GOVERNMENT INSTRUMENTS AND COMMUNITY ENERGY: ADVANCING ENERGY TRANSITION IN NORTHERN AND INDIGENOUS COMMUNITIES

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By

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ABSTRACT

Energy transition is considered to be one of the greatest solutions to climate change, given that the adoption of renewable energy reduces drastically the amount of greenhouse gas emissions. Renewable energy can also address energy security problems, especially when combined with local ownership. For example, community energy, that is, renewable energy projects with community ownership or participation, is one of the alternatives to the limited, unreliable and expensive power generation scenario of northern and Indigenous communities in Canada. The implementation of community energy, however, depends on supportive government instruments, such as energy policies and regulations. Nevertheless, there is limited research on the nature and implications of these instruments for enabling community energy, especially in the context of northern and Indigenous communities. Thus, this research explores role of government instruments in facilitating energy transition and renewable energy development in northern and Indigenous communities. To do so, this research explores the current emphasis of scholarly research on government instruments for community energy, and identifies the government instruments supporting or hindering community energy in northern and Indigenous communities in Canada. The results show that there are multiple instruments available to support community energy, and emphasizes the importance of coordination and complementarity between the levels of government and between government instruments. The findings also emphasize the importance of localized government instruments to offer equitable and meaningful opportunities for community-owned renewable energy projects in northern and Indigenous communities.

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Two years ago, I could not tell how passionate I would be about this project and this new research field. I feel incredibly grateful to have worked on CASES project with outstanding colleagues and excellent professors.

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LIST OF ABBREVIATIONS

CE	Community energy
FIP	Feed-in Premium
FIT	Feed-in Tariffs
FNPA	First Nation Power Authority
GHG	Greenhouse gases
IPP	Independent Power Producer
ISC	Indigenous Services Canada
NGO	Non-governmental organization
NTPC	Northwest Territories Power Corporation
NWT	Northwest Territories
PPA	Power Purchase Agreements
REACHE	Responsible Energy Approach for Community Heat and Electricity
REC	Renewable Energy Certificates
RPS	Renewable Portfolio Standard

SEIS	Seed Enterprise Investment Scheme
UK	United Kingdom

CHAPTER 1 – INTRODUCTION

Climate change is a reality: the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea levels have risen as never seen before [1]. Northern and Indigenous communities are at high risk from the adverse impacts of climate change. In Alaska, for example, Indigenous communities are migrating because of accelerated coastal erosion and flooding [2]. In northern Canada, the availability of traditional food sources are at risk [3] and infrastructure is collapsing under thawing permafrost conditions [4]. Impacts to housing, cultural sites, and water quality are also expected [5]. To prevent the aggravation of climate change, the Paris Agreement was signed in 2015 to set the goal of keeping global temperature rise well below 2 degrees Celsius above pre-industrial levels, and limiting the temperature increases even further to 1.5 degrees Celsius [6]. To meet these targets, a set of mitigation and sustainable development measures are being implemented by several countries. One of the key measures is the adoption and implementation of renewable energy technologies to curb global greenhouse gas emissions.

The push for energy transition, however, is not limited to mitigating the impacts of climate change. The pursuit of renewable energy resources can also contribute to economic growth [7–9], job creation [10,11], improve air quality [12,13], and – especially in the case of northern and Indigenous – increase energy security and combat energy poverty [14–16]. Many Northern and Indigenous communities rely on diesel generators and on an aging energy infrastructure to meet their daily energy needs [17,18]. These communities often experience high energy costs, unreliable fuel supplies, and increasing energy insecurity [19]. Drastic fluctuations in crude oil prices play out at the local level, impacting directly the seasonal cost of fuel used in diesel generators. As a result, electricity costs in remote communities, where the fuel is imported only once or twice a year, can be locked-in to high prices for extended periods of time [19]. These communities are also rarely the owners of the means of energy generation, and depend on the services provided by corporations located in regions far from their communities. Consequently, if there is a power outage in the middle of the winter, there are high chances that the northern community will need to wait for a few hours – or even days – to resolve the problem [20]

Renewable energy also has the potential to offer decentralized solutions, creating opportunities for local ownership and alleviating energy insecurity. Renewable energy technologies allow the decentralization of infrastructure, offering power generation close to where power is used [21], and can also decentralize energy ownership, meaning that the ownership of energy

infrastructure is also in the hands of community groups and local authorities [22]. This can enable the development of community energy – energy projects with a degree of public ownership or participation – a generation model that can offer several local benefits [23,24]. Some of the benefits include the development of more reliable sources of energy [24,25], lower energy generation costs [26,27]. While community energy benefits are of major importance to communities of interest (i.e. groups of people which share a similar interest) [28,29], such benefits are critical to communities of place (i.e. communities defined by its geographic place [30]), such as Indigenous communities. For example, community energy in Indigenous communities can promote local control and encouragement of energy sovereignty [24,25], and support processes of reconciliation with Indigenous peoples [31,32]. There is a growing literature on renewable energy transitions, often emphasizing a high degree of community ownership or participation [27,33–35]. Transitions are defined as "processes of structural change in major societal subsystems and involve a shift in the dominant 'rules of the game', a transformation of established technologies and societal practices, movement from one dynamic equilibrium to another" [36]. Much of this research has focused on transition pathways [37–39], explaining how energy innovations occur and the multiple actors involved in the transition. However, there is also increasing recognition of the need to better understand the role of formal institutional arrangements in community-based energy transitions, as institutions and their formal policies and rules play an important role in shaping energy transitions [40–42].

Political institutions shape actor's behaviour using a set of different institutional constraints. Lowndes and Roberts [43] identify three modes of institutional constraints: rules, practices and narratives. The rules, or formal constraints, represent formally constructed and written rules, such as "clauses in a constitution, terms of reference for an assembly, national and international laws, and a vast panoply of standards, regulations, protocols, and policies" [43]. The informal constraints, include the practices demonstrated through conduct and the narratives expressed through the spoken word [43]. Practices and narratives, the informal constraints, often emerge in the literature as a key to local energy transitions, specially while discussing the importance of grassroot initiatives [44,45]. However, the role of formal constraints, here referred to as *government instruments*, to advance community-based energy transitions is poorly understood in the emerging literature.

