places like Alaska have limited information from utilities, but fairly detailed information from the government. At first glance, the difference in information availability between Russiand and Alaskan utilities may be due to the size of the companies and associated levels of capacity to undertake detailed public reporting. Canada falls in the middle, having a reasonable amount of information available from both government and utilities, but there is room for improvement on both sides. While Greenland does have a good amount of information available, a lot of it is not available in english.

CONCLUSIONS

Developing a policy framework for the Arctic Energy Atlas (AEA) has provided preliminary insights into the different pathways Arctic nations are taking in terms of their energy systems. This includes information regarding utility structure, different government instruments being used, priority areas for development, among other factors. Furthermore, this project has identified several areas that will require further research and analysis to understand and compare energy systems across the pan-Arctic. As the product of this research is a framework, it provides structure for analysis, but also room for expansion to include other areas of interest in the future. Developing a framework for something broad like energy systems at an international scale is challenging, as countries each use their own metrics, and choose or are required to make different data available.

This challenge results in information gaps that will need to be addressed in order to undertake more comprehensive analyses and comparisons in the future. Recommendations for next steps include:

- Text analysis of utility annual reports to gain further insight into leadership and areas of priority.
- Detailed case studies of communities across the pan-Arctic demonstrating successful renewable energy projects to understand enabling conditions for such initiatives.
    - Possible areas of focus for the case studies could include the role of community leaders, or the effectiveness of government instruments.
- Further analysis of subsidies in order to make accurate comparisons across regions (e.g. government vs. market-based programs, analysis of subsidies within the supply chain, cost of generation vs. cost to consumers, etc.).
- Developing a community-facing version of key information collected in this research as a resource for communities wishing to have a greater understanding of their own energy systems as well as those around them.
- Further research into capital project funding to find out the extent to which governments are supporting community based versus industrial projects.
- Comparative analysis of regulatory structures. This could include examining information such as the extent to which regulatory bodies are politically appointed or truly independent. Metrics could include appointment processes and term lengths.
- Analysis of the countries' policy strategies through the lens of the Sustainable Development Goals to facilitate comparison.

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APPENDIX A - GOVERNMENT INSTRUMENTS DEFINITIONS

Government instruments	Definition
Financial Supports	Financial contributions offered by governments to support community energy, either directly or indirectly, including funding programs, grants, and loans.
Feed-in Tariff (FiT)	Agreements that offer fixed payments for renewable energy generation over an established period.
Grid Services	Includes all instruments that control the access to a grid system, including laws and regulations that control energy connection, transmission, and distribution.
Fiscal Incentives	Benefits offered by government in the form of tax deductions, exceptions, or exclusions for energy development.
Energy Market Instruments	Control the ability to sell generated power in the energy market, such as energy market legislations and regulations.
Renewable Energy Certificates (REC)	Certificates that attest the generation of a minimum amount of renewables-based electricity, offered to renewable energy generators to trade the electricity generated on the energy market.
Renewable Energy Auction or Tender	An instrument of sourcing and acquiring renewable energy through competitive bids, whereby the interested parties who offer the lowest price take it.
Community Ownership Instruments	Regulations, legislations, and policies that guarantee or encourage full ownership or shared ownership of renewable energy projects for communities.
Power Purchase Agreements (PPA)	Energy contract between those who generate and those who will purchase the generated electricity.
Climate Change and GHG Mitigation Instruments	Laws, regulations, and policies that establish GHG reduction targets and aim to control the effects of climate change and improve air quality.
Net Metering	Agreement in which consumers who generate energy can receive credits on their electricity bills for the excess of electricity generated.
Environmental and Environmental Planning	Laws, regulations, policies, and strategies that aim to protect the environment and identify and manage possible environmental impacts generated by renewable energy projects.
Land Use Controls	Land and spatial planning legislation, regulation and policies used to control land use in a specific area.
Energy Planning	Legislation, regulations, and policies created to guide the development of a region's energy system.
Energy Efficiency	Laws, regulations, and policies created to reduce energy use and promote energy conservation.
Support to Intermediaries	Legislative, regulatory, and policy tools that aim to support organizations that assist with the planning and implementation processes of community energy projects.
Feed-in Premiums (FiP)	Agreements that offer payments for renewable energy generation based on the wholesale electricity price.
Renewable Portfolio Standard (RPS)	A policy that establishes a minimum of total energy production that must come from renewable sources.
Energy Storage	Laws and regulations that control the storage of energy produced and the types of energy storage available.

Government instruments supporting energy as identified in the literature by Leonhardt et al. 2021

APPENDIX B - CANADA SUMMARY

Regulatory Structure:

Regulation of energy systems across Canada is done at the provincial and territorial level.

In Newfoundland and Labrador, the Board of Commissioners of Public Utilities is responsible for the regulation of electric utilities in the province (Board of Commissioners of Public Utilities, n.d.). This includes ensuring that rates are fair and reasonable, and that the service provided is secure and reliable. As a quasi-judicial regulatory body, the Board is appointed by the Lieutenant Governor in Council.

In Quebec, the régie de l'énergie is responsible for setting and changing the rates and conditions for transmission and distribution of electricity (The régie de l'énergie, 2010). The régie de l'énergie is an independent agency funded by duties and fees paid by the regulated distributors.

The regulator in Ontario is the Ontario Energy Board. Its responsibilities include: setting the rules for energy companies operating in the province; setting energy rates; licensing energy companies; monitoring the wholesale electricity market; developing energy policies and providing guidance to government; and providing the public with energy literacy (Ontario Energy Board, n.d.).

The Public Utilities Board of Manitoba (PUB) is the regulator in Manitoba. The PUB is a quasi-judicial administrative tribunal, and its responsibilities include setting rates for utilities (Manitoba Public Utilities Board, n.d.).

Saskatchewan does not have a public utilities board as seen in other provinces. Instead the Saskatchewan Rate Review panel reviews and advises the government on utility applications for rate changes (Saskatchewan Rate Review Panel, 2016). Rate changes are then approved by the government. In 2010, the board of Sask Power created the Saskatchewan Electric Reliability Authority (SERA), which is responsible for ensuring the utility complies with the North American Electric Reliability Corporation (NERC) standards (Natural Resources Canada, 2016).

Alberta's utility sector is regulated by the Alberta Utilities Commission (AUC). The AUC is responsible for approving rates, as well as the routes, tolls, and tariffs of energy transmission in the province (Alberta Utilities Commission, n.d.).

The regulator in British Columbia is the British Columbia Utilities Commission (BCUC). The quasi-judicial body's responsibilities include: reviewing rate applications; overseeing compliance with

electric grid reliability standards; and reviewing questions and complaints about the actions of regulated utilities in the province (British Columbia Utilities Commission, n.d.).

Utilities in the Yukon are regulated by the Yukon Utilities Board. The board is responsible for setting rates, and hearing and adjudicating customer complaints regarding service provided by utilities in the territory (Yukon Utilities Board, n.d.).

The Northwest Territories Public Utilities Board (PUB), is responsible for regulating the utilities in the territory. Responsibilities include rate setting and investigating customer complaints (NWT Public Utilities Board, n.d.).

In Nunavut, the Utility Rates Review Council of Nunavut (URRC) is an advisory body to the Minister responsible for the Qulliq Energy Corporation. The URRC does not have rate setting power, but makes recommendations to the government (The Utility Rates Review Council, n.d.).

Ownership Structure:

The ownership structure of a country's utilities plays a role in creating the political environment in which energy systems operate. Whether utilities are public companies, privately owned, or owned by the government can influence how they operate and what their priorities are in terms of new projects and initiatives. It can also influence if and how communities or individuals are able to undertake energy projects of their own.

Canada's utility structure varies between provinces and territories as they each have jurisdiction over their own energy resources and systems as per the *Constitution Act, 1867* (Government of Canada, 2021). The main utilities in most provinces and territories take the form of crown corporations, which are structured similarly to private companies, but are wholly owned by the government (Tupper, 2006). State-owned crown corporations are the primary electric utilities in Nunavut, British Columbia, Saskatchewan, Manitoba, and Quebec. The Yukon and Northwest Territories, as well as Newfoundland, have both crown corporations and privately owned utilities in their electricity markets. Ontario and Alberta have deregulated energy markets consisting of privately owned and public companies.

The crown corporations are monopolists, having primary responsibility for energy provision in their respective jurisdictions. In Nunavut, British Columbia, Saskatchewan, Manitoba, and Quebec, this includes the responsibility for energy in remote communities. Ontario's Hydro One Remotes, a division of Hydro One, is responsible for providing electricity to the province's remote communities. Remote communities in Alberta are serviced by ATCO Electric. Newfoundland's remote communities receive service from the crown corporation NL Hydro. In the Yukon, while most consumers are

serviced by crown corporation Yukon Energy, those communities not connected to the territorial grid are serviced by ATCO Electric Yukon, a public company. Similarly, in the Northwest Territories, while most consumers are serviced by Northwest Territories Power Corporation, a crown corporation, some communities are serviced by Northland Utilities, a public company and subsidiary of ATCO Electric.

Table 1: Utility Ownership Structure in Canada

Province/Territory	Utility Serving Remote Areas*	Ownership Structure
British Columbia	BC Hydro	State-owned
Alberta	ATCO Electric	Public company
Saskatchewan	SaskPower	State-owned
Manitoba	Manitoba Hydro	State-owned
Ontario	Hydro One	Public company (Government of Ontario owns 47.4%)
Quebec	Hydro Quebec	State-owned
Newfoundland and Labrador	NL Hydro	State-owned
Yukon	Yukon Energy, ATCO Electric Yukon	State-owned, Public company
Northwest Territories	Northwest Territories Power Corporation, Northland Utilities	State-owned, Public company
Nunavut	Qulliq Energy Corporation	State-owned

*Jurisdictions such as Alberta and Ontario have additional utilities but they do not provide service in the north

Utility Budget:

ATCO Electric Alberta Costs and Expenses (CAD Millions)

2019	2020
3,362	2,923

ATCO (owner of ATCO Electric Yukon and Northland Utilities) Operating Costs (CAD Millions)

2018	2019
2,378	2,598

BC Hydro Operating Expenses (CAD Billion)

2019	2020
4.684	4.98

Manitoba Hydro Expenses (CAD Millions)

2019	2020
2565	2615

Nalcor (NL Hydro) Expenses (CAD Millions)

2015	2016	2017	2018	2019
824	687	873	847	911

Northwest Territories Power Corporation Expenses (CAD Thousands)

2019	2020
116,470	116,318

Qulliq Energy Corporation Expenses (CAD Thousands)

2018	2019
122,134	131,089

Hydro Quebec Expenditure (CAD Millions)

2019	2020
8,403	8,688

Sask Power Expenses (CAD Millions)

2018-19	2019-20
2,528	2,566

Yukon Energy Operating Expenses (CAD Thousands)

2018	2019

48,323	58,119

Leadership:

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie. In Canada, the board of directors for all state owned crown corporations are appointed, not elected. Yukon Energy's board of directors is appointed by the board of its parent company, Yukon Development Corporation, which is another crown corporation whose board of directors is appointed by the Government of Yukon. Northwest Territories Power Corporation's board of directors is appointed by the Government of Northwest Territories. In Nunavut, Qulliq Energy Corporation's board of directors is appointed by the Minister responsible for the crown corporation. Manitoba Hydro, BC Hydro, NL Hydro, and SaskPower's board of directors' are appointed by each province's Lieutenant Governor in Council. Hydro Quebec's board of directors is appointed by the Quebec Government. The board of directors for utilities that are public companies in Ontario and Alberta are not appointed by the government. In Ontario, Hydro One's board of directors are elected by the company's shareholders. Alberta's ATCO Electric, which also includes the subsidiaries ATCO Electric Yukon and Northland Utilities (Northwest Territories), is similar in that its board of directors is also elected by the shareholders. In this case, the communities served do not have an ownership state in the utilities.

Table 2: Utility Leadership in Canada

Utility	Board of Directors
Yukon Energy	Appointed by Yukon Development Corporation
Northwest Territories Power Corporation	Appointed by government of Northwest Territories
Qulliq Energy Corporation	Appointed by Minister responsible for the crown corporation
Manitoba Hydro	Appointed by Lieutenant Governor in Council
BC Hydro	Appointed by Lieutenant Governor in Council
NL Hydro	Appointed by Lieutenant Governor in Council
SaskPower	Appointed by Lieutenant Governor in Council
Hydro One	Elected by shareholders
Hydro Quebec	Appointed by Quebec government

ATCO Electric, ATCO Electric Yukon, Northland Utilities	Elected by shareholders

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate. In Canada, these sort of high level strategies are found at both the federal and provincial/territorial levels.

Perhaps the most prominent piece of Canada's policy strategy, the Pan-Canadian Framework on Clean Growth and Climate Change was published by the federal government in 2016. Developed collaboratively with the provinces and territories and in consultation with Indigenous peoples, the Pan-Canadian Framework on Clean Growth and Climate Change outlines Canada's plan to reduce greenhouse gas emissions, grow the economy, and build resilience to climate change (Government of Canada, 2016). Built around four pillars: pricing carbon pollution; complementary actions to reduce emissions; adaptation and climate resilience; and clean technology, innovation, and jobs, the Pan-Canadian Framework provides guidance to all levels of government, including for their energy sectors. Energy related goals outlined in the framework include: increasing renewable and non-emitting energy sources; connecting clean power with places that need it; modernizing electricity systems; and reducing reliance on diesel working with Indigenous peoples and northern and remote communities. Investing in and supporting clean energy solutions for remote Indigenous communities is among the goals stated in the framework (Heerema & Lovekin, 2019).

Another important piece of Canada's policy strategy with respect to energy in the Arctic is Canada's Arctic and Northern Policy Framework. Developed collaboratively with Inuit, Metis, First Nations, and the governments of Yukon, Northwest Territories, Nunavut, Newfoundland and Labrador, Quebec, and Manitoba, the framework sets out the federal government's direction with respect to the future of Canada's northern region (Government of Canada, 2019). Among the priorities set out in the framework is to invest in energy infrastructure in the north. The framework describes achieving energy security and sustainability and improving access to reliable, affordable, and clean energy in all northern communities as an objective.

In addition to the Pan-Canadian Framework on Clean Growth and Climate Change, each province and territory has its own overarching strategies or policies that guide the direction of energy. Such strategies may be designed by the governments, utilities, or adopted from elsewhere.

All provinces and territories with the exception of Saskatchewan have energy strategies that set out the direction of their energy futures. These documents influence the government programs and policies related to energy, as well as the activities of the utility companies, particularly in those jurisdictions with ownership structures in the form of crown corporations.

Some provinces and territories have guiding principles or protocols for working with Indigneous communities and furthering reconciliation for past and ongoing harms of colonialism. Of the 283 remote off-grid communities in Canada, 171 are Indigneous, while 112 are non-Indigneous (Canada Energy Regulatory, 2021). Such guiding mechanisms are a part of the policy strategy that impacts the direction of energy. In British Columbia, the government has several different guiding documents and agreements for working with Indigenous peoples and communities (Heerema & Lovekin, 2019). Examples include reconciliation agreements and memorandums of understandings with multiple First Nations, and the Metis Nation Relationship Accord (Government of British Columbia, n.d.). British Columbia is also working towards adopting the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) through legislation (Heerema & Lovekin, 2019). Ontario's Hydro One operates under a First Nations and Metis Relations Strategy, which guides the utility in improving communication and partnership with Indigenous communities (Heerema & Lovekin, 2019). Quebec's provincial government has an action plan outlining its strategy for reconciliation, and has put forward its intention to adopt UNRIP, although it has yet to introduce legislation doing so (Heerema & Lovekin, 2019). Final and self government agreements, as well as modern treaties, also provide overarching guidance to the direction of energy in a province or territory. For example, Yukon has implemented Yukon First Nation Final and Self Government Agreements which contain provisions giving First Nations opportunities to have ownership over initiatives such as those related to energy (Heerema & Lovekin, 2019). Similar agreements are in place in other jurisdictions in Canada.

<u>Development Focus:</u>

The focus areas of Canada's energy development are extremely varied, perhaps not surprising for such a large country with multiple governments. Based on information disclosed in the most recent annual reports from Canadian utility companies, some insight can be gained into which areas are being prioritized in terms of new energy projects and initiatives.