1.1 RESEARCH PURPOSE

The development of community energy in northern and Indigenous regions hinges in part on supportive government instruments [46,47]. Despite the importance of government instruments in enabling energy transition [48,49], there is limited research on the nature and implications of these instruments for enabling community energy, especially in the context of northern and Indigenous communities. Thus, the overall purpose of this research is to explore the nature and role of government instruments in facilitating energy transition and renewable energy development in northern and Indigenous communities. To do so, the research address three main objectives. First, it explores the current emphasis of scholarly research on government instruments for community energy and identifies key lessons and recommendations. Second, it identifies the government instruments supporting or hindering community energy in northern and Indigenous communities in Canada, specifically the Northwest Territories, northern Manitoba, and northern Saskatchewan. Third, it identifies key opportunities and research directions for government instruments to advance community energy.

1.2 RESEARCH APPROACH

To address the three research objectives a qualitative approach was adopted, comprised of a structured analysis of the peer-reviewed literature and semi-structured interviews (**Error! R eference source not found.**). First, a structured analysis of the peer-reviewed literature was conducted to explore the current emphasis of scholarly research on government instruments for community energy. The Scopus database was used to identify the peer-reviewed literature addressing government instruments for community energy. The results identified were scanned by title and abstract, and were then coded according to thematic categories emerging from the repetition of concepts in the literature [50]. Following, the content of each thematic category was analyzed to identify specific government instruments that impact or influence the development of community energy. The 19 different types of instruments identified were then then grouped into four ‘global categories’ based on the various functions they serve [40].

Second, 45 semi-structured interviews were conducted to identify the government instruments supporting or hindering community energy in northern and Indigenous communities in Northwest Territories, Manitoba and Saskatchewan. These three jurisdictions are each part of a larger research initiative, the Community Appropriate Sustainable Energy Security (CASES) partnership housed at the University of Saskatchewan, to which this research contributes. The goal of CASES is to reimagine energy security in northern and Indigenous communities by co-

creating and brokering the knowledge, understanding, and capacity to design, implement and manage renewable energy systems that support and enhance social and economic values. This requires, in part, an understanding of the various government instruments that exist that either enable or constrain local, community energy transitions.

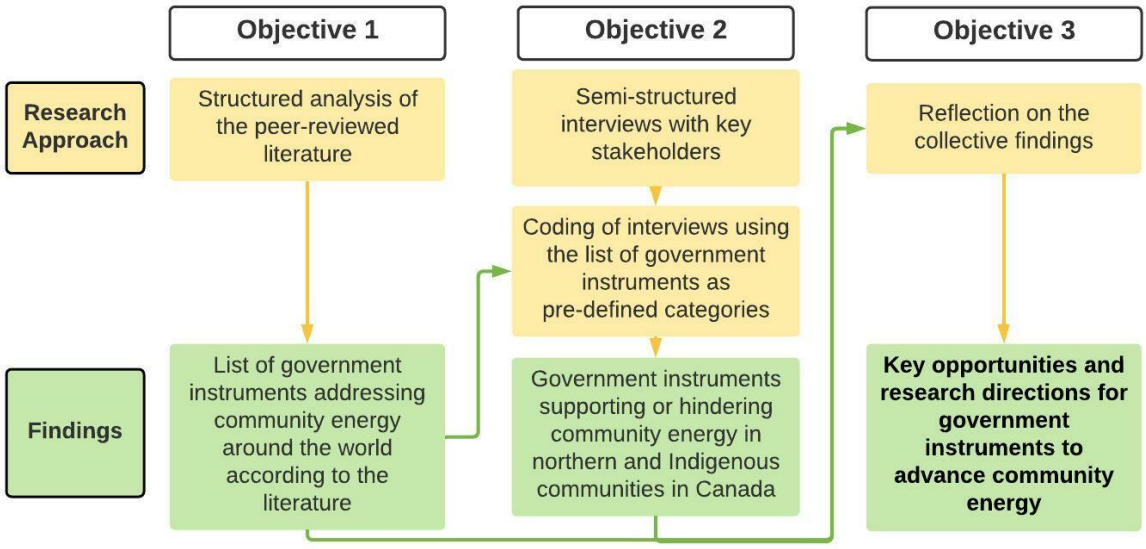

Figure 1.1 – Research approach addressing research objectives 1, 2 and 3.

Each of the three jurisdictions included in this research are also characterized by a Crown corporation as the primary energy provider. There are also several challenges with fuel dependency and energy security in each of these jurisdictions [37–40], especially for Indigenous communities, coupled with a growing interest by northern and Indigenous communities to pursue local energy initiatives. The interview participants engaged in this research represent Indigenous leadership, energy utilities, government, intermediary organizations, researchers and private companies who are to some degree involved with community energy in Canada's North. The interviews were analyzed using a qualitative content analysis methodology [53,54] combined with deductive thematic analysis [55], guided by pre-defined categories of government instruments as identified in the first objective.

Third, reflection on the collective findings based on the previous two objectives helped to identify the opportunities and research directions for government instruments to advance community energy in the study regions, with lessons emerging that are also applicable to northern jurisdictions elsewhere.

1.3 THESIS STRUCTURE

This thesis is presented in four chapters, including this Introductory chapter, and adopts a manuscript-style structure. Chapter 2 (manuscript 1) examines government instruments supporting community energy based on an analysis of the peer-reviewed literature, exploring the dominant focus of scholarly attention on government instruments and gaps in current scholarship. This chapter was recently published in the journal *Energy Research & Social Science* (**https://doi.org/10.1016/j.erss.2021.102350**). Chapter 3 (manuscript 2) examines the scope and perceived impacts of government instruments for the advancement of community energy in northern and Indigenous communities, focusing on the Northwest Territories, Saskatchewan, and Manitoba. This manuscript will be submitted for publication in *Energy Policy*. The thesis concludes with Chapter 4, identifying the main takeaways from the research and exploring key opportunities and research directions to advance community energy.

CHAPTER 2 – MANUSCRIPT 1: ADVANCING ENERGY TRANSITIONS: A REVIEW OF GOVERNMENT INSTRUMENTS SUPPORTING COMMUNITY ENERGY

Chapter 2 addresses the first objective of this thesis. It explores the current emphasis of scholarly research on government instruments for community energy and identifies key lessons and recommendations. This chapter also identifies a list of government instruments that address community energy which is a major component of the framework used in Chapter 3. The lessons and recommendations identified in this chapter also contribute to shape the research directions discussed in Chapter 4.

This chapter was led by Renata Leonhardt under the supervision of Bram Noble and Greg Poelzer. Renata Leonhardt collected and analyzed the data, and Bram Noble and Greg Poelzer reviewed the findings. Patricia Fitzpatrick, Ken Belcher and Gwen Holdmann contributed to the final revision of the manuscript. Chapter 2 has been published in the journal Energy Research and Social Science.

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2.1 ABSTRACT

The adoption and encouragement of community energy, that is, the incentive to develop renewable energy projects with community participation and ownership, is a key ingredient of energy transition. Government policies and other instruments can pose both barriers and opportunities for community energy development; however, there has been little analysis of the state of research on the range of government tools to facilitate energy transition and the implications of these instruments for community energy. This paper analyses the current scholarly research on government instruments for community energy, focusing on the multiple scales of governance. Our analysis identified 108 articles addressing government instruments and community energy. Research addressing government instruments and community energy has increased substantially in recent years, with most of the emphasis on national or state instruments, situated in the European context, and focused on grid-connected communities. We identified four global categories of government tools designed to support community energy: payment-based, grid access, environmental protection and community planning and capacity. Within these categories, nineteen different government instruments emerged with tools for financial support, feed-in-tariffs, grid services, and fiscal incentives receiving the most attention. Findings emphasize the need for further research on community-focused instruments for renewable energy, the importance of coordination between levels of government to support such instruments, and analysis of the suitability of current instruments for community-appropriate energy solutions in remote and off-grid communities.

2.2 INTRODUCTION

The global energy landscape is changing. Local, decentralised, and community-driven renewable energy projects—community energy [56]—are playing an increasingly important role in a traditionally centralized and fossil-fuel-dominated energy market [48,57]. Meeting international climate targets and transitioning to a low carbon future will require substantial investment in community energy [58,59], but the benefits of community renewable energy projects extend far beyond technological solutions to climate change. Significant societal benefits can also be realized through community energy, from capacity building and community resilience to shaping community social and economic opportunities [60].

Across Europe, the community energy movement has grown in part to enhance energy security whilst generating local revenue streams and community business investment opportunities [23,61,62]. The growing interest in community energy also includes rural and remote regions

[63,64]. In northern Canada, for example, over 170 Indigenous communities are not connected to the electrical grid, relying largely on diesel generation or trucked-in liquefied natural gas [65]. In these regions, community energy serves to alleviate energy poverty, creates new social and economic opportunities, and charts a pathway to energy sovereignty and achieving reconciliation with Indigenous peoples [66–68].

Much of the current literature, and the factors that enable communities to adopt or transition to renewable energy, are framed within the context of transition management and the multi-level perspective [69–72]. Focused on institutions, norms, innovation space, and governance, the transitions management and multi-level perspective literature provide important insights into the nature of energy system transformations [73]. Scholars recognize that within the context of this transition there is a need to better understand the role of formal institutional arrangements, specifically the formal policies and rules that can pose both barriers and enablers to community energy development [40,42,74].

Literature discussing the importance of government instruments to energy transition is extensive [46,47,75], and scholars have argued that such instruments play an essential role in enabling (or constraining) energy transitions and community energy opportunities [46,48,49]. Researchers have examined the role of government instruments in shaping energy transition – including community energy. For example, Thornley and Cooper [41] explored the relationship between the growth of bioenergy in select European states and the roles of national energy policy, while Roos et al. [76] identified national and local policy as critical factors to bioenergy implementation. However, Aklin and Urpelainen [77] note that government instruments are largely treated "as an explanatory factor of secondary importance" in the energy transition. There has been limited research exploring the range of government instruments available to facilitate energy transition and the implications of these instruments for enabling community energy.

This paper explores the current emphasis of scholarly research on government instruments for community energy and identifies key lessons to guide the adoption or advancement of the most appropriate government instruments. We do so based on a systematic review of how the peer-reviewed literature has approached community energy and the government instruments that either constrain or support its development. The premise is that by understanding how current scholarship analyzes community energy and the role of government instruments, such as policies and regulations, we will be better positioned to identify critical research gaps and

opportunities to improve government instruments for enabling and supporting the long-term viability of community energy.

2.3 METHODS

Seyfang et al. [78] define community energy simply as: "projects where communities (of place or interest) exhibit a high degree of ownership and control, as well as benefit collectively from the outcomes". We extend this definition in our research to include small-scale energy projects with a high degree of local participation and local energy initiatives [79], with a predominant focus on renewable energy sources. Our systematic review [53] used the Scopus database, due to its indexing coverage, advanced search tools, and search design replicability [80], to examine the current state of scholarly research on government instruments for community energy (Figure 2.1). We searched for papers that include "energy" in the title, with "community" or "local" as keywords, using the query: [TITLE (energy)) AND ((KEY(community AND energy)) OR (KEY(local AND energy))], and limited the search to journal articles in English. This generated 5,029 results, of which numerous papers were related to technical subject areas including engineering (1,760), computer science (762), and physics and astronomy (1,034), among others, that do not specifically speak to government instruments. The subject area was thus limited to the Scopus subject areas "energy" and "social sciences" as these were deemed most likely to contain research relevant to this work. We excluded papers in the engineering, mathematics, chemical engineering, materials science, chemistry, physics and astronomy, computer science, arts and humanities, and other related technical and applied science fields, leaving 973 results. No restrictions were placed on the year of publication.