In Yukon, recent developments include small scale solar projects, the expansion of the Atlin hydroelectric project, a Demand Side Management (DSM) pilot program, and upgrades and expansions to the transmission system, including the connection of Eagle mine to the territorial grid (Yukon Energy Corporation, 2019). The most recent activities in Northwest Territories include the development of small scale solar projects, the refurbishment of hydroelectric facilities, the development of the Inuvik High Point wind project, the replacement of the Lutsel K'e diesel plant, and the construction of the Fort Simpson LNG generation facility (Northwest Territories Power

Corporation, 2020). Nunavut's recent efforts have centered around replacing aging infrastructure, primarily in the form of diesel generators (Hareerema & Lovekin, 2019). In addition to replacing seven diesel generators, work was done on a hybrid power plant in Kugluktuk which will include 500kW of solar generation (Qulliq Energy Corporation, 2020). The project is estimated to be complete by 2023. Recent projects in Alberta include the construction of a hydrogen blending plant in Fort Saskatchewan, and a 2,800 kilowatt solar project in partnership with three Indigenous nations in Fort Chipewyan (ATCO Electric, 2019). Saskatchewan has recently commissioned a new natural gas power station, has constructed new transmission lines, refurbished hydroelectric facilities, developed solar generation, and began an evaluation of small scale nuclear power (SaskPower, 2020). In Newfoundland, a transmission line was recently built to transmit power from Churchill Falls, Labrador to the island portion of the province (Nalcor Energy, 2019). Manitoba's recent developments include the construction of large scale hydroelectric infrastructure and new transmission lines connecting the province to both Minnesota and Saskatchewan (Manitoba Hydro, 2020). In Quebec, recent projects include solar generation, new transmission lines, and the province's first microgrid (Hydro-Québec, 2020). Due to a lack of information in the utility companies annual reports, it is unclear what recent developments have been undertaken in British Columbia and Ontario.

External Communications/Transparency:

Transparency can be demonstrated by considering the information disclosed in utility companies annual reports, as they provide insight into the ongoing activities in the energy sector. In Canada, the utilities' annual reports are primarily focused on financial information. This means information related to their specific projects and activities is more difficult to find in detail. It is especially difficult to find information regarding how specific projects were paid for and if they received government funding.

On the government side, a lot of information is publicly available, but the federal government's website can be challenging to navigate. For example, it is easy to find information on government instruments supporting energy, but more challenging to find information regarding the level of success of these programs and how they are being implemented.

Government Instruments

Government instruments supporting energy are prominent at both the federal and provincial/territorial levels in Canada. The federal government administers a number of programs and policies that are applicable across the country, in addition to those unique to each province and territory. Federal level government instruments include financial supports, which include funding programs, grants, and loans. Fiscal incentives also exist at the federal level in the form of tax deductions. The federal government also has standards and regulations stipulating requirements for energy efficiency. The federal government also has a carbon pricing program that applies to all

provinces and territories that do not have their own programs that meet federal emissions requirements. Key government instruments administered by the Government of Canada are outlined in Table 2.

Table 2: Government Instruments Supporting Energy in Canada - Federal Government

Type of Government Instrument	Name	Source/Further Reading
Economic: Financial Supports	Clean Energy for Rural and Remote Communities (NRCAN) - $220 million over 6 years starting in 2018/19. Remote, Rural, and Industry are eligible for funding for bioheat, demonstration, deployment, and capacity building projects	https://www.pembina.org/reports/power-shift-indigenous-communities.pdf https://www.nrcan.gc.ca/reducingdiesel/clean-energy-for-rural-and-remote-communities-funded-projects/22524 https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Impact Canada Initiative (NRCAN) $75 million over 4 years. Impact Canada will use an outcome-based approach to accelerate efforts toward solving Canada's big challenges. The Indigenous Off-diesel Initiative was launched in 2019. The initial years of the program were focused on capacity building (through the Catalysts program in partnership with Indigenous Clean Energy) and energy planning.	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf https://impact.canada.ca/en/challenges/off-diesel/process
Economic: Financial Supports	Northern REACHE (Crown Indigneous Relations and Northern Affairs): $53.5 million over 10 years starting in 2018/19 and $5.4 million ongoing (renewal of the existing program). Established in 2003 as a national program. Pembina Report: which funds clean energy, heating and energy efficiency programs in the Yukon, Northwest Territories, Nunavut, Nunavik and Nunatsiavut.	https://www.pembina.org/reports/power-shift-indigenous-communities.pdf https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Arctic Energy Fund (Infrastructure Canada) $400 million over 11 years starting in 2018/19 (for the territories only)	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Green Infrastructure Stream	https://www.nrcan.gc.ca/sites/www.nrc

	(Infrastructure Canada): $9.2 billion for green infrastructure over 11 years starting in 2018/19	an.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Rural and Northern Stream (Infrastructure Canada): $2 billion for rural and northern infrastructure over 11 years starting in 2018/19	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Low Carbon Economy Fund (Environment and Climate Change Canada): $2 billion over five years starting in 2017/18	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	First Nation Infrastructure Fund (Indigenous Services Canada): Could be leveraged to optimize the use of energy and reduce reliance on diesel fuel in First Nation communities	https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/CERRC%20EN%20Webinar%20Mar72018.pdf
Economic: Financial Supports	Indigenous Forestry Initiative ($13 million over three years) which supports Indigenous-led economic development in the forestry sector (including bioheat projects)	https://www.pembina.org/reports/power-shift-indigenous-communities.pdf https://www.nrcan.gc.ca/science-and-data/funding-partnerships/funding-opportunities/forest-sector-funding-programs/indigenous-forestry-initiative/13125
Economic: Financial Supports	Community Opportunity Readiness Program ($21 million), providing project based funding to Indigenous communities for a range of activities. Energy projects eligible under infrastructure stream	https://www.pembina.org/reports/power-shift-indigenous-communities.pdf https://www.sac-isc.gc.ca/eng/1100100033417/1613659339457
Economic: Fiscal Incentives	Class 43.1 and Class 43.2 and Canadian Renewable and Conservation Expenses: Under Classes 43.1 and 43.2 in Schedule II of the Income Tax Regulations, certain capital costs of systems that produce energy by using renewable energy sources or fuels from waste or that conserve energy by using fuel more efficiently are eligible for accelerated capital cost allowance.	https://www.nrcan.gc.ca/science-data/funding-partnerships/funding-opportunities/funding-grants-incentives/tax-savings-industry/5147
Tech/Infrastructure: Energy Efficiency	Natural Resources Canada (NRCan), Office of Energy Efficiency (OEE) Energy	https://oee.nrcan.gc.ca/residential/programs/details.cfm?&max=10&pageId=1&

	Efficiency Regulations: Regulations and Standards	categoryID=1&regionalDeliveryId=all&programTypes=all&keywords=&ID=1583
Tech/Infrastructure: Energy Efficiency	Natural Resources Canada (NRCan),Natural Resources Canada (NRCan), Office of Energy Efficiency (OEE) Energy Efficiency for Homes	https://oee.nrcan.gc.ca/residential/programs/details.cfm?&max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=all&keywords=&ID=2789
Tech/Infrastructure: Energy Efficiency	Natural Resources Canada (NRCan), Office of Energy Efficiency (OEE) Energy Efficiency for Products	https://oee.nrcan.gc.ca/residential/programs/details.cfm?&max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=all&keywords=&ID=4846
Economic & Tech/Infrastructure: Financial Supports/Energy Efficiency	Canada Mortgage and Housing Corporation (CMHC) CMHC Green Home	https://oee.nrcan.gc.ca/residential/programs/details.cfm?&max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=all&keywords=&ID=1561
Economic & Tech/Infrastructure: Financial Supports/Energy Efficiency	Environment and Climate Change Canada Energy Savings Rebate Program	https://oee.nrcan.gc.ca/residential/programs/details.cfm?&max=10&pageId=1&categoryID=1&regionalDeliveryId=all&programTypes=all&keywords=&ID=5766
Economic & Tech/Infrastructure: Financial Supports/Energy Efficiency	Canada Greener Homes Grant (NRCAN)	https://www.nrcan.gc.ca/energy-efficiency/homes/canada-greener-homes-grant/23441
Social: Capacity Building	Local Energy Efficiency Partnerships (LEEP) (NRCAN)	https://www.nrcan.gc.ca/energy-efficiency/homes/local-energy-efficiency-partnerships-leep/17338
Environmental/Economic: Climate Change and GHG Mitigation Instruments	Federal Carbon Tax	https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work.html

At the provincial and territorial level, each jurisdiction administers its own programs and policies with respect to energy. Government instruments vary, but common policies and programs include energy efficiency grants or rebates, power purchase agreements for independent power producers, and net metering programs. Nunavut, Yukon, and Northwest Territories have subsidy programs to offset the high costs of diesel fuel for consumers. Key government instruments administered by the provincial and territorial governments are outlined in Table 3.

Table 3: Government Instruments in Canada Supporting Energy - Provincial/Territorial Governments

Province/Territory	Type of Government Instrument	Name	Source/Further Reading
British Columbia	**Political:** Energy Planning	2019 CleanBC plan includes a target of reducing diesel	Pembina Report https://www2.gov.bc.ca/assets/go

		consumption by 80% by 2030 in BC's 22 largest remote communities. CleanBC's Remote Community Clean Energy Strategy supports the 80% reduction target, and has four pillars: capacity building, renewable heat, energy efficiency retrofits and clean power. Budget 2019 dedicated $15 million to implement this strategy	v/environment/climate-change/action/cleanbc/cleanbc_2018-bc-climate-strategy.pdf
	Economic: Financial Supports	Innovative Clean Energy Fund ($40 million)	https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/innovative-clean-energy-solutions/innovative-clean-energy-ice-fund
	Economic: Financial Supports	First Nations Clean Energy Business Fund ($7.7 million)	https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/consulting-with-first-nations/first-nations-clean-energy-business-fund
	Economic: Financial Supports	British Columbia Indigenous Clean Energy Initiative ($3 million)	http://www.newrelationshiptrust.ca/initiatives/bcicei/
	Economic/Tech&Infrastrture/Social: Financial Supports/Energy Efficiency/Capacity Building	Fraser Basin Council's First Nations Home EnergySave program	https://www.fraserbasin.bc.ca/First_Nations_Home_EnergySave.html
	Economic/Tech & Infrastructure: Financial Supports/Energy Efficiency	BetterHomesBC and BetterBuildingsBC	https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/energy-efficiency-conservation/programs
	Political: Energy Planning	Clean Energy Act	https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/10022_01#part1
	Tech & Infrastructure/Political: Energy Efficiency	Energy Efficiency Act	https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/00_96114_01

	Economic: Financial Supports	Community Energy Leadership Program	https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/community-energy-solutions/community-energy-leadership-program
	Environmental: Climate Change and GHG Mitigation Instruments	Renewable and Low Carbon Fuel Requirements Regulations	https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/394_2008
	Economic: Power Purchase Agreements	Independent Power Producer program	https://www.bchydro.com/work-with-us/selling-clean-energy/meeting-energy-needs/how-power-is-acquired.html
Alberta	**Economic:** Fiscal Incentives	Clean Energy Improvement Program	https://www.alberta.ca/clean-energy-improvement-program.aspx
	Political: Energy Planning	Renewable Electricity Act	https://www.alberta.ca/renewable-energy-legislation-and-reporting.aspx
	Market: Grid Services	Micro-generation Regulation	https://www.alberta.ca/micro-generation.aspx
	Environmental: Climate Change and GHG Mitigation Instruments	The Carbon Competitiveness Incentive Regulation	https://www.alberta.ca/carbon-competitiveness-incentive-regulation.aspx
	Environmental: Climate Change and GHG Mitigation Instruments	Technology Innovation and Emissions Reduction Regulation	https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation.aspx
Saskatchewan	**Market** Net Metering	Net Metering Program	https://www.saskpower.com/Our-Power-Future/Powering-2030/Generating-Power-as-an-Individual/Using-the-Power-You-Make/Net-Metering
	Economic: Power Purchase Agreements	Power Generation Partner Program	Pembina Report, SaskPower Fact Sheet (pdf, not a webpage)
Manitoba	**Economic/Tech & Infrastructure:** Financial Supports/Energy Efficiency	First Nation Insulation and Direct Install	https://efficiencymb.ca/my-home/first-nations-insulation-program/
	Economic/Tech & Infrastructure: Financial Supports/Energy Efficiency	Efficiency Manitoba Residential Programs	https://efficiencymb.ca/my-home/
	Economic/Tech & Infrastructure: Financial Supports/Energy Efficiency	Efficiency Manitoba Commercial Programs	https://efficiencymb.ca/business/

	Social/Tech&Infrastructure/ Economic/Capacity Building: Support to Intermediaries/Energy Efficiency	Community Energy Efficiency Program	https://efficiencymb.ca/community/community-efficiency/
	Economic: Financial Supports	Manitoba Hydro loans and financing	https://www.hydro.mb.ca/your_home/loans_financing/
Ontario	**Social:** Capacity Building	Community Energy Champion Program	https://www.ieso.ca/en/Get-Involved/Funding-Programs/Community-Energy-Champion-Program/CEC-Overview
	Social: Capacity Building	Education and Capacity Building program	https://www.ieso.ca/en/Get-Involved/Funding-Programs/Education-and-Capacity-Building-Program/Overview
	Economic: Financial Supports	Grid Innovation Fund	https://www.ieso.ca/en/Get-Involved/Funding-Programs/Grid-Innovation-Fund/Overview
	Political: Energy Planning	Indigneous Community Energy Plan program	https://www.ieso.ca/en/Get-Involved/Funding-Programs/Indigenous-Community-Energy-Plan-Program/ICEP-Overview
	Economic/Market: Financial Supports/Net Metering	Renewable Energy Innovation Diesel Emission Reduction	https://www.hydroone.com/abouthydroone/CorporateInformation/Documents/2019%20Reindeer%20Renewable%20Energy%20Program%20Remotes.pdf
Quebec	**Economic/Tech & Infrastructure:** Financial Supports/Energy Efficiency	Transition Énergétique Québec funding programs	https://transitionenergetique.gouv.qc.ca/en/
	Economic: Financial Supports	Plan Nord funding programs	https://plannord.gouv.qc.ca/en/financial-support/
	Economic: Power Purchase Agreements	Hydro Quebec PPA	https://www.hydroquebec.com/electricity-purchases-quebec/
	Market: Net Metering	Hydro Quebec Net Metering Program	http://www.hydroquebec.com/self-generation/faq.html
	Political: Energy Planning	2030 Plan for a Green Economy	https://www.quebec.ca/en/government/policies-orientations/plan-green-economy
Newfoundland	**Political:** Energy Planning	Nunatsiavut Energy Security Plan	https://www.nunatsiavut.com/wp-content/uploads/2017/01/Nunatsi

			avut-Energy-Security-Plan.pdf
	Economic/Tech & Infrastructure: Financial Supports/Energy Efficiency	TakeCHARGE program	https://takechargenl.ca/
	Economic/Tech & Infrastructure: Financial Supports/Energy Efficiency	Home Energy Savings Program	https://www.nlhc.nl.ca/housing-programs/home-energy-savings-program-hesp/
Nunavut	**Economic:** Power Purchase Agreements	Independent Power Producer Program	https://www.qec.nu.ca/customer-care/generating-power/independent-power-producer-program
	Economic: Financial Supports	Nunavut Electricity Subsidy Program	WWF Report: The program was implemented to offset a portion of the high cost of energy in remote communities and to bring it more in line with the rate that Nunavummiut pay in Iqaluit. That said, not all of a customer's electricity consumption may be eligible for the NESP: from April to September, residential customers can benefit from the subsidized rate only for the first 700 kWh of electricity consumed each month, after which point a customer would have to pay the full rate applied by QEC in their community. From October to March, the threshold is increased to 1,000 kWh
	Economic: Financial Supports	Public Housing Power Support Program	WWF Report: The Public Housing Power Support Program (PHPSP) is the GN's largest singular measure to reduce the cost of electricity for Nunavummiut.
	Economic: Financial Supports	Department of Family Services Income Assistance Program	WWF Report: Senior Fuel Subsidy: Nunavummiut who are at least 60 years old and are permanent Nunavut residents are eligible to receive support on heating fuel purchases for up to 3,500 litres annually, given that they own and live in their own home