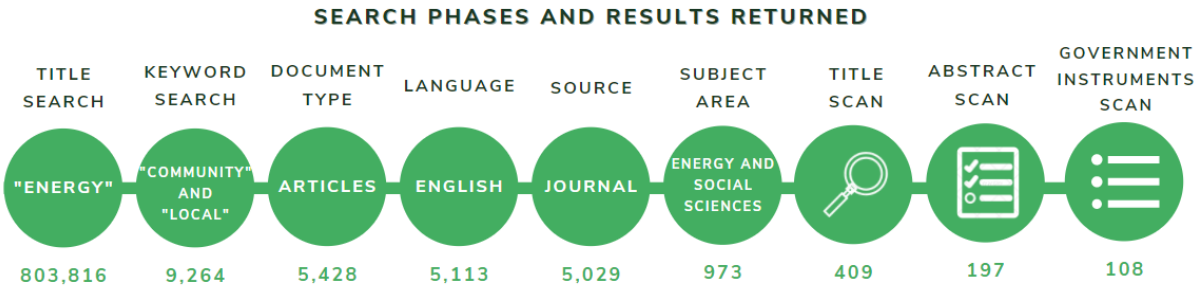


Figure 2.1 – Process used to identify instruments of government and community energy literature.

Titles were then scanned to exclude papers not related to community or local energy projects. For example, the research string still yielded papers related to such topics as the food-energy nexus [81] and building design [82]. The title scan resulted in 409 papers, for which the

abstracts were reviewed, and over 200 articles excluded as not relevant or disconnected from the topic of this research – for example, those related to stakeholder involvement in, or public acceptance of, large-scale energy construction projects [83,84]. This process yielded 239 papers, which were then coded according to thematic categories emerging from the repetition of concepts in the literature [50]. Examples include funding, policies, regulations, community capacity and acceptance, intermediary support, and institutional structures. Each category's content was then analyzed to identify papers addressing specific *government instruments* that impact or influence the development of community energy. We identified 108 peer-reviewed articles addressing one or more government instruments, which include 19 different types of instruments. Those instruments were then grouped into four 'global categories' based on the various functions they serve [40] (

Figure 2.2).

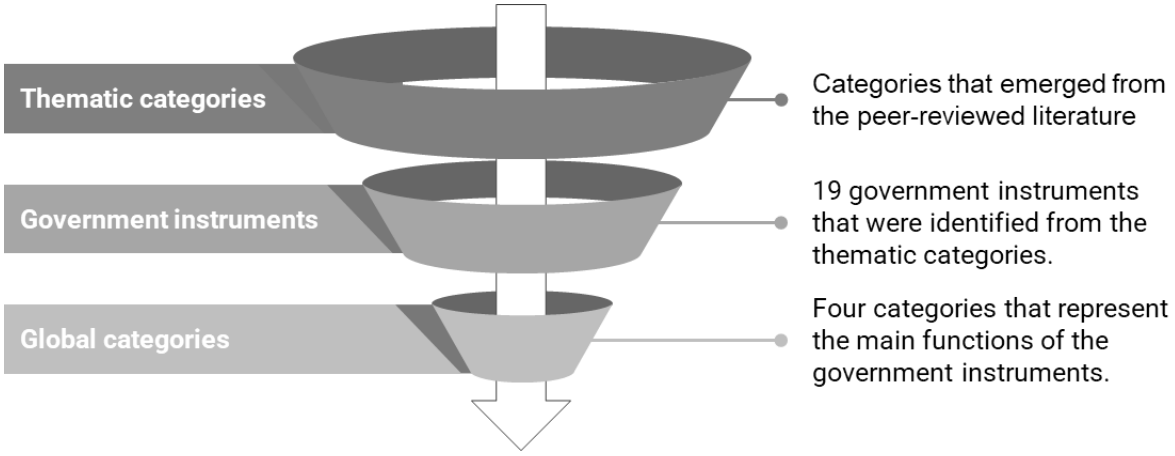


Figure 2.2 – Scheme used to review the selected papers and categorize government instruments based on Attride-Stirling [50].

Considering the importance of multi-level governance for the advancement of community energy [72], the final selection of articles was also classified according to the respective level(s) of government at which the specific instruments were examined or applied, specifically: i) *supranational to national* and ii) *regional to local*. It is also possible that an instrument may be addressed in research at both levels. For example, if an article examined an instrument used or promoted by the European Union or Canada to support community energy development, this instrument was classified as supranational to national; however, in other papers, the efficacy of that same instrument may have been examined or applied in the context of a

provincial/regional government or even at the municipal level, and thus classified as regional to local.

The methodology has limitations due to the broad spectrum of definitions of and approaches to "community" energy [85]. The analysis considered projects developed by communities to be small-scale projects that provided benefits locally. Thus, large-scale projects developed by groups that have offered benefits to specific regions, or small-scale projects that have not offered benefits to the local population were excluded from this analysis. A further limitation is that there is literature addressing government instruments that are not captured in Scopus, even though Scopus is a fairly comprehensive database – specifically books, book chapters, and other technical reports. There are limitations to any review method [53] where judgment is used in the scanning and categorization of research. However, the use of systematic literature searches as described above are common in scholarly research when used to establish the state of knowledge in a particular field of research [e.g., 76,77], including energy research [e.g., 78,79].

2.4 RESULTS

A total of 108 articles were identified based on the review and coding process. The earliest two papers that addressed community energy and government instruments [90,91] were published in 2001 (Figure 2.3). The number of papers published on the topic increased significantly post-2012, and since then, the number of articles has grown exponentially, with over 60% of articles published within the last 5 years.

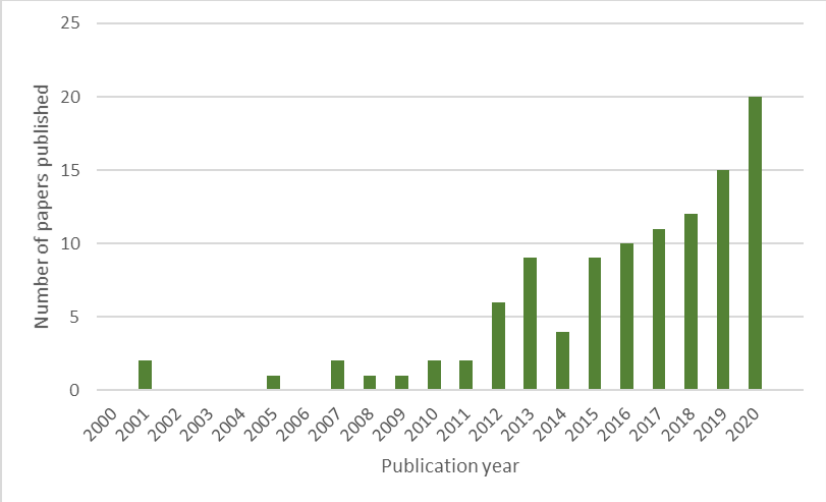


Figure 2.3 – Number of papers published annually (2000 - 2020) addressing at least one government instrument in relation to community energy.

Based on the case studies or jurisdictions discussed in each article, most papers addressing government instruments (~80%) do so in the European context. The second most addressed region is North America, at nearly 9%. Most papers are also focused on government instruments in the context of grid-connected communities. Despite a growing literature on the importance of community energy to address energy insecurity in remote or off-grid areas [23,92], we identified only six articles focused on government instruments in these contexts. There is an emerging interest in community energy security in Arctic communities, in particular, emphasizing the importance of locally-based energy solutions [e.g., 55,83,84], but we identified only two articles addressing the merits of government instruments for community energy in Arctic regions [67,68].

Four global categories were identified based on the functions of the 19 different government instruments (Figure 2.4). These categories are (1) payment-based instruments, which provide money directly (e.g., grants and funding programs) or indirectly (e.g., tax exemptions or feed-in tariffs) to community energy projects; (2) grid access instruments, which facilitate or create alternatives for communities to access the grid and control the buying and selling of energy; (3) environmental protection instruments, which aim to protect the environment through clean energy generation goals, emissions targets, and incentives for energy savings; and (4) planning and capacity instruments, which encourage community energy planning and capacity generation to advance community energy initiatives. However, not all instruments are exclusive to a single category. For example, financial supports, which are categorized as payment-based instruments, can also be used to develop local capacity and, therefore, can also be effective tools for community planning and capacity-building. Energy storage instruments can be included under the environmental protection category, in view of the environmental risks that batteries might pose. However, communities can also use the grid as an alternative to batteries, so this instrument can also be a tool for grid access.

Results indicate a diversity of instruments that can either support or hinder community energy (Table 2.1). Four instruments were addressed in ten or more articles: the role of financial support instruments (i.e., funding programs, grants, loans) was addressed in 37% of articles, followed by feed-in tariffs (32%), grid services (12%), and fiscal incentives (i.e., tax breaks, 11%). These four instruments are addressed not only in papers exploring community energy in Europe and North America, but also in countries such as Australia, New Zealand, Japan, South Korea, and South Africa. These four instruments also appear to offer at least some support for

off-grid regions; of the eight instruments identified in the six articles that *did* address off-grid regions, two are financial supports and two are grid services instruments. Of course, our findings represent the extent to which these instruments are addressed in research, which does not necessarily reflect how common the instrument is found in practice.

Financial support instruments, feed-in tariffs (FITs), grid services and fiscal incentives were mainly discussed in the supra-national to, primarily, national context – an observation applicable to most all instruments (Table 2.1). The exceptions were power purchase agreements (PPAs), energy efficiency programs, and, interestingly, instruments related to climate change, which tended to be discussed more at the regional (i.e., regional or provincial government) to local (i.e., community or municipality) level in terms of implications for community energy development. Articles addressing PPAs focused on agreements between communities and regional energy utilities, or between utilities and local consumers [91,95]. In terms of energy efficiency programs, the emphasis on local instruments primarily concerned municipal energy efficiency – specifically residential and commercial buildings [96,97]. Climate instruments, such as incentives to reduce emissions through community energy transition, tended to be

addressed in the context of regional to local governments' climate change policies and mitigation plans [e.g., 88,89].

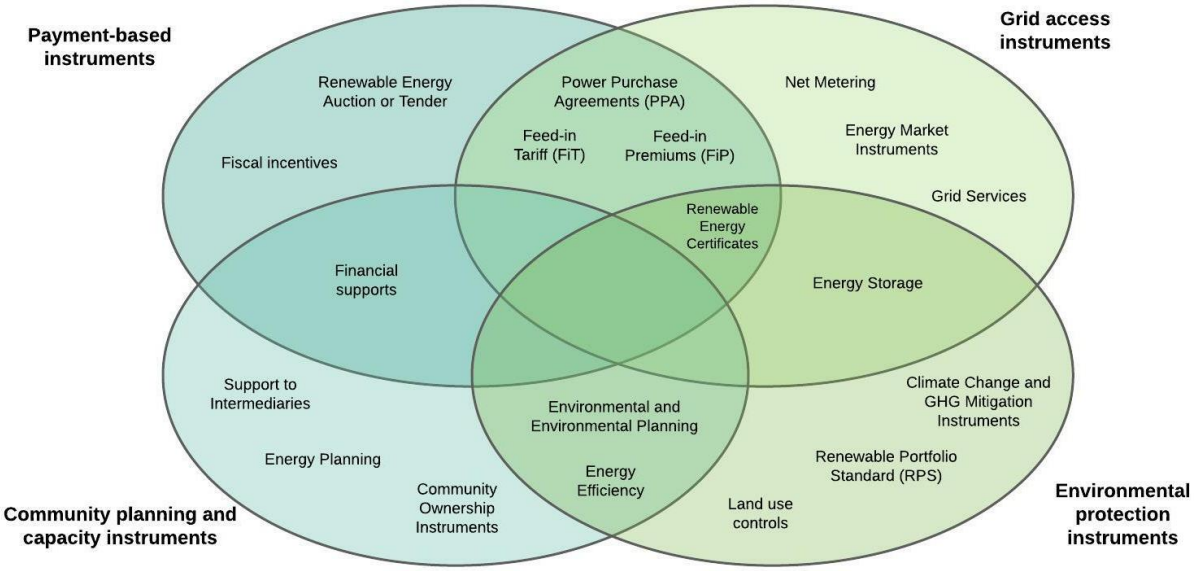


Figure 2.4 – Distribution of government instruments across four global categories – payment-based, grid access, environmental protection, and community planning and capacity.