	Economic: Financial Supports	Nunavut Housing Corporation - O&M Costs for Public Housing	WWF Report: Heating fuel component: The NHC provides heating fuel to its public housing tenants as part of their rent, which means that tenants are not responsible for any heating fuel expenses.
	Economic: Financial Supports	Nunavut Housing Corporation - Staff Housing Policy—Power & fuel	WWF Report: The Government of Nunavut offers a staff housing program that includes subsidized rental housing to term and indeterminate employees that is designed to assist in the recruitment and retention of staff. A portion of the subsidized expenses goes to cover the cost of heating fuel, and sometimes other utilities including power
	Economic: Financial Supports	Nunavut Housing Corporation - Heating Oil Tank Replacement Program	WWF Report: Eligible homeowners can receive a grant of up to CAD 7,500 from NHC to replace their oil tank. This includes the costs of materials, freight and labour for replacement or refurbishment
	Economic: Financial Supports	Department of Finance - Government-Owned Buildings	WWF Report: According to QEC officials, between 1 March 2016 and 28 February 2017, the power corporation billed for 195.9 million kWh of electricity consumption to government-owned or leased buildings
	Economic: Financial Supports	Department of Finance - Fuel Tax Rebate	WWF Report: The Fuel Tax Rebate program is centrally administered by the Department of Finance as well. It targets two specific categories of fossil fuel consumers: Nunavummiut engaged in traditional activities such as hunting, fishing, trapping, gathering and outfitting, on the one hand, and the mining industry on the other. Eligible beneficiaries receive a rebate for the fuel tax

			that they had to pay either for fuel purchases made in Nunavut or for fuel that they imported. Furthermore, the rebate is only applicable to fuel that was used off-road in vehicles and machinery. The Department of Finance notes that since the program was created in 2006, the mining industry has benefited from almost all of the rebates processed
	Market: Net Metering	Net Metering Program	https://www.qec.nu.ca/customer-care/generating-power/net-metering-program
Northwest Territories	**Economic:** Financial Supports	Alternative Energy Technologies Program	https://aea.nt.ca/program/renewable-energy/
	Economic/Tech & Infrastructure: Financial Supports	Energy Efficiency Incentive Program	https://aea.nt.ca/program/energy-efficient-products/
	Economic: Financial Supports	Commercial Energy Conservation and Efficiency Program	https://www.inf.gov.nt.ca/en/services/%C3%A9nergie/energy-programs
	Economic/Environmental: Climate Change and GHG Instruments/Financial Supports	GHG Grant Program for Government	https://www.inf.gov.nt.ca/en/services/energy/ghg-grant-program-government
	Economic/Environmental: Climate Change and GHG Instruments/Financial Supports	GHG Grant Program for Buildings and Industry	https://www.inf.gov.nt.ca/en/services/energy/ghg-grant-program-buildings-and-industry
	Market: Net Metering	NTPC Net Metering program	https://www.ntpc.com/customer-service/net-billing
	Economic: Financial Supports	Territorial Power Support Program	https://www.ntpc.com/customer-service/territorial-power-support-program---tpsp
Yukon	**Economic:** Financial Supports	Community Renewable Energy Project funding	https://yukon.ca/en/innovative-renewable-energy-initiative
	Economic: Financial Supports	Good Energy Rebates	https://yukon.ca/en/good-energy-rebates
	Economic: Power Purchase Agreement	Standing Offer Program (IPP)	https://yukonenergy.ca/energy-in-yukon/standing-offer-program

	Economic: Financial Supports	Interim Electrical Rebate	https://yukonenergy.ca/customer-service/programs/interim-electrical-rebate
	Economic: Power Purchase Agreement	Independent Power Producer policy	https://yukon.ca/en/news/government-yukons-independent-power-production-policy-implemented

Key Subsidies

As energy provision is a provincial/territorial responsibility in Canada, subsidies vary across jurisdictions and utilities. Additionally, the federal government provides subsidies in some cases, such as for First Nations who rely on diesel, which further complicates the system. One example of subsidies in Canada is in Nunavut, where all 25 remote communities rely on diesel fuel (Lovekin et al., 2016). In order to keep rates affordable, the territorial government operates the Nunavut Electricity Subsidy Program, which subsidizes rates to approximately $0.60 per kWh. Additionally, the government operates a program for those living in public housing (52% of Nunavut's population) where electricity rates are capped at $0.06 per kWh. This system in Nunavut where subsidies are provided by the territorial government differs from other jurisdictions, such as Maniotba where diesel subsidies for remote communities are provided by both the utility and the federal government. Evidently, subsidies in Canada are not uniform across the board.

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APPENDIX C - ALASKA SUMMARY

Regulatory Structure

The Regulatory Commission of Alaska (RCA) has the authority to regulate both utilities and pipeline carriers within the state (Regulatory Commission of Alaska, 2018). The RCA exercises a

delegated legislative power, and must reach its regulatory decisions quasi-judicially. In Alaska, most utilities providing services to ten or more customers require a certificate in order to operate. Certificates are issued by the RCA, which then regulates the rates, services, and practices of those utilities. The RCA also determines the level of support received by eligible customers under the Power Cost Equalization program. There are some utilities in Alaska that are not regulated, including local, government-owned utilities, very small utilities, and cooperatives whose members have voted to be deregulated.

Ownership Structure:

The ownership structure of a country's utilities plays a role in creating the political environment in which energy systems operate. Whether utilities are public companies, privately owned, or owned by the government will influence how they operate and what their priorities are in terms of new projects and initiatives. It will also influence if and how communities or individuals are able to undertake energy projects of their own.

Alaska's utilities are a mix between privately owned companies, cooperatives, and those owned by municipal or tribal governments. It is important to note that utilities owned by tribal governments differ from those owned by native regional corporations, which are classified as private companies.

Table 1: Utility Ownership in Alaska

Utility	*Ownership Structure*
Akutan Electric Utility	Municipal
TDX Power	Private
City of Atka	Municipal
Atmautluak Tribal Utilities	Tribal
North Slope Borough Department of Public Works	State owned
TDX Adak Generating LLC	Private
City of Akhiok	Municipal
Akiachak Native Community Electric Co	Tribal
Akiak City Council	Municipal

City of Akutan	Municipal
Alaska Village Electric Cooperative	Coop
Alaska Power & Telephone Company	Private
Nushagak Electric Cooperative	Coop
Homer Electric Association	Coop
Chugach Electric Association	Coop
Golden Valley Electric Association Inc	Coop
Inside Passage Electric Cooperative	Coop
Aniak Light & Power	Private
Alaska Electric Light & Power Company	Private
Barrow Utilities & Electric Cooperative Inc.	Coop
City of Seward	Municipal
Beaver Joint Utilities	Private
Matanuska Electric Association	Coop
Birch Creek Village Electric	Private
Gold Country Energy	?
Chalkyitsik Village Council	Tribal
Naterkaq Light Plant (City of Chefornak)	Municipal
Chenega Ira Council	Tribal
City of Chignik	Municipal
Chignik Lagoon Power Utility	Tribal
Chignik Lake Electric Utility	Tribal
Kodiak Electric Assn Inc	Coop
Chitina Electric Inc	Private
Middle Kuskokwim Electric	Coop

Circle Electric Utility	Municipal
City of Clark's Point	Municipal
G & K Inc	Municipal
Elfin Cove Utility Commission	Municipal
Cordova Electric Cooperative	Coop
University of Alaska Fairbanks	University
City of False Pass	Municipal
Gwitchyaa Zhee Utilities Company	Private
Copper Valley Elec Assn Inc	Coop
City of Galena	Municipal
Golovin Power Utilities	Municipal
Hughes Power & Light	Municipal
Igiugig Electric Company	Tribal
I-N-N Electric Coop, Inc	Coop
Alutiiq Power Company	Tribal
Ketchikan Public Utilities	Municipal
Southeast Alaska Power Agency	regional Joint Action Agency of the State of Alaska
City of King Cove	Municipal
Naknek Electric Association	Coop
Kipnuk Light Plant	Tribal
Kokhanok Village Council	Tribal
New Koliganek Village Council	Tribal
Puvurnaq Power Company (Kongiganak)	Tribal
Kotzebue Electric Association	Coop
City of Koyukuk	Municipal

Kwethluk Incorporated d/b/a Kuiggluum Kallugvia	Private
Kwigillingok Power Company	Tribal
Minchumina Power Company	?
Larsen Bay Utility Company	?
Levelock Electrical Coop	Coop
Lime Village Electric Utility	?
TDX Manley Generating LLC	Private
Manokotak Power Company	?
Metlakatla Power & Light	?
Napakiak Ircinraq	?
Napaskiak Electric Utility	?
Nelson Lagoon Electrical Coop	Coop
Ungusraq Power Company	?
City of Nikolai	Municipal
Umnak Power Company	?
Nome Joint Utility Systems	Municipal
Nunam Iqua Electric Company	?
City of Ouzinkie	Municipal
Pedro Bay Village Council	Tribal
Pelican Utility	Municipal
Native Village of Perryville	Tribal
City of Petersburg	Municipal
Pilot Point Electric Utility	?
City of Platinum	Municipal
Tanalian Electric Cooperative	Coop
Port Heiden Utilities	Municipal

Rampart Village Council	Tribal
Middle Kuskokwim Electric	?
City of Ruby	Municipal
City of St. George	Municipal
Saint Paul Municipal Electric	Municipal
TDX Corporation	Private
City & Borough of Sitka	Municipal
Stevens Village Ira Council	Tribal
Takotna Community Assoc Inc	?
Tanana Power Company Inc	Private
Tatitlek Village Ira Council	Tribal
City of Tenakee Springs	Municipal
Tuluksak Traditional	Tribal
Tuntutuliak Community	Tribal
Twin Hills Village Council	Tribal
Kipnuk Light Plant	?
Unalakleet Valley Electric Cooperative	Coop
City of Unalaska	Municipal
Venetie Village Electric	Tribal
City of White Mountain	Municipal
City of Wrangell	Municipal

Leadership:

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie. In Alaska, the board of directors for cooperatives are elected by members. Due to a lack of available

information, it is unclear whether municipally owned utilities have boards of directors, and if so, how they are appointed.

Table 2: Utility Leadership in Alaska

Utility	*Board of Directors*
Akutan Electric Utility	?
TDX Power	?
City of Atka	?
Atmautluak Tribal Utilities	?
North Slope Borough Department of Public Works	?
TDX Adak Generating LLC	?
City of Akhiok	?
Akiachak Native Community Electric Co	?
Akiak City Council	?
City of Akutan	?
Alaska Village Electric Cooperative	Board of Directors elected by members
Alaska Power & Telephone Company	Board of Directors elected by shareholders
Nushagak Electric Cooperative	Board of Directors elected by members
Homer Electric Association	Board of Directors elected by members
Doyon Utilities LLC	?
Anchorage Municipal Light & Power	?
Chugach Electric Association	Board of Directors elected by members
Golden Valley Electric Association Inc	Board of Directors elected by members
Alaska Environmental Power LLC	?
Inside Passage Electric Cooperative	Board of Directors elected by members
Aniak Light & Power	?
Alaska Electric Light & Power Company	?

Barrow Utilities & Electric Cooperative Inc.	Board of Directors elected by members
City of Seward	?
Beaver Joint Utilities	?
Matanuska Electric Association	Board of Directors elected by members
Birch Creek Village Electric	?
Southfork Hydro, LLC	?
Enerdyne, LLC	?
Gold Country Energy	?
Chalkyitsik Village Council	?
Naterkaq Light Plant (City of Chefornak)	?
Chenega Ira Council	?
City of Chignik	?
Chignik Lagoon Power Utility	?
Chignik Lake Electric Utility	?
Kodiak Electric Assn Inc	Board of Directors elected by members
Chitina Electric Inc	?
Middle Kuskokwim Electric	?
Circle Electric Utility	?
City of Clark's Point	?
G & K Inc	?
Elfin Cove Utility Commission	?
Cordova Electric Cooperative	Board of Directors elected by members
University of Alaska Fairbanks	?
Aurora Energy LLC Chena	?
US Air Force Eielson AFB	?
City of False Pass	?

Gwitchyaa Zhee Utilities Company	?
Copper Valley Elec Assn Inc	Board of Directors elected by members
City of Galena	?
Golovin Power Utilities	?
Gustavus Electric Co	?
Hughes Power & Light	?
Igiugig Electric Company	?
I-N-N Electric Coop, Inc	Board of Directors elected by members
Alutiiq Power Company	?
Ketchikan Public Utilities	
Southeast Alaska Power Agency	Each director is appointed by a member community's Mayor or Assembly
City of King Cove	?
Naknek Electric Association	Board of Directors elected by members
Kipnuk Light Plant	?
Kobuk Valley Electric Company	?
Kokhanok Village Council	?
New Koliganek Village Council	?
Puvurnaq Power Company	?
Kotzebue Electric Association	?
City of Koyukuk	?
Kwethluk Incorporated d/b/a Kuiggluum Kallugvia	?
Kwigillingok Power Company	?
Minchumina Power Company	?
Larsen Bay Utility Company	?
Levelock Electrical Coop	?

Lime Village Electric Utility	?
TDX Manley Generating LLC	?
Manokotak Power Company	?
Metlakatla Power & Light	?
Napakiak Ircinraq	?
Napaskiak Electric Utility	?
Nelson Lagoon Electrical Coop	?
Ungusraq Power Company	?
City of Nikolai	?
Umnak Power Company	?
Nome Joint Utility Systems	?
Banner Wind, LLC	?
Nunam Iqua Electric Company	?
City of Ouzinkie	?
Pedro Bay Village Council	?
Pelican Utility	?
Native Village of Perryville	?
City of Petersburg	?
Pilot Point Electric Utility	?
City of Platinum	?
Tanalian Electric Cooperative	?
Port Heiden Utilities	?
Rampart Village Council	?
Middle Kuskokwim Electric	?
City of Ruby	?
City of St. George	?

Saint Paul Municipal Electric	?
TDX Corporation	?
City & Borough of Sitka	?
Stevens Village Ira Council	?
Takotna Community Assoc Inc	?
Tanana Power Company Inc	?
Tatitlek Village Ira Council	?
City of Tenakee Springs	?
Tuluksak Traditional	?
Tuntutuliak Community	?
Twin Hills Village Council	?
Kipnuk Light Plant	?
Unalakleet Valley Electric Cooperative	?
City of Unalaska	?
Venetie Village Electric	?
City of White Mountain	?
City of Wrangell	?

Utility Budget

Utilities' budgets can likely be found on the Regulatory Commission of Alaska's website.

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

A key piece of Alaska's policy strategy is the state's energy plan, *Alaska Energy Pathway - Towards Energy Independence.* Published in 2010, the plan outlines targets and a roadmap for the

future of energy in Alaska. The main goals and priorities outlined in the plan include: generating 50% of the state's electricity from renewable energy sources by 2025; improving energy efficiency and conservation by 20% by 2020; addressing climate change; energy security; economic development; innovation; education and workforce development; and continued development of fossil fuel resources (Alaska Energy Authority, 2010).

Another important component of Alaska's policy strategy relates to tribal lands. With over 44 million acres, Alaska has more territory held as tribal lands than any other state (United States Energy Information Administration, 2021). Under the Alaska Native Claims Settlement Act, passed in 1971, the state was divided into 12 geographic regions, each designated to a regional native corporation (United States Energy Information Administration, 2021). Unlike in the lower 48 states, where Native American reservations hold sovereign status, tribal lands in Alaska are owned by the native corporations (United States Energy Information Administration, 2021). Tribal lands in Alaska are home to oil and gas as well as renewable resources, therefore the regional native corporations play a key role in the direction of energy in the state.

At the federal level, the United States Energy Policy Act also contributes to Alaska's policy strategy. The Energy Policy Act addresses energy production in the United States including: energy efficiency; renewable energy; oil and gas; coal; Tribal energy; nuclear matters and security; vehicle and motor fuels, including ethanol; hydrogen; electricity; energy tax incentives; hydropower and geothermal energy; and climate change technology (United States Environmental Protection Agency, n.d.). Policies, programs, and other directions set out in the federal Energy Policy Act apply to all states, therefore the legislation plays an important role in creating Alaska's energy context.

Development Priorities:

The current priorities in developing Alaska's energy system are somewhat unclear due to the decentralized nature of the utility market, and a lack of accessible information on their recent activities. Many utilities do not have websites, and those that do contain little information.

From those utilities that do have websites and annual reports detailing their recent activities, key areas of priority include: integrating renewable energy technologies such as solar and wind; upgrading and replacing aging fossil fuel based energy infrastructure; and constructing new transmission and distribution lines (Alaska Power and Telephone, 2020; Alaska Village Electric Cooperative, 2021; Copper Valley Electric, 2020; Chugach Electric Association, 2020; Davidson, C., & Scott, 2020; Golden Valley Electric Association, 2020; Homer Electric Association, 2020; Matanuska Electric Association, 2020). Additionally, some utilities such as Alaska Power and Telephone Company, Homer Electric Association, and Chugach Electric Association have been implementing electric vehicle

incentive programs and charging stations (Alaska Power and Telephone, 2020; Chugach Electric Association, 2020; Homer Electric Association, 2020).

External Communications/Transparency:

On the utility side, most companies do not have websites, and those that do contain limited information regarding their activities. This is not surprising as small utilities likely do not have the budget or capacity to maintain detailed websites, but it makes it challenging to know what types of projects or initiatives are being undertaken.

The government has very good information available, especially concerning government instruments supporting energy. The majority of this information can easily be found on the Alaska Energy Authority website, which is very easy to navigate. Information regarding utilities can also be found on the Regulatory Commission of Alaska's website, but it is more challenging and time consuming to navigate.

Government Instruments:

Government instruments supporting energy in Alaska are found in the table below.

Key Subsidies:

The Power Cost Equalization Program (PCE) is a subsidy program providing economic assistance to communities and residents in rural Alaska where the cost of electricity is three to five times higher than for customers living in urban areas (Alaska Energy Authority, n.d.). The PCE is administered by the Alaska Energy Authority (AEA) and the Regulatory Commission of Alaska (AEA), and serves 82,000 people in 193 communities primarily reliant on diesel fuel. The program works by lowering the rates paid by PCE-eligible consumers to levels comparable to those paid by consumers in the urban areas of Anchorage, Fairbanks, and Juneau.