Feed-in premiums (FIPs), renewable portfolio standards (RPS), and energy storage instruments are the least mentioned across the sample of papers reviewed. All of these instruments were discussed in terms of community energy initiatives in Europe, and all were situated at the supranational (i.e., European Union) to national level. FIPs were often identified as a risky instrument from a community energy perspective, in that the need to sell the energy generated in the wholesale market is seen as a complex arrangement for many communities [62,100]. In Denmark, for example, the adoption of FIPs generated a wave of community energy projects dissolving and a decline in the entry of new players in the community energy market [62,100]. In Germany, however, FIPs were identified as one of the drivers of growth in community energy [101] – but largely because small producers were not required to sell the generated energy on the wholesale market. Despite the popularity of RPS in countries such as the United States [102,103], the papers captured in this review that discussed the relationship between RPS and community energy were mainly focused on Europe. In those papers, RPS were largely identified as a tool that provides support to other government instruments, such as FITs and

climate change legislation, to support community energy [104]. Nevertheless, Burton and Hubacek [105] argue that RPS tend to favour large-scale projects.

Despite the crucial role of storage in enabling the energy transition [92], energy storage instruments were mentioned in only one article. The Energy Storage report published by the International Energy Agency [106] indicates that energy storage development depends on much more than technology – it requires supporting storage policies and regulations. Baldinelli et al. [107], for example, report that the lack of energy storage instruments can pose major barriers to the deployment of community energy projects. The authors present the case of the municipality of Perugia, Italy, which proposed to build a photovoltaic and energy storage system but because of the absence of legislation to regulate the installation of energy storage systems, the project was discontinued.

In the sections that follow, the four key instruments identified most frequently in recent scholarship are further explored to examine the state of scholarship and merits relative to community energy. Collectively, these four instruments comprise over 50% of the instruments discussed in the scholarly literature regarding community energy. The relative strengths and limitations of these instruments for supporting community energy, and key lessons learned from research application, are synthesized in (Table 2.2).

Table 2.1 – Government instruments identified from the sample of literature, indicating number and % of papers identifying the instrument and level of focus of governance or implementation.

Categories	Government instruments	Definition	# of papers mentioning instrument	%[1]	Supranational to National	Regional to Local
Payment-based instruments	**Financial Supports**	Financial contributions offered by governments to support community energy, either directly or indirectly, including funding programs, grants, and loans.	**40**	**37.0%**	**29**	**13**
	Feed-in Tariff (FiT)	Agreements that offer fixed payments for renewable energy generation over an established period.	**35**	**32.4%**	**30**	**6**
	Fiscal Incentives	Benefits offered by government in the form of tax deductions, exceptions, or exclusions for energy development.	**12**	**11.1%**	**9**	**3**
	Renewable Energy Certificates (REC)	Certificates that attest the generation of a minimum amount of renewables-based electricity, offered to renewable energy generators who trade the electricity generated on the energy market.	**9**	**8.3%**	**9**	**0**
	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 are selected.	**8**	**7.4%**	**8**	**2**
	Feed-in Premiums (FiP)	Agreements that offer payments for renewable energy generation based on the wholesale electricity price.	**3**	**2.8%**	**3**	**0**
Grid access instruments	**Grid Services**	Includes all instruments that control the access to a grid system, including laws and regulations that control energy connection, transmission, and distribution.	**13**	**12.0%**	**11**	**2**
	Energy Market Instruments	Control the ability to sell generated power in the energy market, such as energy market legislations and regulations.	**9**	**8.3%**	**8**	**1**
	Power Purchase Agreements (PPA)	Energy contracts between those who generate and those who will purchase the generated electricity.	**7**	**6.5%**	**3**	**4**
	Net Metering	Agreement in which consumers who generate energy can receive credits on their electricity bills for the excess of electricity generated.	**6**	**5.6%**	**4**	**2**

	Energy Storage	Laws and regulations that control the storage of energy produced and the types of energy storage available.	**1**	**0.9%**	**1**	**0**
Environmental protection instruments	**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.	**7**	**6.5%**	**3**	**5**
	Land Use Controls	Land and spatial planning legislation, regulation and policies used to control land use in a specific area.	**6**	**5.6%**	**4**	**3**
	Environment 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.	**6**	**5.6%**	**5**	**1**
	Energy Efficiency	Laws, regulations, and policies created to reduce energy use and promote energy conservation.	**4**	**3.7%**	**1**	**3**
	Renewable Portfolio Standard (RPS)	A policy that establishes a minimum of total energy production that must come from renewable sources.	**3**	**2.8%**	**3**	**0**
Planning and capacity instruments	**Community Ownership Instruments**	Regulations, legislations, and policies that guarantee or encourage full ownership or shared ownership of renewable energy projects for communities.	**8**	**7.4%**	**7**	**1**
	Energy Planning	Legislation, regulations, and policies created to guide the development of a region's energy system.	**5**	**4.6%**	**5**	**0**
	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.	**4**	**3.7%**	**4**	**0**
	TOTAL				**155**	**49**

[1]Total does not add to 100% as the same article can cite more than one government instrument.

Table 2.2 – Key strengths and limitations of government instruments for community energy, including key lessons from research, as identified in the literature.

Instruments	Reported strengths	Reported limitations	Lessons and observations	Examples
Financial supports	Supports capacity development at the local level. Covers up-front investment, such as feasibility studies and construction, to jump-start projects, especially in energy poverty communities. Opportunity for low-interest loans for local energy initiatives. Accessible support for remote and off-grid communities.	Increases community external financial dependency for kick-starting new projects. Unannounced or unexpected change in external funding can slow or stop community energy projects. Inequitable distribution and availability to communities. Typical one-time nature can constrain the long-term viability of projects or increase dependency on other forms of funding.	Successful examples of community energy emphasize the importance of coordination between levels of government for financial supports to be most effective – and non-conflicting with other instruments. A mixed funding model that includes a minimum level of investment from communities can increase community buy-in and long-term viability of community energy projects. One-time funding models can constrain longer-term project success, especially in energy-poor communities. Over-compensation generated by communities receiving funds from two different government sources may result in the cancellation of some funding programs. Loans offered by state-owned banks or government entities are important sources of funding for communities, when low-interest loans are possible.	[108–110]
Feed-in Tariff (FiT)	Can generate income for communities. Surplus revenue generated through FIT can be used to create training programs to improve community capacity. By guaranteeing stable income, FIT creates an investment security scenario for projects allowing banks to offer loans with better interest rates. The investment security scenario helps attract private investors. An alternative to community dependency on grants, which are usually one-time funding and are not always available.	Often a complex application process, favouring larger players. Upfront investment, with no availability of capital for the planning process. Electricity rates offered sometimes insufficient for communities and do not consider additional costs of grid connection. Highly vulnerable to political and policy changes. Even with long-term contracts, project viability at end of contract term can be uncertain.	Communities benefit most when FIT has specific provisions for community energy or when FIT programs are developed only for community energy projects. Simplified applications process and extended periods for receiving applications usually benefit communities aiming to apply for FIT programs. Electricity rates should be guaranteed for communities regardless of the application period - in cases where rates change according to the period in which the application is made. FIT eligibility criteria must include provisions for off-grid communities.	[100,111,112]