Government Instruments in Alaska

Type of Government Instrument	*Name*	*Source/Further Reading*
Economic: Financial Supports	Emerging Energy Technology Fund Grants (phased out)	http://www.akenergyauthority.org/What-We-Do/Grants-Loans/Emerging-Energy-Technology-Fund-Grants The Alaska State Legislature created the Emerging Energy Technology Fund (EETF) in 2010 to promote the expansion of energy sources available to Alaskans. The EETF is a grant program governed

		by AS 42.45.375 and 3 AAC 107.700 to 3 AAC 107.779. Grants are for demonstration projects of technologies that have a reasonable expectation of becoming commercially viable within five years and; test emerging energy technologies or methods of conserving energy, improve an existing technology, or deploy an existing technology that has not previously been demonstrated in the state. The program has executed three solicitations (2010, 2012, and 2016) and awarded funding to 22 projects from a pool of 106 applicants.
Economic: Financial Supports	Power Cost Equalization Program	http://www.akenergyauthority.org/What-We-Do/Power-Cost-Equalization The PCE program provides economic assistance to communities and residents of rural electric utilities where the cost of electricity can be three to five times higher than for customers in more urban areas of the state. AEA, along with the Regulatory Commission of Alaska (RCA), administers the program that serves 82,000 Alaskans in 193 communities that are largely reliant on diesel fuel for power generation.
Economic: Financial Supports	Power Project Fund (PPF)	http://www.akenergyauthority.org/What-We-Do/Grants-Loans/Power-Project-Fund The Power Project Fund (PPF) loan program provides loans to local

		utilities, local governments or independent power producers for the development, expansion or upgrade of electric power facilities, including distribution, transmission, efficiency and conservation, bulk fuel storage and waste energy.
Social: Capacity Building	Alaska Energy Authority Community Assistance	http://www.akenergyauthority.org/What-We-Do/Energy-Planning-Project-Development/Community-Assistance AEA assists across the entire lifecycle of communities' infrastructure—from identifying a community's needs and goals to providing training needed to manage utilities and maintain infrastructure.
Political: Energy Planning	Alaska Electric Vehicle Working Group	http://www.akenergyauthority.org/What-We-Do/Energy-Planning-Project-Development/Electric-Vehicles The Working Group meets quarterly to discuss EVs and charging infrastructure in Alaska.
Economic: Financial Supports	VW Diesel Settlement Grants	http://www.akenergyauthority.org/What-We-Do/Energy-Planning-Project-Development/Electric-Vehicles Through a public process, AEA has dedicated $1.25 million from the Volkswagen Settlement to install Level 2 and Level 3 charging stations throughout the state. The current plan is to dedicate funding towards Level 3 chargers along the

		contiguous road system and Level 2 chargers in population centers. In order to capitalize on economies of scale AEA intends to have a single vendor install all of the charging stations.
Economic: Financial Supports	Renewable Energy Fund (REF)	http://www.ak-ea.org/What-We-Do/Grants-Loans/Renewable-Energy-Fund The Alaska Renewable Energy Fund (REF) provides benefits to Alaskans by reducing and stabilizing the cost of energy through development of renewable energy projects. The program is designed to produce cost-effective renewable energy for heat and power to benefit Alaskans statewide. The program creates jobs, uses local energy resources, and keeps money in local economies.
Technology/Infrastructure: Energy Efficiency	Rural Power System Upgrade Program	http://www.akenergyauthority.org/What-We-Do/Rural-Energy-Assistance/Rural-Power-System-Upgrade-Program Powerhouse upgrade projects replace outdated, inefficient mechanical systems with new electronically controlled generator sets.
Economic/Social: Financial Supports/Capacity Building	Bulk Fuel Upgrade (BFU) program	http://www.ak-ea.org/What-We-Do/Rural-Energy-Assistance/Bulk-Fuel-Upgrade-Program The Alaska Energy Authority's Bulk Fuel Upgrade (BFU) program may provide financial assistance and technical assistance including construction management and

		training to eligible recipients.
Economic: Financial Supports	Diesel Emission Reduction Act Program	http://www.ak-ea.org/What-We-Do/Rural-Energy-Assistance/Diesel-Emission-Reduction-Act-Program The Clean Diesel Program provides support for projects that protect human health and improve air quality by reducing harmful emissions from diesel engines. This program includes grants and rebates funded under the Environmental Protection Agency's (EPA) Diesel Emissions Reduction Act (DERA).
Economic: Financial Supports	Assistance to High Energy Cost Communities (US Department of Agriculture)	https://www.grants.gov/web/grants/view-opportunity.html?oppId=324819 USDA RUS Grants: assist communities with extremely high energy costs. The grant funds may be used to acquire, construct, or improve energy generation, transmission, or distribution facilities serving communities where the average annual residential expenditure for home energy exceeds 275% of the national average. Eligible projects also include on-grid and off-grid renewable energy projects and the implementation of energy efficiency and energy conservation projects for eligible communities. Projects cannot be for the primary benefit of a single household or business. Grant funds may not be used for the preparation of the grant application, operating costs, or for the purchase of any equipment, structures, or real estate not

		directly associated with the provision of community energy services.
Economic: Financial Supports	Fiscal Year 2020 Advanced Vehicle Technologies Research Funding	https://www.grants.gov/web/grants/view-opportunity.html?oppId=323822 This FOA seeks research projects to address priorities in the following areas: advanced batteries and electrification in support of the recently-announced DOE Energy Storage Grand Challenge; advanced engine and fuel technologies, including technologies for off-road applications and alternative fueled engines; lightweight materials; new mobility technologies (energy efficient mobility systems); and alternative fuels technology demonstrations.
Economic/Social: Financial Supports/Capacity Building	The U.S. Department of Energy (DOE) Office of Indian Energy	https://www.energy.gov/indianenergy/technical-assistance The U.S. Department of Energy (DOE) Office of Indian Energy provides federally recognized Indian tribes, including Alaska Native villages, tribal energy development organizations, and other organized tribal groups and communities, with technical assistance to advance tribal energy projects. Types of Technical Assistance: • Technical Analysis • Financial Analysis • Strategic Energy Planning
Economic/Technology & Infrastructure: Financial Supports/Energy Efficiency	Rural Energy for America Program Renewable Energy Systems & Energy Efficiency Improvement Guaranteed Loans & Grants	https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-

		systems-energy-efficiency Funding Available • Loan guarantees on up to 75% project cost • Grants up to 25% of project cost • Combined grant and loan guarantee, up to 75% project cost Loan Guarantee Terms • $5,000 minimum loan amount • $25 million maximum loan amount Renewable Energy System (RE) Grants • $2,500 minimum • $500,000 maximum Energy Efficiency (EE) Grants • $1,500 minimum • $250,000 maximum
Economic: Financial Supports	Rural Business Development Grants	https://www.rd.usda.gov/programs-services/rural-business-development-grants Enterprise grants must be used on projects to benefit small and emerging businesses in rural areas as specified in the grant application.
Economic: Financial Supports	Economic Development Assistance Programs	https://www.grants.gov/web/grants/view-opportunity.html?oppId=306735 U.S. Department of Commerce Grant: Promoting innovation and competitiveness, preparing American regions for economic growth and success in the worldwide economy through strategic investments and partnerships that create the regional economic ecosystems required to foster globally competitive regions throughout the United States. EDA supports

		development in economically distressed areas of the United States by fostering job creation and attracting private investment.
Economic: Financial Supports	Economic Impact Initiative Grants	https://www.rd.usda.gov/programs-services/economic-impact-initiative-grants USDA RD Grant: Up to 75% of eligible project cost based on need and funding availability. Priorities are given to projects related to public health and safety, energy efficiency and education. To construct, enlarge or improve community facilities for health care, public safety and public service. Grants may be made in combination with other financial assistance such as a Community Facilities direct or guaranteed loan, applicant contribution or funding from other sources.
Economic/Technology & Infrastructure: Financial Supports/Energy Efficiency	Community Facilities Direct Loan & Grant Program	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program Provides financing for permanent energy-efficient improvements to public buildings owned by regional educational attendance areas, by the University of Alaska, by the state or by municipalities in the state. Borrowers obtain an Investment Grade Audit as the basis for making cost-effective energy improvements, selecting from the list of energy efficiency measures identified with the initial rating. All of the improvements must be completed within 365 days of loan closing.

Social: Capacity Building	Biomass Training	http://www.ak-ea.org/What-We-Do/Energy-Technology-Programs/Biomass/Biomass-Training The Alaska Energy Authority in collaboration with the Alaska Wood Energy Development Task Group and the State of Alaska Department of Labor, periodically offers Cordwood Operator and Maintenance Training. This week-long course includes classroom, video, and hands-on experience in all tasks related to the daily operation and periodic maintenance of Garn Boiler systems. This training is open to current and future operators of cordwood systems.
Economic: Financial Supports	Commercial Property Assessed Clean Energy (C-PACE)	http://www.ak-ea.org/What-We-Do/Grants-Loans/C-PACE a financing tool for improving commercial buildings with energy efficiency measures or renewable energy systems. Unlike conventional construction loans, C-PACE is designed to work specifically with the unique needs and barriers of financing building improvements, including longer loan terms, off-book debt, and repayment that transfers with the sale of property just as does the savings generated by the building improvements. Debt associated with doing the improvements is repaid via a line item on local tax assessments.
Political: Energy Planning	AEA Regional Energy Planning Program	http://www.ak-ea.org/What-We-Do/Energy-Planning-Project-Development/Regional-Energy-

		Plans From 2009 through 2017, AEA assisted Alaska's regions with developing regional energy plans. Beginning with the Railbelt Integrated Resource Plan in 2009 and the Southeast Integrated Resource Plan in 2011, AEA's regional energy planning program provided a way for Alaskans to determine their energy priorities and formulate a concrete, implementable, fundable energy plan. The plans addressed energy needed by communities and regions for electricity, heat and transportation. Each energy region had the opportunity to create a specific action plan for a less expensive, more reliable, efficient and sustainable energy future. Each planning effort included regional stakeholders, evaluated alternatives and provided a prioritized action plan of projects.
Social: Capacity Building	AEA Circuit Rider program	http://www.ak-ea.org/What-We-Do/Rural-Energy-Assistance/Circuit-Rider provides eligible utilities with technical assistance to improve the efficiency, safety, and reliability of their energy infrastructure and helps reduce the risk and severity of emergency conditions.
Social: Capacity Building	AEA Training & Utility Assistance	http://www.ak-ea.org/What-We-Do/Rural-Energy-Assistance/Training-Utility-Assistance AEA provides training

		opportunities to rural operators and managers for their energy infrastructure. The intent of this training is to ensure that the local operators and managers have the knowledge and skills to operate maintain and sustain their energy infrastructure. With proper training and by following best practices the local staff will be safer, keep their facilities in compliance with regulatory requirements, operate as efficiently as possible, and their infrastructure will last its design life.
Market: Net Metering	Net Metering	https://alaskarenewableenergy.org/wp-content/uploads/2020/03/Renewable-Energy-Atlas-2019.pdf Alaska's net metering regulations, promulgated in 2010, apply to renewable energy systems of 25 kW or less and require large utilities to purchase up to 1.5 percent of the utility's average load from customers who install projects. Customers receive an amount equal to what the utility is able to avoid spending on fuel and operations to generate the electricity. The number of customer-built projects, particularly solar photovoltaic, is beginning to grow rapidly and at least one utility is projected to reach the 1.5 percent cap set by the Regulatory Commission of Alaska (RCA) sometime around 2022.
Political: Energy Planning	Alaska State Legislature House Bill 306	https://alaskarenewableenergy.org/wp-content/uploads/2020/03/Renew

		able-Energy-Atlas-2019.pdf established nonbinding goals to produce 50 percent of the state's electricity from renewable resources by 2025 and reduce energy use 15 percent per capita by 2020.
Political/Technology & Infrastructure: Energy Planning/Energy Efficiency	Alaska State Legislature SB 220	https://alaskarenewableenergy.org/wp-content/uploads/2020/03/Renewable-Energy-Atlas-2019.pdf mandated that 25 percent of the state's public facilities over 10,000 square feet be energy retrofitted by 2020, a goal met by 2015. Efficiency improvements to state facilities since 2010 are now achieving a cumulative annual cost avoidance of approximately $3.4 million.
Political: Energy Planning	Federal Energy Policy Act	https://www.epa.gov/laws-regulations/summary-energy-policy-act The Energy Policy Act (EPA) addresses energy production in the United States, including: (1) energy efficiency; (2) renewable energy; (3) oil and gas; (4) coal; (5) Tribal energy; (6) nuclear matters and security; (7) vehicles and motor fuels, including ethanol; (8) hydrogen; (9) electricity; (10) energy tax incentives; (11) hydropower and geothermal energy; and (12) climate change technology. For example, the Act provides loan guarantees for entities that develop or use innovative technologies that avoid the by-production of greenhouse gases. Another provision of the

		Act increases the amount of biofuel that must be mixed with gasoline sold in the United States.
Economic: Financial Supports	Electric Infrastructure Loan & Loan Guarantee Program	https://www.rd.usda.gov/programs-services/electric-infrastructure-loan-loan-guarantee-program https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix (ACEP Barriers Report) The Electric Infrastructure Loan and Loan Guarantee Program awards insured loans and loan guarantees to non-profit and cooperative associations, public bodies, corporations, limited liability companies, and utilities. Insured loans are used for financing construction of electric distribution facilities in rural areas
Economic: Financial Supports	RUS Distributed Generation Energy Project Financing	https://www.rd.usda.gov/programs-services/distributed-generation-energy-project-financing https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix (ACEP Barriers Report) The RUS Electric Program can provide loans and loan guarantees to energy project developers for distributed energy projects including renewables that provide wholesale or retail electricity to existing Electric Program borrowers or to rural communities served by other utilities.
Economic: Financial Supports	Denali Commission High Energy Cost Grants	https://www.rd.usda.gov/programs-services/denali-commission-

		high-energy-cost-grants https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix (ACEP Barriers Report) This program assists the Denali Commission in lowering the cost of energy for families and individuals in areas with extremely high per-household energy costs (275% of the national average or higher).
Economic: Financial Supports	Department of Energy Loan Programs Office (LPO)	https://www.energy.gov/lpo/loan-programs-office https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix (ACEP Barriers Report) The mission of LPO is to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale sufficient to contribute meaningfully to the achievement of national clean energy objectives including job creation, reducing dependence on foreign oil, improving the nation's environmental legacy, and enhancing American competitiveness in the global economy
Economic: Financial Supports	AIDEA Sustainable Energy Transmission and Supply Development Fund (SETS)	http://www.aidea.org/Programs/Energy-Development https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix (ACEP Barriers Report)

		Energy development projects that qualify for SETS funding include any project that consists of the transmission, generation, conservation, storage, or distribution of heat or electricity

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APPENDIX D - GREENLAND SUMMARY

Regulatory Structure:

Greenland's main utility, Nukussiorfiit, is owned by the government, but operates as an independent business (Nukissiorfiit, 2019). Nukissiorfiit's prices, sales, and delivery conditions are approved by the Nalakkersuisut, the government of Greenland. Previously, consumers in Greenland paid different prices depending on the cost of production and supply available at their location (Naalakkersuisut, 2017). This pricing model was financed by cross-subsidies within Nukissiorfiit, and saw those in the areas with the lowest average incomes paying the highest prices for electricity and water. Following Naalakkersuisut's suggestion outlined in the 2017 Sector Plan for Energy and Water, a new pricing system was introduced in 2018. Since the uniform price reform in 2018, all consumers have paid the same prices for electricity, water and heat (Nukissiorfiit, 2019).

Ownership Structure:

The ownership structure of a country's utilities plays a role in creating the political environment in which energy systems operate. Whether utilities are public companies, privately owned, or owned by the government will influence how they operate and what their priorities are in terms of new projects and initiatives. It will also influence if and how communities or individuals are able to undertake energy projects of their own.

In Greenland, Nukissiorfiit is the main utility. Nukissiorfiit is owned by the government and functions as an independent business with a focus on the increased use of renewable energy sources and customer-efficient solutions (Nukissiorfiit, 2019). Nukissiorfiit provides electricity, water, and heat for the majority of the country. In the communities of Kangerlussuaq, Narsarsuaq and Kulusuk, energy and water is supplied by Mittarfeqarfiit Greenland Airport (World Wildlife Foundation, 2017).

Table 1: Utility Ownership in Greenland

Utility	*Ownership Structure*	*Role*	*Region Serviced*
Nukissiorfiit	State owned	Production and supply of electricity, water, and heat	17 cities and 52 settlements in Greenland
Mittarfeqarfiit Greenland Airport	State owned	Production and supply of electricity, water, and heat	Kangerlussuaq, Narsarsuaq and Kulusuk

Utility Budget - Nukissiorfiit:

Operating Expenses (million DKK)

2019	2018	2017	2016	2015
371.3	368.8	309.8	302.2	308.8

Operating Grants (million DKK)

2019	2018	2017	2016	2015
0.0	0.0	13.7	24.0	34.4

Leadership

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie. Based on available information on Nukissiorfiit's website and annual reports, it does not appear that the utility has a board of directors. There is also no information on how senior management is hired or appointed. It is also unclear whether Mittarfeqarfiit Greenland Airport has a board of directors that may be responsible for directing their energy supply operations.

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

An important piece of Greenland's policy strategy is the government's Sector Plan for Energy and Water. Published in 2017, the plan sets out the government's priorities for the future of its water and energy systems. The three main objectives outlined in the plan are: by 2030 the public energy supply should come from as many renewable energy sources as possible; ensuring low and uniform prices for electricity and water; and the modernization of the energy system by replacing fossil fuels with renewable energy sources and expanding the hydro power supply (Naalakkersuisut, 2017).

Additionally, following the most recent parliamentary election in 2021, the government released a new Coalition Agreement outlining it's direction for the future. Key points made in the Coalition Agreement include the government's intention to increase green energy production including through the increase of hydro power, and the implementation of the Sustainable Development Goals (Inuit Ataqatigiit, 2021).

Development Priorities:

Greenland's priorities for developing their energy system are primarily focused on the increased use of renewable energy sources. Nukissiorfiit's 2019 Annual Report notes that solar projects were recently established in Kangerluk, Saqqaq, and Qewertaq (Nukissiorfiit, 2019). Further plans for building more solar PV plants are underway in the districts of Nukissiorfiit, Ammassivik, Kapisillit, Ikerasaasuk, Ilima naq, Uummannaq and Ittoqqoqtoormiit. The solar plants at Ilima naq and Ammassivik are expected to include battery storage.

In addition to the continued development of solar projects, Greenland is focused on increasing its hydroelectric capacity. The 2021 Coalition Agreement states that the government intends to establish a new hydro power plant at Qasingiannguit and expand the existing hydro plant

at Nuuk ((Inuit Ataqatigiit, 2021). The government of Greenland intends to use hydropower for electricity, but also plans to use it for the country's heat supply as it becomes feasible (Naalakkersuisut, 2017). Furthermore, in 2017, the government was working to attract energy intensive industries such as mining, data centers, steelworks, and aluminium to the country through targeted market materials and the mapping of large hydroelectric potential on the west coast (Naalakkersuisut, 2017). As a new government has recently come into power in 2021, it is unclear whether increased industrial activity is still among the country's development priorities.

Other objectives outlined in the government's Sector Plan for Energy and Water include:

- Testing the potential for wind, solar, hydrogen, and geothermal energy;
- Increase the use of electric cars;
- Use residual heat from waste incineration plants for district heating;
- Install heat meters in publicly owned rental properties;
- Study the possibility of using heat pumps in the public district heating network;
- Test the potential for storage methods and hybrid systems;
- Increase cooperation with other countries that share Greenland's climate and supply-related challenges (Naalakkersuisut, 2017).

External Communication/Transparency:

The main challenge with accessing information on Greenland's energy system is that there is very little information available in English. The utility annual reports and government documents have to be translated, and some information may be getting lost through that process. Information related to government instruments supporting energy was challenging to find. Some programs identified were only found because they were noted in journal articles, but could not be found through government sources. A good source of information is the government's Sector Plan for Energy and Water, which details the country's overall approach to the energy and water systems.

Government Instruments:

Table 2: Government Instruments Supporting Energy in Greenland

Type of Government Instrument	*Name/Description*	*Source/Further Reading*
Economic: Power Purchase Agreements	Nukissiorfiit allows private producers to sell power back to the grid	WWF Report p.7/8: http://awsassets.wwfdk.panda.org/downloads/Greenland_RE_Report_July_2017_v2.pdf
Economic: Financial Supports	Climate Fund	http://climategreenland.gl/en/citi

		zen/the-climate-pool/ The Climate Fund is managed by the Ministry of Nature and Environment. In 2020 the ministry distributed DKK 400,000 in total. Citizens, businesses, institutions, associations, researchers, municipalities and others can apply for funding for projects that aim to: • Increase knowledge on the effect of climate changes on nature and on society. • Develop strategies for adaptation to climate changes. • Launch pilot projects within adaptation to climate changes. • Develop and disseminate information as well as share knowledge with relevant parties.
Economic: Financial Supports	The Governmental Fund for Renewable Energy Sources and Climate	https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix Unable to find any official information from the government. From Mortensen et al. 2017: The Governmental Fund for Renewable Energy Sources and Climate supports different research projects on solar, wind, and hydro power.
Market: Net Metering	Net Metering	https://drive.google.com/drive/u/0/folders/107sI1QdbN7l1RO6YXyQEBzMs5CMZ8Nix Unable to find any official information from the government.

		Mortensen et al. 2017 notes that Greenland has a net metering program
Economic: Financial Supports	Annual Subsidy/Grant from Danish government	https://www.bbc.com/news/business-51014148 This subsidy totals 3.9bn Danish kroner ($600m; £450m), and provides more than half of the yearly budget of the Greenland government
Economic: Financial Supports	Since January 1, 2014, renewable energy generators may receive a subsidy based on the cost of having to supply the equivalent amount of energy by non-renewable means.	https://archive.nordregio.se/en/Publications/Publications-2016/GREEN-GROWTH-IN-NORDIC-REGIONS-50-ways-to-make-/Clean-tech-and-renewable-energy--/The-f/index.html No further information found on this program other than the mention in the Nordregio article
Political: Energy Planning	Sector Plan for Energy and Water Supply	Naalakkersuisut. (2017). *Sector plan for energy and water supply*.

Key Subsidies:

Electricity Cost Equalization/Price Reform

Prior to 2018, citizens and businesses in Greenland paid different prices for electricity depending on their location (The Ministry of Industry, Labour, Trade, and Energy, 2018). Those living in urban centers with easy access to energy supply paid low prices, while those living in rural areas where production and transportation costs were higher paid higher prices. Following a reform in how electricity prices are set, all customers now pay the same price for electricity regardless of their location in the country. The cost of lower electricity prices through the reform was offset in part by a reduction in the annual construction loans to Nukissiorfiit from the government.

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APPENDIX E - RUSSIA SUMMARY

Regulatory Structure:

Russia's power sector is primarily regulated by the Ministry of Energy. The primary regulations are outlined in the legislation: Federal law No. 35-FZ "On Electric Power", dated 26 March 2003 (Electric Power Law), which provides the general framework for the regulation of the electricity market in Russia; and Federal law No. 36-FZ "On Specifics of Functioning of the Electric Power in the Transitional Period and Amending Certain Legislative Acts of the Russian Federation", dated 26 March 2003, which outlines how the power market should function during the power sector's transition from state control to market regulation (Josefson et al., 2019). Prior to a reform in 2003, the Russian power market consisted of an integrated state monopoly (RAO UES) with fully regulated prices (Josefson et al., 2019). In 2008, a reform saw RAO unbundled into over 20 independent power companies with diversified ownership, triggering the formation of a competitive power market (Josefson et al., 2019). Following this reform, approximately 80% of electric power is now traded at non-regulated market prices (Josefson et al., 2019). The public continues to pay state-regulated prices for electricity, and it is likely that the competitive market will not extend to certain isolated regions of Russia such as the Far East, Kaliningrad, and Arkhangelsk regions (Josefson et al., 2019).

Russia's power market is divided into two segments: wholesale and retail. The wholesale market is reserved for power trade between generating companies and suppliers, as well as some larger end consumers (Josefson et al., 2019). The retail market is where power is sold by suppliers to both industrial and residential consumers. Furthermore, the country is divided into price and non-price zones, as well as isolated zones. The two price zones, in the European-Ural and Siberian zones, electricity prices are unregulated and the market price is determined using locational marginal pricing which takes into account the fuel mix and capacity in different regions (Kristiansen, n.d.). Prices are regulated in non-price and isolated zones. The Federal Tariff Service regulates wholesale tariffs, while regional energy commissions are responsible for regulation within the retail segment (Iakovleva, 2017).

Ownership Structure:

Utility	*Ownership*	*Role*	*Area Serviced*
En+ Group	Public Limited Company	Power generation (primarily hydro) and aluminium manufacturing	Power generation assets located in the Eastern Siberia and Volga regions
Rosseti FGC UES	State Owned/Publicly Traded (State must own 75% plus one share)	Electricity transmission	Unified National Electric Grid, 78 regions of Russian Federation
Enel Russia	Public Company	Electricity and heat generation, sale of electricity and heat, purchase of electricity and heat from the wholesale electricity capacity market	Tver region, Stavropol Territory, Sverdlovsk region, Murmansk region, Rostov region
Fortum	State owned (Finland)	Generation and sales of electricity and heat	Urals and Western Siberia, Ulyanovsk region, Republic of Bashkortostan
Inter RAO	Public Company	Electric power and heat generation, supply business, international power trading, power industry engineering, export of power industry equipment, management of distribution grids outside of Russia	62 regions of Russia
RAO Energy Systems of the East	Public Company	Production and distribution of electric and heat energy, marketing, the development of generation capacity in the Far-East, and the development of alternative energy	Russian Far East

RusHydro	Public Company (Russian government is the largest shareholder)	Generation and transmission of electricity and heat	All over Russia, See map: http://www.rushydro.ru/company/company_geography/
Irkutskenergo	Public Company (En+ Group is the largest shareholder)	Generation and sale of electricity and heat	Irkutsk Oblast
Kuzbassenergo	Public Company	Electric and thermal power generation, electric power transfer, distribution and sales	Kemerovo Region in south-western Siberia
Mosenergo	Public Company	Generation and sale of electricity and heat	City of Moscow and Moscow Region
Gazprom	Public Company (Russian government is the largest shareholder)	Natural gas exploration, production, refining, transport, distribution, power generation	?
Siberian Business Union/SDS-Energo	Private Company. SDS-Energo is a subsidiary of Siberian Business Union, which is owned by Russian billionaire Vladimir Gridin and his sons. Grindin is a politician in the United Russia party	Production, transmission and sale of heat energy, operation of power facilities, transmission of electrical energy	Kemerovo region
T Plus	Private Company (previously public, shares delisted from Moscow Exchange in 2016)	Electricity and heat generation and supply	Vladimir, Kirov, Mordovian, Nihzny, Orenburg, Perm, Samara, Saratov, Sverdlovsk, Udmurt, Ulyanovsk, Komi, Mari El and Chuvashia
TGC-1	Public Company	Electricity and heat generation and supply	St. Petersburg, Leningrad Oblast, Murmansk Oblast, Republic of Karelia
TGC-2	Public Company	production of electrical and thermal energy and the sale of heat (steam and hot water) to	Arkhangelsk, Vologda, Kostroma, Novgorod and Yaroslavl regions

		consumers	
TGC-11	Part of InterRAO (public company)	Production of electricity and thermal energy	Omsk region
Unipro	Public Company (majority shareholder is German company Uniper)	Electric and thermal power generation and sales	Smolensk Region, Moscow Region, Perm Region, Tumen Region, Krasnoyarsk Region
Atomenergoprom	State Owned	Atomenergoprom provides a full production cycle of nuclear power engineering — from uranium production to nuclear power plant construction and energy generation. Atomenergoprom is actively developing the Russian wind power market.	?
Rosatom	State Owned	Nuclear energy, wind energy	?
Mechel (Mechel-Energo OOO)	Public Company	Production of electricity and thermal energy	?
Siberian Coal Energy Company (SUEK)	Private Company	Coal mining, heat and power generation	Siberia and Far East
Chornomornaftogaz	State Owned	Natural gas exploration and production, transport, storage and distribution	?
Lukoil Ecoenergo	Public Company	Generation, transmission, and distribution of heat and electricity	Astrakhan Region, Krasnodar Territory
Quadra	Public Company	Generation of electricity and heat	Belgorod, Voronezh, Kaluga, Kursk, Lipetsk, Orel, Ryazan, Smolensk, Tambov and Tula

			Regions
Yenisei Territorial Generating Company	?	?	?
TGK-14	Public	Generation and sale of heat and electricity	?

Leadership:

Utility	*Board of Directors*
En+ Group	Elected by shareholders
Rosseti FGC UES	Elected by shareholders
Enel Russia	Elected by shareholders
Fortum	Elected by shareholders
Inter RAO	Elected by shareholders
RAO Energy Systems of the East	Elected by shareholders
RusHydro	Elected by shareholders
Irkutskenergo	Elected by shareholders
Kuzbassenergo	?
Mosenergo	Elected by shareholders
Gazprom	Elected by shareholders
Siberian Business Union/SDS-Energo	?
T Plus	?
TGC-1	Elected by shareholders
TGC-2	Elected by shareholders
TGC-11	Elected by shareholders (part of Inter RAO)
Unipro	Elected by shareholders

Atomenergoprom	Elected by shareholders
Rosatom	Governed by a supervisory board whose members are appointed by the president of the Russian Federation
Mechel (Mechel-Energo OOO)	Elected by shareholders
Siberian Coal Energy Company (SUEK)	Elected by shareholders
Chornomornaftogaz	?
Lukoil Ecoenergo	Elected by shareholders
Quadra	Elected by shareholders
Yenisei Territorial Generating Company	?
TGK-14	Elected by shareholders

Utility Budget

Antomenergoprom Cost of Sale (RUB Billion)

2016	2017	2018
461.6	478.4	479.8

En+ Group Cost of Sales (USD Million)

2019	2020
8,873	7,808

Enel Cost of Sales (RUB thousand)

2018	2019
61 615 013	62 254 788

Gazprom Operating Expenses (RUB Billion)

2018	2019	2020
6,181.2	6,387.1	5,665.8

InterRAO Operating Expenses (RUB Million)

2017	2018	2019
812,779	885,785	945,975

Mosenergo Operating Expenses (RUB Million)

2018	2019
172 437	179 290

Quadra Operating Expenses (RUB Million)

2017	2018	2019
46, 708	46,441	49,564

Rosseti Production cost of goods, products and services sold (RUB Thousand)

2018	2019
170 825 202	174 447 368

RusHydro Operating Costs (RUB Billion)

2017	2018	2019
190.5	201.3	215.2

SUEK Cost of Sales (USD Million)

2019	2020
3,507	2,959

TGC-1 Operating Expenses (RUB Million)

2018	2019
77,429	85,599

Unipro Total Costs (RUB Million)

2018	2019	2020
60,149.3	60,149.5	60,507.5

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

A key piece of Russia's policy strategy is the country's *Energy Strategy to 2035.* The strategy outlines the government's vision and priorities for the energy system for the next 15 years (Novak, 2020). The five main goals of the energy strategy are:

- To meet the socioeconomic development needs of the country with products and services from the fuel and energy sectors;
- The development and diversification of exports in the fuel and energy sectors;
- The modernization, development, and increase in the availability of infrastructure;
- Technological independence and increasing the competitiveness of the fuel and energy sectors; and
- The digital transformation of the fuel and energy sector (Novak, 2020).

Within Russia's energy sector several utilities have adopted the United Nations Sustainable Development Goals (SDGs) as a framework for their operations. These utilities include: Enel Russia, Inter RAO, RusHydro, Gazprom, Unipro, and Atomenergoprom. Gazprom has also committed to The Universal Declaration of Human Rights, the International Bill of Human Rights, the Declaration on Fundamental Principles and Rights at Work, the UN Global Compact Principles, the UN Guiding Principles on Business and Human Rights, the UN Convention against Corruption, Principle 15 (precautionary approach) of the Rio Declaration on Environment and Development, the climate and water security programs under the Carbon Disclosure Project, and Recommendations of the Task Force on Climate-related Financial Disclosures (Gazprom, 2020).

Development Priorities:

In developing its energy system, Russia is making a variety of investments in large-scale projects. Utility companies in Russia publish detailed annual reports that provide insight into their recent activities. The main areas of priority in the development of Russia's energy system are:

- The modernization and upgrading of aging infrastructure;
- The development of renewable energy projects, particularly in remote northern regions;
- Construction of new large-scale generation (fossil fuel and hydro);

- Construction of new transmission connecting the Far East and other areas of interest;
- Exports and partnerships with other nations;
- Supporting industrial and economic development (e.g. mines, metals, bitcoin) by constructing new generation and transmission;
- Increasing energy efficiency

External Communication/Transparency:

Russia's utility companies provide a high level of detail in terms of the information they make available to the public. The majority of their websites are easy to navigate, and many have the option to switch to English rather than having to rely on Google Translate. The utilities' annual reports are also generally available in English, and include detailed information on their activities.

On the government side, the accessibility of information is less so compared to the utilities. The Russian government website is somewhat challenging to navigate, and many sections and documents do not have options to translate to English. It was most challenging to find information regarding government instruments supporting energy, as there does not appear to be a centralized location listing government programs and energy policies.