			Availability of upfront funding to cover initial project expenses, such as project planning and programs applications, is recommended for communities to have access to FIT. When offering FIT rates to community energy projects, the higher expenses with grid connection and distribution should be considered in the established rates. When profits from FIT are shared or reinvested in the community, overall community support for renewable energy projects can increase.	
Grid Services	Effective grid instruments can ensure that communities have access to affordable grid tariffs.	Grid regulations imposed by higher levels of government can conflict with local regulations. High grid connection and distribution rates can make smaller community energy projects unfeasible. Grid regulations and connection requirements are often unfavourable for small or remote communities and favour large players	Coordination between all levels of government is essential to avoid regulatory conflicts. Grid connection and distribution fees can challenge community energy projects; some authors suggest that excluding distribution and connection fees may support the development of community energy projects.	[112,113]
Fiscal incentives	Tax relief and tax exemptions can 'free-up' resources for communities. Establishes an investment security scenario to help communities secure low-interest rate loans. Fiscal incentives can result in long-term funding for communities when programs are stable.	Some tax relief programs are focused on private organizations and end up not always benefiting communities seeking to develop energy projects. Guidelines and requirements are often unstable or change or discontinue without sufficient notice. Changes in guidelines or program availability can slow down the development of community energy projects or cause project termination.	There is no single type of fiscal incentive that is best for community energy projects. Community eligibility criteria and guidelines must be designed considering the multiple forms of community energy (e.g. cooperatives, municipalities, indigenous trusts and cooperatives, etc.).	[96,100,114]

2.4.1 Financial supports

Financial supports are the most frequently discussed instrument in the literature on community energy. These include financial supports from supranational or national governments, such as the programs offered by the government of Denmark for the development of wind turbines [100], to smaller-scale financial supports provided by regional and local governments [79,109]. The literature often referred to specific funding opportunities for community energy project economic feasibility studies [e.g., 50,81,105,106]; funding land purchases for renewables project development [66]; and funding to promote renewable energy and energy conservation awareness [108,117].

Several authors discuss the importance of loans provided by governments or state-owned banks as essential financial instruments to support community energy [e.g., 90,108]. Nolden [119], for example, identifies loans provided by German state-owned banks as among the country's most important financial instruments supporting community energy. The emphasis on such loans offered by government entities is based on the premise that they can be offered to communities and local energy developers at subsidised interest rates [111]. The Local Energy Communities project in Germany [120], for example, indicates that the loans offered by KfW Bank, a German state-owned bank, to support community renewable energy projects include a low 1% interest rate.

Much of the discussion on financial supports, however, is focused on grants or one-time, non-repayable funds as important financial instruments for communities to pursue local energy initiatives [78,121]. Government grants were often identified as providing essential support for local communities facing major energy obstacles, like energy poverty and remoteness – including, for example, grant programs to address fuel poverty in England [122], and state support for the development of renewable energy technologies (e.g., wind, solar, geothermal, hydrothermal, biomass, in-stream hydropower) in remote Alaskan communities [67]. Grants to support initial community energy project feasibility studies were identified as especially important. Roesler [123] reports that even the most basic feasibility studies for community energy projects in Germany can cost on average about 10,000€. In remote regions, these costs are even higher [116], and communities rarely have the resources to cover these upfront costs of community energy development [23,99]. However, the intermittent and one-time nature of many grant programs is identified as an enduring constraint to the longer-term success of community energy initiatives [108].

Regardless of the type of financial support, a clear message in the literature is that the costs of energy development are often far greater than what most communities can afford [119], and the lack of government financial support poses a major barrier to the pursuit and success of community energy [67,101,124]. Cebotari [125], Honvári & Kukorelli [63], and Parag et al. [126], for example, point to examples where in absence of government funding several community energy projects would not have succeeded without government funding. Hicks and Ison [23] note that the *lack* of government funding in Australia, specifically in the form of grants, has made community energy projects largely unfeasible. The lack of funding programs supporting training and capacity building, that is, the development of human resources with training and education, is also identified as a challenge to community energy projects [127], but financial instruments to support energy education and training have received relatively less attention in the literature. Several scholars suggest that a mixed funding model, whereby financial support from government is complemented by modest local community contributions, can address financial barriers to community energy and also promote a stronger sense of ownership and responsibility and more community-wide engagement in local energy projects [121,128].

2.4.2 Feed-in tariffs

Feed-in tariffs (FITs) are the second most common instrument discussed in the literature regarding community energy, addressed in approximately 31% of articles. Thirty articles mentioned FITs in the supranational to national [e.g., 90,119], and six in the context of regional or local governments [e.g., 32,101,120]. We observed ten articles identifying FITs as an important driver for community energy development [e.g., 121–123], including multiple community energy projects in Denmark, Germany, Scotland, and Switzerland [100,110,134,135]. However, Nolden [119] argues that FITs alone do not guarantee community energy project success, identifying that upfront investments, uncertainties of planning outcomes, and grid connection costs are some of FIT's primary constraints to community energy.

Generating income locally, a primary feature of FITs [121,136], is often identified as the main reason for communities to engage in community energy projects [108]. Bere et al. [137], for example, report that in a poor community in Wales the income from FITs was used to pay for child-care programs to support single working mothers. In England, the local revenue generated from FITs was used to pay team members of “low carbon community groups” who

previously worked as volunteers [123]. The revenue generated from FIT is also considered an avenue to help reduce fuel poverty in communities [138], and to create an environment of investment security for communities, banks, and private investors [100]. For example, for communities seeking loans from private or state banks to cover the initial expenses of community energy projects, having a FIT long-term energy purchase agreement allows banks to provide loans at a lower rate of interest [23,110]. However, other researchers have cautioned that FITs do not bring the same benefits to regions where community energy development is focused on off-grid communities. In Indonesia, for example, Guerreiro & Botetzagias [127] report that FITs are not considered an essential, national instrument for the success of community energy projects because the benefits of such programs do not accrue to the rural and remote communities where community energy is most needed.