Government Instruments:

Government Instruments Supporting Energy in Russia

Type of Government Instrument	*Name*	*Source/Further Reading*
Economic: Renewable Energy Auction or Tender	Mechanism for the Promotion of Renewable Energy on the Wholesale Electricity and Capacity Market (Decree 449)	https://thelawreviews.co.uk/title/the-renewable-energy-law-review/russia#footnote-017-backlink The main mechanism under Decree 449 for encouraging the use of renewable energy is the conclusion of long-term energy capacity supply agreements with renewable energy source operators. A potential supplier is granted the right to enter into such agreements through a tender procedure conducted by the Trading System Administrator (ATS). Under such an agreement, a supplier will be obliged to create the renewable energy facility within a certain time frame and to

		supply capacity into the Russian energy system. The supplier will be entitled to receive remuneration for its capacity and for the energy it supplies based on 15-year fixed prices.
Economic: Financial Supports	Russian federal budget subsidies	https://thelawreviews.co.uk/title/the-renewable-energy-law-review/russia#footnote-017-backlink In addition to the incentives provided by Decree 449, suppliers are also entitled to apply for subsidies from the Russian federal budget, provided that they meet certain criteria. These subsidies could include reimbursement of costs for the technological connection of the generating facility to the electrical power networks. Such reimbursement currently amounts to up to 50 per cent of technological connection costs but not more than 30 million roubles per generating facility.
Economic: Power Purchase Agreements	Federal Law No. 471-FZ dated 27 December 2019	https://thelawreviews.co.uk/title/the-renewable-energy-law-review/russia#footnote-017-backlink It provides that the owners of micro-scale generation facilities (up to 15kW) may sell any excess electric power produced to retail consumers (in this case, suppliers of last resort) and the latter may not refuse to purchase such electric power.
Economic: Fiscal Incentives	Decree of the Russian Government No. 64 dated 30	https://thelawreviews.co.uk/title/

	January 2019	the-renewable-energy-law-review/russia#footnote-017-backlink During the period between 1 January 2021 and 1 January 2029, any proceeds from selling electric power generated by micro-scale generation facilities will be exempt from personal income tax.
Economic: Financial Supports	Power Plant Modernization Program	https://www.reuters.com/article/us-russia-power-upgrade-idUSKCN1PI1B8 From 2022-2031, will cover 41 gigawatts (one sixth of Russia's existing power plant capacity. 1.9 trillion rubles ($29 billion USD)
Economic: Energy Planning	Energy Strategy to 2035	https://minenergo.gov.ru/node/17492

Key Subsidies:

Cross-subsidization, a means of energy price equalization between different consumers, has been a prominent part of Russia's energy market (Iakovleva, 2017). There are eight types of cross-subsidization based on both technological and social aspects:

- Subsidization of electricity production through the production of thermal energy at combined heat and power plants;
- Subsidization of the costs of providing electric power reserves at the expense of the costs of electricity;
- Subsidization of the costs of providing thermal capacity reserve at the expense of the cost for producing thermal energy;
- Subsidization of socially valuable consumers (voters) on the principle of "everyone at the expense of all";
- Subsidization of remote consumers at the expense of consumers in close proximity to energy source;
- Subsidization of new consumers at the expense of "old" ones; and
- Subsidization of new and energy-saving technologies (Iakovleva, 2017)

Cross-subsidization in Russia is currently being phased out. In 2015, the Russian Federation signed a decree to gradually phase out cross-subsidization in Yakutia, with 95% of the cross-subsidies financed by the federal government initially, but decreasing to zero within 12 years (Iakovleva, 2017).

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Novak, A. (2020). *Alexander Novak's report at a meeting of the Government of the Russian Federation on the issue "On the Draft Energy Strategy for the Period up to 2035" | Ministry of Energy*. Russian Federation Ministry of Energy. https://minenergo.gov.ru/node/17492

APPENDIX F - SVALBARD SUMMARY

Regulatory Structure:

Svalbard's regulatory structure is unclear. It may fall under Norway's system.

Ownership Structure

Table 1: Utility Ownership in Svalbard

Utility	*Ownership*	*Role*	*Area Serviced*
Longyear Energiverk	Municipally owned	Production and supply of electricity and heating	Longyearbyen
Kings Bay	State owned (Norway)	Production and supply of electricity and heating	Ny-Ålesund
Arktikugol	State owned (Russia)	Production and supply of electricity and heating	Barentsburg

Utility Budget:

Table 2: Utility Operating Costs and Grants in Svalbard 2020 (million NOK)

Utility	*Operating Costs*	*Operating Grants*
Kings Bay	71.6	39.5
Arktikugol	Information unavailable	Information unavailable
Longyear Energiverk	Information unavailable	Information unavailable

Leadership

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie. There is limited information available regarding boards of directors for utilities operating in Svalbard. There is no information available indicating whether Longyear Energiverk has a board of directors.

According to annual reports, Kings Bay has a board of directors, but there is no information available indicating how the board is appointed or elected. There is no information available indicating whether Arktikugol has a board of directors.

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

Svalbard falls under Norweigian jurisdiction, thus many of Norway's laws and policies apply. There is currently a lack of information regarding what overarching policies are guiding the direction of energy in Svalbard, but the Norweigian government has stated that its state budget for 2022 will include an energy plan for Svalbard (Government of Norway, 2021). This plan will likely outline the future of Svalbard's energy system.

Development Priorities:

Information regarding the priorities for developing Svalbard's energy system is limited. A key change coming in the near future is the Norweigian government's plan to shut down the 10mW coal fired heat and power plant in Longyearbyen within the next two to five years (Walstad, 2021). The plant supplies electricity and heating for the community of Longyearbyen, so plans will need to be made regarding replacement energy sources. The Norweigian government has stated that its state budget for 2022 will include an energy plan for Svalbard, and that it is considering both fossil fuels and renewable alternatives to the coal plant in Longyearbyen (Government of Norway, 2021). Conversely, there are no indications that the Russian-owned Arktikugol has plans to close its coal mine and power plant in Barentsburg (Walstad, 2021).

A number of small-scale solar and wind energy projects have been implemented in Svalbard in recent years. With 100 000 NOK in funding from the Svalbard Environmental Protection Fund, the tourism company Svalbard Husky installed two 100W windmills and a battery bank in 2012 (Nordregio, n.d.) Other projects that received unknown amounts of funding saw solar panels installed on the roof of two apartment buildings in Longyearbyen, and six solar panels installed on a satellite reference station in 2015. Also in 2015, 18 solar panels were installed at Svalbard's airport. In 2016, an additional 56 solar panels were installed at the airport. Expansions continued and another 430 solar panels, each producing from 265 to 330 watts of power were installed in 2017.

On the utility side, there is little information and no annual reports available detailing the recent activities of Longyear Energiverk or Arktikugol. Kings Bay, which provides electricity and

heating in Ny-Ålesund, notes in it's 2020 Annual Report that it's priorities include monitoring emissions from power production in order to reduce fuel consumption, and future upgrades to ensure the production of electricity and heat becomes more sustainable and has increased redundancy (Kings Bay, 2020).

External Communications/Transparency:

Information regarding Svalbard's energy system exists but detail is lacking in some areas. On the utility side, companies' websites are not easily navigable and do not include detail on their activities. On the government side, Svalbard's website consists primarily of information related to tourism. Additionally, the Norwegian government's website is difficult to navigate and much of its information and documents are not available in English.

Government Instruments:

Government Instruments Supporting Energy in Svalbard

Type of Government Instrument	*Name*	*Source/Further Reading*
Economic: Financial Supports	Svalbard Environmental Protection Fund	https://www.regjeringen.no/en/dokumenter/grants-svalbard-envrionment-fund/id750407/ https://nordregioprojects.org/carbon-neutral-islands/archipelago-of-svalbard-the-place-of-solar-and-wind-energy-in-norway/ In order to try renewable energy solutions, Svalbard received funding from Svalbard Environmental Protection Fund for several initiatives

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APPENDIX G - FAROE ISLANDS SUMMARY

Regulatory Structure:

The sole utility responsible for the energy system in the Faroe Islands is SEV. In addition to providing electricity production, transmission, and supply, SEV also has oversight over the system's production security, load balancing, and quality assurance (Government of the Faroe Islands Ministry of Trade and Industry, 2011). Such oversight is typically the responsibility of government authorities, but this is not the case in the Faroe Islands.

Ownership Structure:

The ownership structure of a country's utilities plays a role in creating the political environment in which energy systems operate. Whether utilities are public companies, privately owned, or owned by the government will influence how they operate and what their priorities are in terms of new projects and initiatives. It will also influence if and how communities or individuals are able to undertake energy projects of their own.

In the Faroe Islands, one utility has the sole responsibility for the power supply system (SEV, 2020). SEV is owned by all the municipalities in the Faroe Islands. It has been noted that the current structure of SEV may be a barrier to the rapid development of renewable energy sources, as municipal interests may conflict with the interests of SEV as a utility (Government of the Faroe Islands Ministry of Trade and Industry, 2011).

Utility Budget

SEV Total Expenses (DKK Millions)

2019	2020
282.6	307.6

Leadership:

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie

SEV's board of directors is elected at the Annual General Meeting. The board consists of one member and one alternate member for each region in the country.

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

The policy strategy of the Faroe islands is centered around the reduction of fossil fuel usage. In 2009, the government introduced the Climate Change Policy for the Faroe Islands (Government of the Faroe Islands Ministry of Trade and Industry, 2011). The goals of the policy are to reduce reliance on oil and to increase the use of renewable energy sources. Furthermore, in 2011, the government released its Comprehensive Plan for Electric Energy in the Faroe Islands. This plan identifies the future development priorities for the country's energy system.

Development Focus:

In terms of the energy system in the Faroe Islands, the primary focus is currently on increasing the use of renewable energy sources in order to reduce reliance on fossil fuels. SEV, the utility, has set a goal of achieving 100% renewable energy production by 2030 (Government of the Faroe Islands, n.d.). The country is planning to transition to renewable energy sources for both the heating and transportation sectors. To do so, the Faroe Islands are undertaking projects related to wind and tidal energy as well as pumped storage (Government of the Faroe Islands Ministry of Trade and Industry, 2011; SEV, 2020). There is also interest in potentially connecting the Faroe Islands to the Icelandic or European grids (Government of the Faroe Islands Ministry of Trade and Industry, 2011).

External Communications/Transparency:

As there is only one utility within the energy sector in the Faroe Islands, it is fairly easy to find information on its activities. SEV's annual reports are detailed and are available in english. The government's website is also available in english, but does not have as much information that is easy to find, especially regarding government instruments supporting energy.

Government Instruments:

Government Instruments Supporting Energy in the Faroe Islands

Type of Government Instrument	*Name*	*Source/Further Reading*
Economic: Fiscal Incentives	Tax rebate for electric, hydrogen, hybrid cars or heat pumps	https://www.taks.fo/en/individuals/tax/reclaim-vat-on-purchase-of-electric-or-hydrogen-cars-and-for-heat-pump-systems/
Economic: Power Purchase Agreements	SEV and Minesto Tidal PPA	https://minesto.com/projects/faroe-islands -In November 2018, Minesto signed a collaboration agreement with the main power generator and distributor on the Faroe Islands, SEV, for the installation, commissioning and operation of two grid-connected units of Minesto's DG100 model, part of the company's unique subsea kite technology called Deep Green. The agreement also includes a power purchase agreement through which SEV commits to purchase the electricity generated by Minesto's tidal energy converters.
Political: Energy Planning	Comprehensive Plan for Electric Energy in the Faroe Islands	Comprehensive Plan for Electric Energy in the Faroe Islands (PDF download)

References:

Government of the Faroe Islands Ministry of Trade and Industry. (2011). *Comprehensive Plan for Electric Energy in the Faroe Islands*.

Government of the Faroe Islands. (n.d.). *Faroese Energy - On the Sustainability Track*. Government of Faroe Islands. Retrieved July 8, 2021, from https://www.faroeislands.fo/economy-business/energy/

SEV. (2020). *SEV Annual Report - 5 Renewable Energy Sources Fed the Grid in 2020*. www.sev.fo

APPENDIX H - ICELAND SUMMARY

Regulatory Structure:

Orkustofnun, a government agency under the Ministry of Industries and Innovation, is responsible for the regulation of the electrical transmission and distribution system in Iceland (ORKUSTOFNUN National Energy Authority, n.d.a). Orkustofnun's responsibilities include supervision of transmission and distribution enterprises, the regulation of income caps, tariffs, and ensuring the quality and security of the supply (Olafsson et al., 2011). Orkustofnun ensures compliance with the Electricity Act, which sets out the regulations for the electricity sector in Iceland. Under the Electricity

Act, Iceland's electricity market was opened for competition in 2006 with the goal of creating an economical electricity system and strengthening Icelandic industry and local development.

Ownership Structure:

The ownership structure of a country's utilities plays a role in creating the political environment in which energy systems operate. Whether utilities are public companies, privately owned, or owned by the government will influence how they operate and what their priorities are in terms of new projects and initiatives. It will also influence if and how communities or individuals are able to undertake energy projects of their own.

As seen in Table 1, utilities in Iceland are owned by the state, municipalities, and private companies.

Table 1: Utility Ownership in Iceland

Utility	Ownership Structure	Utility Role	Area Serviced
Lansvirkjun	Jointly owned by the State Treasury and Eignarhulutir ehfr. (state owns 99.9%)	Electricity generation	Five main areas (can't figure out what they are)
RARIK	State-owned	Distrubution (primarily rural), operation of geothermal plants and district heating systems	Iceland
Landsnet	Public company	Transmission system operator	Iceland
Orkuveita Reykyjavikur/Reykjavik Energy	Municipally-owned	Generation of electricity and geothermal heat	20 communities in south-west Iceland (including Reykjavik)
Veitur	Public company	Generation and distribution of electricity and hot water (geothermal)	Reykjavik, south and west Iceland
Orkulsan	Not clear, I think privately-owned	Electricity supply	Iceland

Leadership:

Though difficult to quantify, leadership can play a significant role in the direction of energy. Considering leadership through the lens of utility companies, the board of directors can provide some insight, particularly in terms of how they are appointed, as this may reflect where their priorities lie

Table 2: Utility Leadership in Iceland

Utility	Board of Directors
Lansvirkjun	Appointed by Minister of Finance
RARIK	Elected at Annual General Meeting, not clear by who*
Landsnet	Appointed, not clear by who
Orkuveita Reykyjavikur/Reykjavik Energy	Chosen by councils of municipalities that own the company
Veitur	Elected by shareholders
Orkulsan	?

*Interestingly, while RARIK is owned by the state, it is run as an independent company with the Minister of Finance managing the state's share in the company (RARIK, n.d.).

<u>Utility Budget:</u>

Orkuveita Reykyjavikur/Reykjavik Energy Annual Expenses (ISK Millions)

2016	2017	2018	2019	2020
16.062	17.285	17.299	18.398	19.172

Lansvirkjun Operating Expenses (USD thousands)

2020
256.181

RARIK Operating Expenses (ISK Millions)

2016	2017	2018	2019	2020
11.399	11.884	13.022	13.276	13.470

Landsnet General Operating Expenses (USD thousands)

2016	2017	2018	2019
30,011	34,678	36,911	36,840

Veitur Total Operating Costs (ISK thousands)

2019	2020
15,249.528	16,069.860

Policy Strategy:

Overarching policies or frameworks can guide the direction of energy. A country's policy strategy can influence the direction of government programs and policies, as well as the direction of activities undertaken by utility companies and communities. Similar to ownership structure, a country's policy strategy helps to form the political environment in which energy systems operate.

The policy strategy guiding Iceland's energy direction consists of overarching frameworks at both the government and utility levels. In 2006, Iceland's government established the Energy Agency, which is supported by the European Union and run by a management board (ORKUSTOFNUN National Energy Authority, n.d.b). The main objectives of the Energy Agency are to provide customers and public authorities with information in the fields of energy; to promote rational use of energy for space heating with emphasis on areas where geothermal energy is limited; to create and introduce education material for schools and consumers; to help small and medium sized companies and municipalities to plan strategies for facilitating energy efficiency; and to promote the reduction of fossil fuel use in the transportation sector.

Furthermore, the Icelandic government's long term energy strategy: *A Sustainable Future An Energy Policy to the Year 2050* outlines the country's overarching goals for its energy system. With the objective of protecting the interests of both current and future generations, the strategy is built upon the need to balance economic, social, and environmental factors (Government of Iceland, 2020). The strategy states that Iceland will achieve carbon neutrality by 2040, and that by 2050 all fossil fuels will have been replaced by renewable energy sources.

Development Focus:

The current focus areas of Iceland's energy development include a renewal of the distribution system, knowledge sharing related to geothermal energy, and the divestment from fossil fuels. RARIK, the utility operating Iceland's largest electricity distribution system, is currently in the process of replacing all overhead lines with ones underground (RARIK, 2021). Approximately 70% of RARIK's

distribution system has been transitioned to underground lines thus far, with the goal of completing the entire system in the near future.

Iceland relies on geothermal energy more than any other country (Holdmann, 2016). Harnessing their expertise in this sector, a key focus of Iceland's energy development is related to sharing knowledge with people and institutions from around the world. The United Nations University Geothermal Training Program (UNU-GTP) which operates through the Icelandic National Energy Authority in partnership with the United Nations University in Tokyo is a 6-month fellowship program open to scientists and engineers from developing countries who go on to implement geothermal technology in their home countries (ORKUSTOFNUN National Energy Authority, n.d.b.; Holdmann, 2016). In addition to knowledge sharing through education programs like the UNU-GTP, Icelandic experts also participate in geothermal projects around the world, including in the United States, China, Indonesia, the Philippines, Germany, Hungary, Djibouti, Eritrea, Nicaragua, and El Salvador (ORKUSTOFNUN National Energy Authority, n.d.c).

In addition to transitioning to an underground distribution network and sharing geothermal expertise with the world, Iceland is also focused on transitioning off fossil fuels completely. As noted in the government of Iceland's *A Sustainable Future An Energy Policy to the Year 2050,* all fossil fuels used in the country will be replaced by renewable energy sources by 2050 (Government of Iceland, 2020). This is therefore an area of priority for the country's energy development.

External Communications/Transparency:

Information from the utilities in Iceland is easily accessible, but the annual reports are somewhat vague in terms of their specific activities. The government's website is also fairly accessible, but some sections and documents are not available in english.

Government Instruments:

Government Instruments Supporting Energy in Iceland

Type of Government Instrument	*Name*	*Source/Further Reading*
Economic: Financial Supports	National Energy Fund	http://www.res-legal.eu/search-by-country/iceland/single/s/res-e/t/promotion/aid/subsidy-national-energy-fund/lastp/369/ -The state-owned National Energy Fund grants subsidies for measures that aim to reduce the use of fossil fuels. Among other

		aims, it supports the exploitation of domestic energy sources instead of fossil fuels -The National Energy Fund offers grants to promote the exploitation of domestic energy sources, among others renewable energy sources, but especially geothermal energy -Grants shall not exceed 50% of the estimated costs of a given project
Economic: Financial Supports	Cost Equalization Program	https://www.stjornarradid.is/media/atvinnuvegaraduneyti-media/media/Acrobat/Jardhitabaklingur.final.pdf -Equalization of energy prices is a decades old Icelandic policy. This policy has been carried out in various ways, such as paying subsidies to those who heat their homes with oil. Families using electricity to heat their homes have also received government subsidies, since 1982 (Fig. 6). In 2002, a new Act on Subsidies was approved. These subsidies now amount to about $15 million per year, and a small part of that goes to lowering the cost of oil where no other means of heating homes are available. The cost of heating is not solely determined by energy prices. Houses differ in their condition, especially older houses, with regards to things like insulation and the control of heating systems. The needs and habits of the inhabitants differ. Therefore the cost of heating two homes of equal size in the same district might vary considerably. The solution for high heating bills might very well be home

		improvements, or implementing energy saving strategies. The government encourages such improvements to reduce subsidies
Economic: Financial Supports	Landsvirkjun Energy Research Fund	https://www.landsvirkjun.com/energy-research-fund -Goal is to strengthen research in the fields of environmental and energy affairs and to award grants to students, university research projects, institutions, companies and individuals researching these areas
Political: Energy Planning	Parliamentary Resolution – 31/5 2017 Energy Transition – Action Plan Valid until 2030	https://orkustofnun.is/media/radstefna-med-iea-feb-2o18/Icelandic-Energy-Policy--GAJ-0218.pdf -Revisited every fifth year
Political: Energy Planning	A Sustainable Energy Future An Energy Policy to the year 2050	https://www.stjornarradid.is/lisalib/getfile.aspx?itemid=e36477fd-3bc1-11eb-8129-005056bc8c60
Social: Capacity Building	The United Nations University Geothermal Training Program (UNU-GTP)	https://nea.is/the-national-energy-authority/
Market: Grid Services	Landsnet Tariff for the Transmission of Electricity and Ancillary Services	https://www.landsnet.is/library/Vidskipti/Gjaldskra/Gjaldskra-landsnets-2018/Tariff%20for%20the%20Transmission%20of%20Electricity%20and%20Ancillary%20Services%20no%2027%20April%201st%202018.pdf

		This tariff applies to the transmission of electricity through Landsnet's transmission system. The tariff also applies to producers connected to Landsnet's transmission system through a distribution system.

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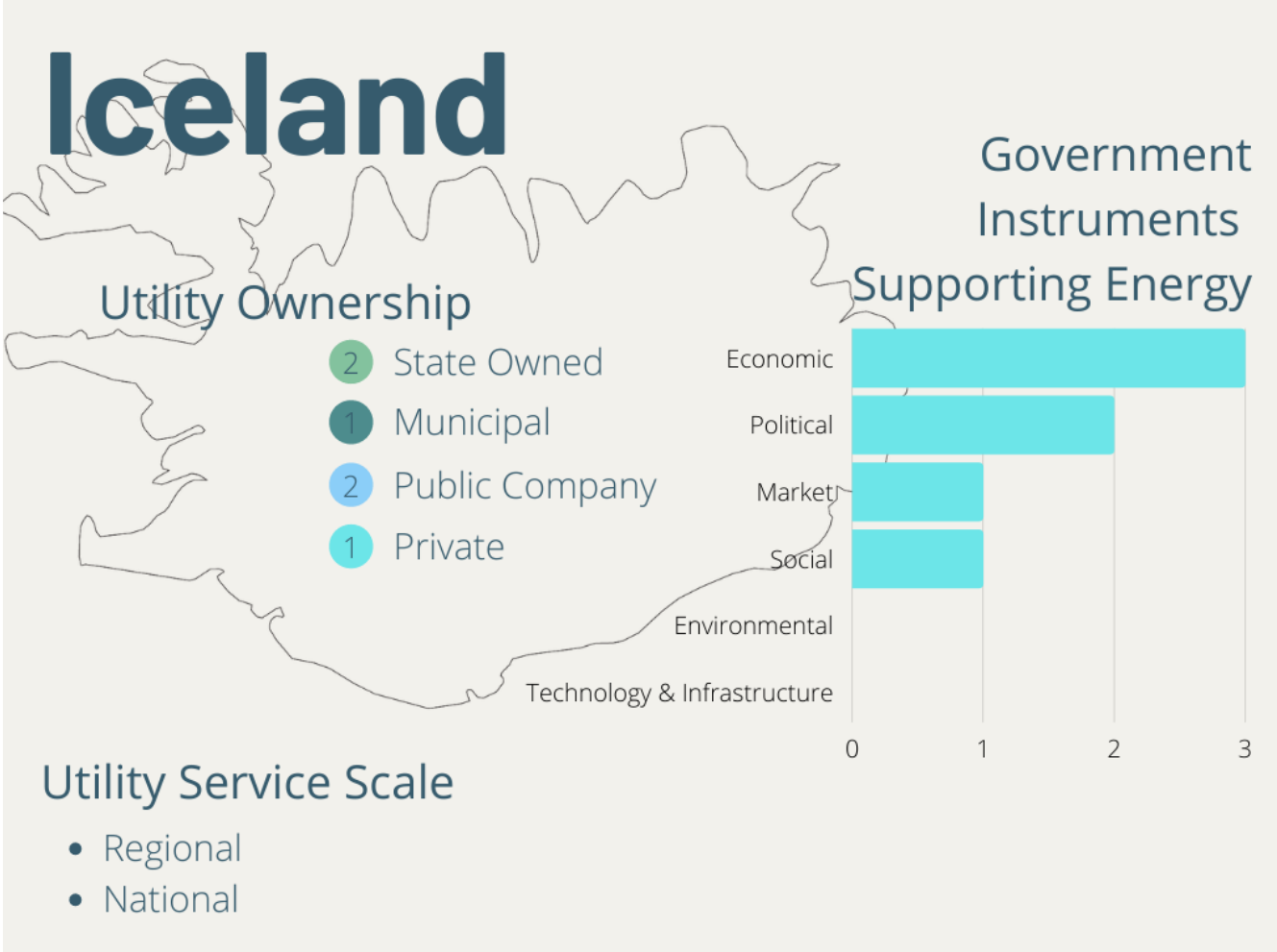
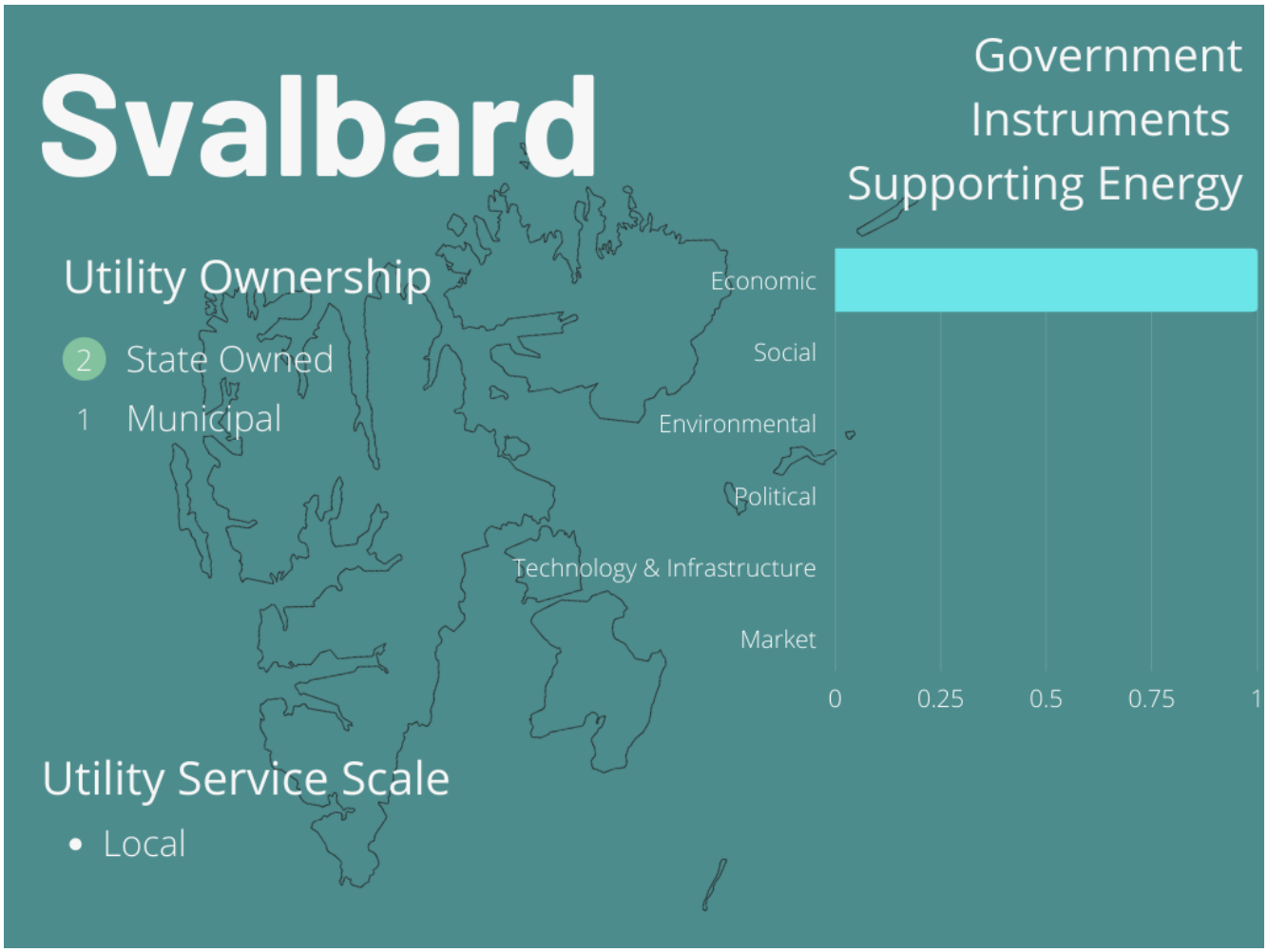
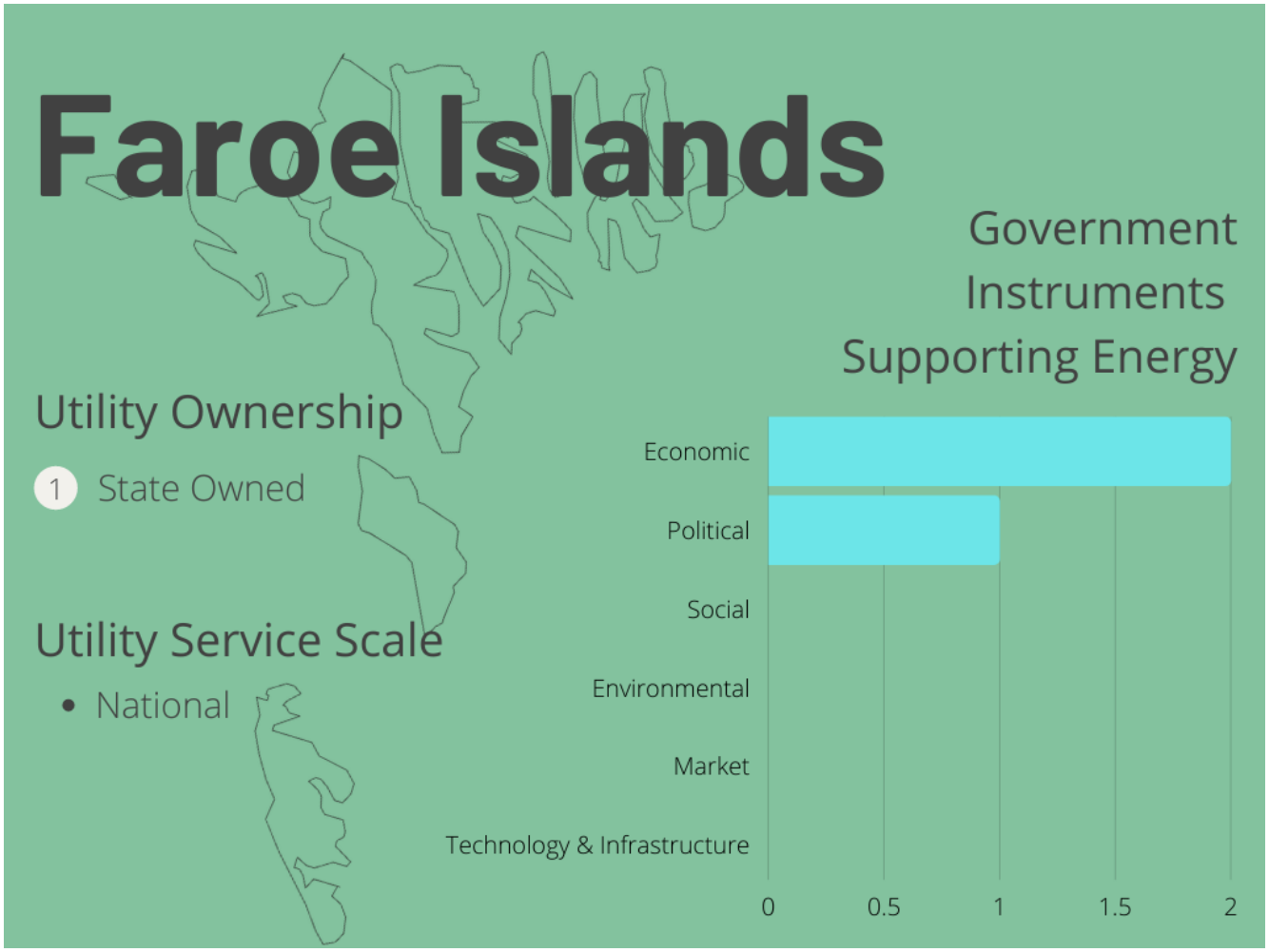
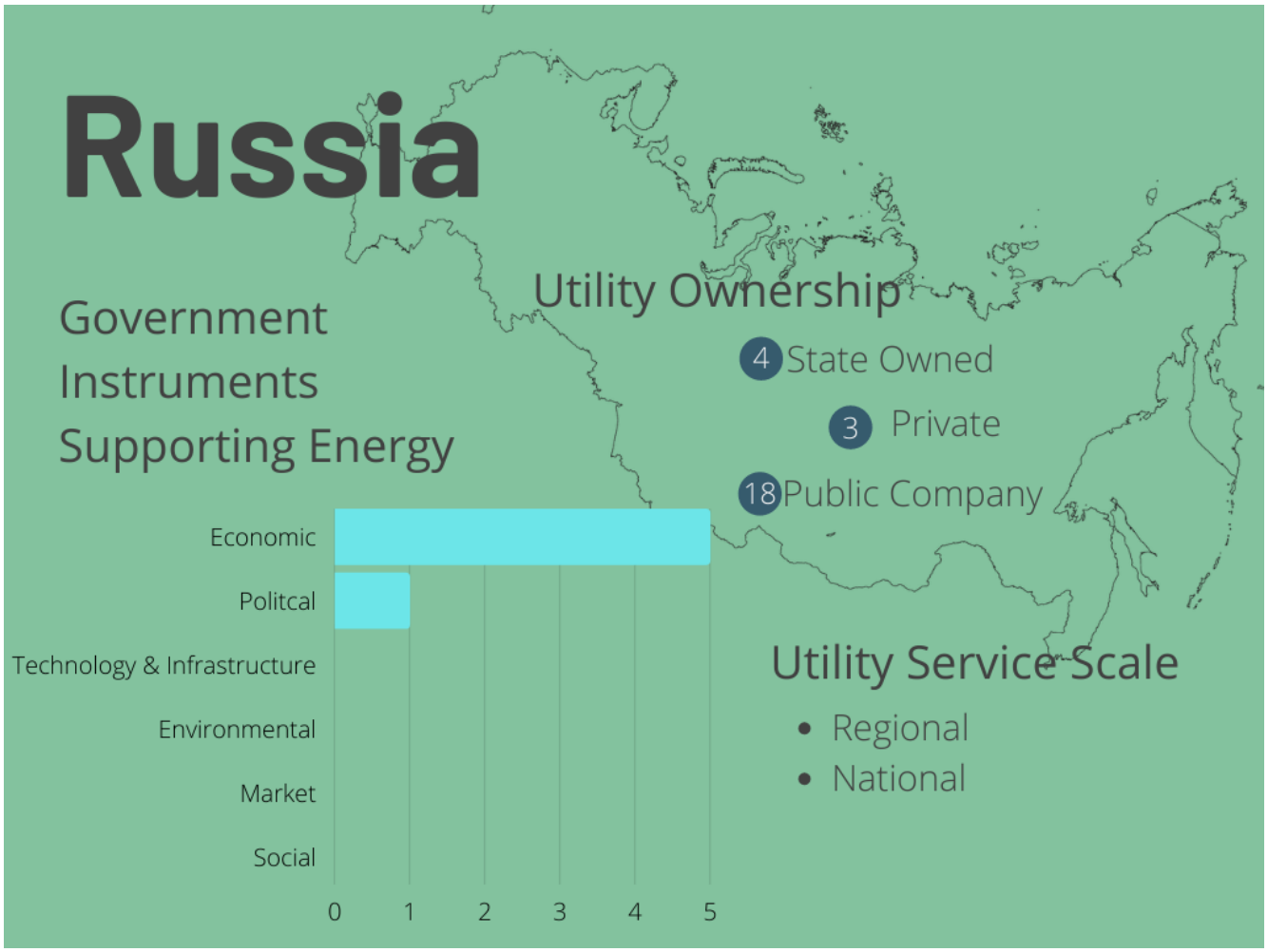
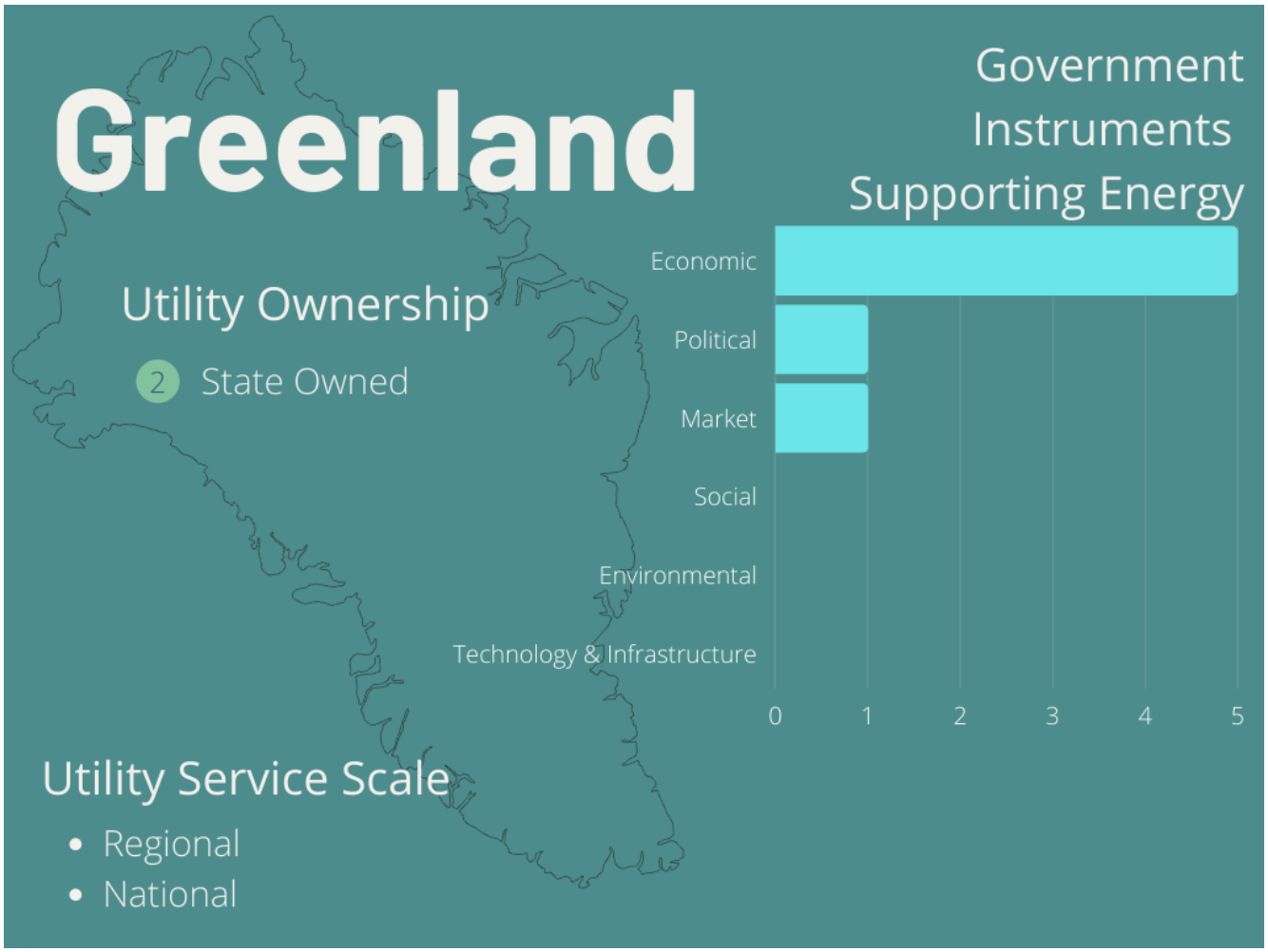
APPENDIX I - ADDITIONAL FIGURES

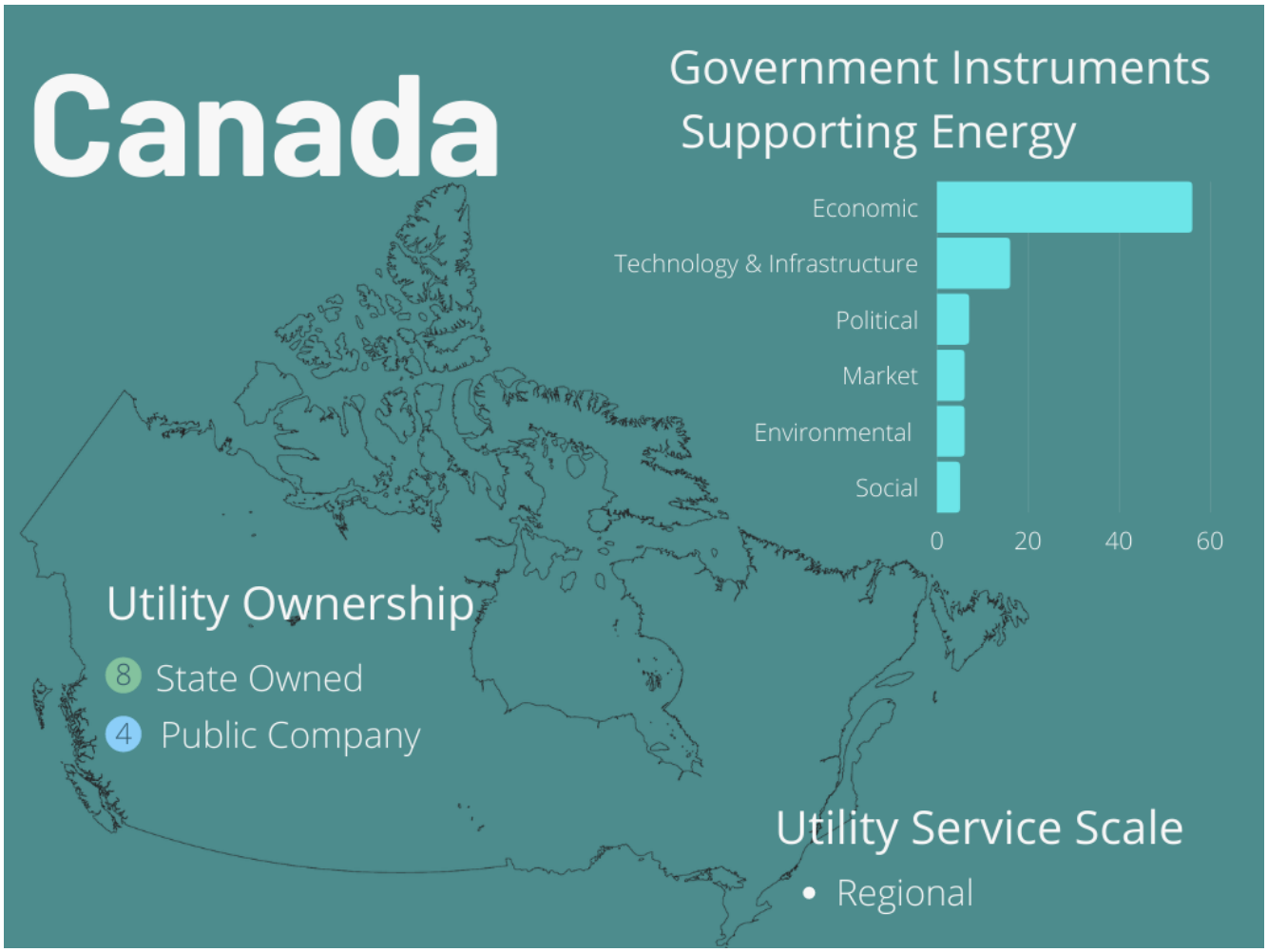


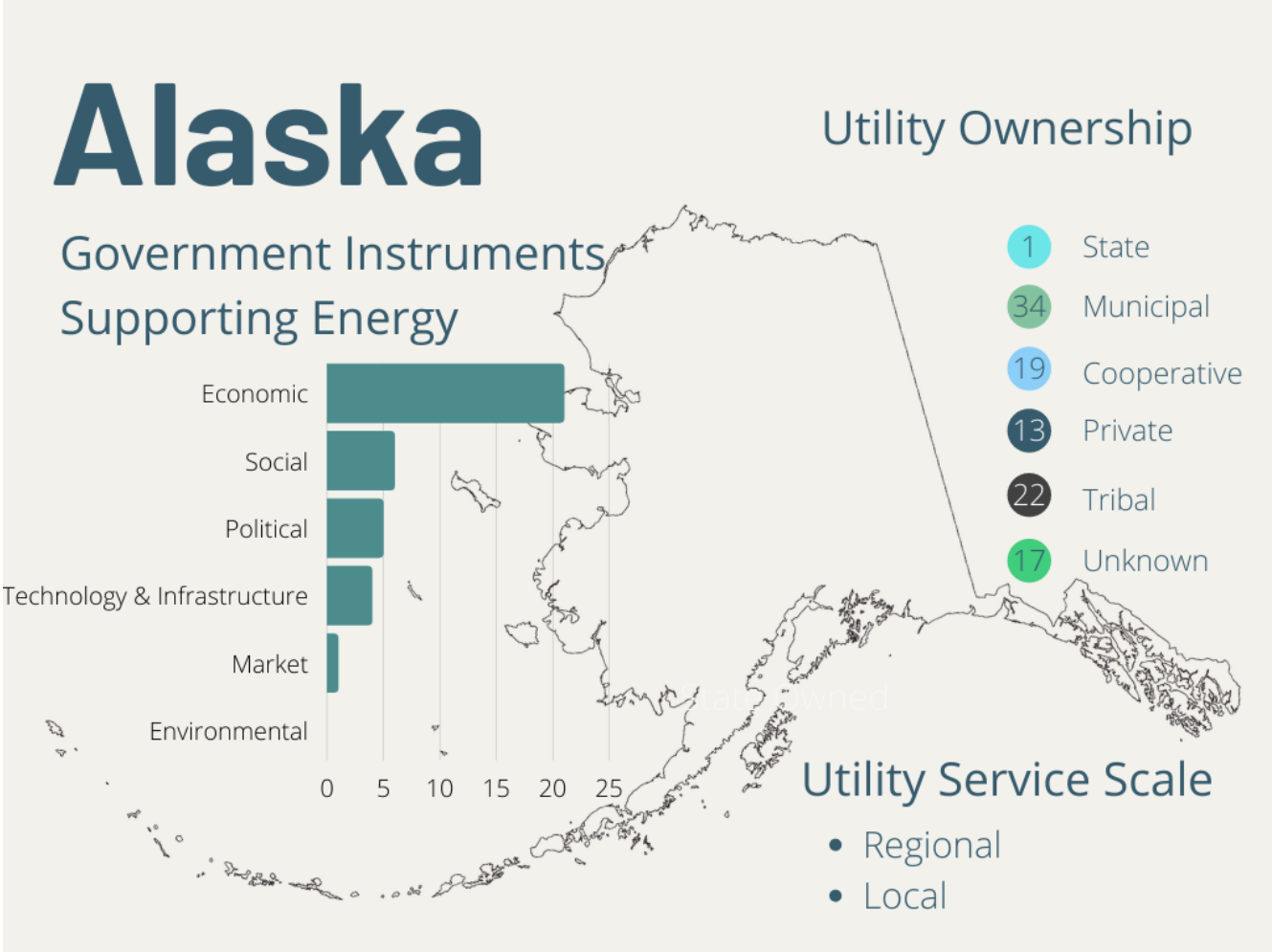

Svalbard
Government Instruments Supporting Energy
Utility Ownership
2 State Owned
1 Municipal
Economic
Social
Environmental
Political
Technology & Infrastructure
Market
0
0.25
0.5
0.75
1
Utility Service Scale
• Local


Faroe Islands
Government Instruments Supporting Energy
Utility Ownership
1 State Owned
Utility Service Scale
• National
Economic
Political
Social
Environmental
Market
Technology & Infrastructure
0
0.5
1
1.5
2


Russia
Utility Ownership
4 State Owned
3 Private
18 Public Company
Government Instruments Supporting Energy
Economic
Politcal
Technology & Infrastructure
Environmental
Market
Social
0
1
2
3
4
5
Utility Service Scale
Regional
National


Greenland
Government Instruments Supporting Energy
Economic
Political
Market
Social
Environmental
Technology & Infrastructure
0
1
2
3
4
5
Utility Ownership
2 State Owned
Utility Service Scale
• Regional
• National


Canada
Government Instruments Supporting Energy
Economic
Technology & Infrastructure
Political
Market
Environmental
Social
0
20
40
60
Utility Ownership
8 State Owned
4 Public Company
Utility Service Scale
• Regional


Alaska
Utility Ownership
1 State
34 Municipal
19 Cooperative
13 Private
22 Tribal
17 Unknown
Government Instruments Supporting Energy
Economic
Social
Political
Technology & Infrastructure
Market
Environmental
0 5 10 15 20 25
Utility Service Scale
Regional
Local

APPENDIX J - REMAINING TASKS:

Task	*Possible Data Source*	*Projected Timeframe*
Utility Budgets - Collect data from Alaska	Regulatory Commission of Alaska	1 Week
Utility Budgets - Convert data to common currency (USD?) for comparison	Utility budgets that could be found are in the country summaries. If additional utilities are found this data is usually in the annual report/financial statement	2-3 hours
Regulatory Structure - Svalbard	Government of Norway (I couldn't find any clear information)	Unsure
Utility Ownership - Alaska	https://docs.google.com/spreadsheets/d/16rma1AWy_UHcPf5BqSjt1Nnj6sS57_xfojYkYIZEtZE/edit#gid=0 Data from Rob Jordan can be used to fill in the table in the Alaska summary	2-3 days
Utility Leadership - Alaska	Contact the utilities to find out if they have boards of directors and how they are elected/appointed	Unsure, will depend on responsiveness from utilities
Subsidies - Further research for Canada and Russia	Unsure, probably government	Unsure, probably several weeks
Policy Strategy - Analysis according to SDGs	Unsure, look for literature that breaks down the SDGs for analyzing energy policy (maybe in Africa?)	Unsure, probably a couple weeks depending on availability of existing literature
Regulatory Structure - Further Research	Regulatory commission websites to find information on term length and appointment processes	1 week
Figure - Area Served by Utilities	Use population data and service area of utilities as a way to compare scale and capacity of utilities in different areas	Not sure how long it will take to get the data, but making the figure will be easy