2.4.3 Grid services

Grid service instruments, those instruments concerning access to a grid system and the laws and regulations that control energy connection, transmission, and distribution, were discussed in 13 articles. The focus was predominately on instruments established at the supranational or national level [e.g., 97,119], but often with implications for community energy establishment and growth and the local level [44]. The literature identifies grid connection restrictions and costs as among the major challenges to current grid services laws or regulations [44,139] – especially for remote and rural areas seeking community energy development or expansion opportunities [140]. Madriz-Vargas et al. [112], for example, report that Panama's current regulations do not allow extensions to the grid for distant, rural communities.

Where extensions and connections are permitted or supported, several researchers note the high costs paid by communities to use the grid as a major impediment to community energy [141,142]. In France, community energy projects, locally known as collective self-consumption operations, have to pay specific grid tariffs set by the National Regulatory Authority [143]. These grid tariffs, however, are usually higher than the grid tariffs applied to standard consumers. Under these types of scenarios, Dragan [139] suggests that excluding distribution and connection fees may support the growth and sustainability of community energy projects.

Regulations on the transmission and distribution of energy are also identified obstacles to local community initiatives [110]. In Japan, for example, Hager & Hamagami [144] report that even though some communities are allowed to sell the energy generated, regulations imposed by

utilities may prevent the transmission and distribution of that energy. Blanchet [44], however, describes grassroots initiatives in Berlin, Germany, that are seeking to change current regulations to allow more localized citizen participation in electricity grid operations. While authors such as Pinker et al. [110] argue that energy distribution regulations tend to favour large players, these grassroots initiatives are seeking to "re-municipalize" the electricity grid or to create partnerships with the municipalities and other actors [44] to control the electricity grid, promote renewable energy locally, and develop the local economy.

2.4.4 Fiscal incentives

Fiscal incentives, such as tax deductions, exceptions, or exclusions for community energy development, are addressed in 12 articles. Such examples include tax relief to communities for investments in renewable energy projects [100]; climate change, environmental protection and carbon taxes [104,143]; and gas taxes that provide funding to improve community energy infrastructure [109]. Nine articles addressed fiscal instruments at the national level – such as state CO_2 tax benefits applied by the Swedish government, which helped develop the country's community energy sector 20 years ago [96]. Three articles addressed fiscal instruments at the regional to local level: Hamman [145], for example, reports how fiscal incentives can be a motivator for communities to engage in the energy transition, identifying tax credits as one reason for a community in France adopting wood-fuelled boilers and solar panels.

Historically, fiscal incentives have been seen as an important factor in the development of community energy projects [96]. For example, fiscal incentives can assist communities in securing private investments. Bauwens et al. [100] report that the Seed Enterprise Investment Scheme (SEIS), a tax relief scheme created by the UK government to stimulate private investments in start-ups, supported community energy projects to offer better investment returns to private investors. Because of this tax scheme, investors seeking to invest in community energy projects were able to receive up to 50% of their investments back. The funds obtained through taxation can also support the development of local energy infrastructure [109,114]. In Canada, for example, the federal Gas Tax Fund is a source of funding intended to provide support to the development of local infrastructure, including community energy systems [109,146].

The eligibility criteria for fiscal incentives, however, do not always favor community energy projects. Magnusson and Palm [96] argue that most tax relief programs are focused on private organizations and end up not always benefiting communities seeking to develop energy

projects. In the United States, for example, Brookshire and Kaza [147] report that certain Indigenous communities or organizations may not benefit from tax incentives offered to private organizations because they are classified as government organizations. Frequent changes in tax guidelines are also identified as a challenge to community energy development. In 2009, a new interpretation of the guidelines of a Swedish tax scheme slowed the development of community energy projects. Magnusson and Palm [96] report that the new tax code interpretation made it difficult to run renewable energy cooperatives and reduced overall interest in cooperative start-ups. Literature also identifies examples where the abrupt termination of established tax schemes also adversely affect community energy – including termination of the Climate Change Levy tax exemptions, an exemption to the environmental tax charged on business energy use in UK, requiring communities to start spending an additional £8000 of the annual income generated by local energy projects on taxes [104].

2.5 DISCUSSION

Governments and the various instruments of government, from GHG reduction targets and energy distribution regulations to fiscal incentives for investment in renewables, play an important role in shaping energy transition and in the establishment and viability of community energy initiatives. Based on a review of the published literature, 19 instruments were identified as the focus of scholarly research and with the potential to impact community energy. These instruments could be broadly classified into four categories based on the functions performed.

Grid access instruments, for example, illustrate that communities do not have grid ownership and depend on effective government instruments to be able to transmit and distribute locally generated power. Instruments with a primarily financial function highlight the need for effective payment-based tools to jumpstart many community energy projects and the importance of long-term continuity in supporting those tools. Instruments with an environmental protection function not only emphasize climate change and mitigation solutions via energy efficiency, safe storage, and community energy, but also the importance of such matters as land controls and minimizing the adverse impact of community energy projects – especially when such projects are developed on Indigenous peoples' traditional lands.

The collection of community planning and capacity instruments all serve to support local community capacity building (e.g., social and economic capital), yet, in some cases, local capacity building is indirect or secondary. For example, while community ownership

instruments may more obviously support local community capacity, other instruments indirectly support a community's capacity to pursue and maintain community energy projects – such as engagement in community energy planning processes or the technical training offered by intermediary organizations. Importantly, the number of instruments that can be grouped into multiple categories demonstrates the multiple functions of some instruments, which suggests the potential for the same instrument to achieve more than one objective and also for multiple instruments to reinforce a common objective. Results indicate the need for further research to better understand which instruments or combinations are most effective in advancing community energy in any given context.

Results also show that the amount of research addressing government instruments for community energy has increased in recent years, but the geographic focus has been concentrated in European contexts and largely focused on grid-connected communities. Most of the instruments addressed in international scholarship are also framed at the supra-national to the national level, but with important implications for the advancement of regional to local community energy projects. The greater focus of scholars on European regions, and supra-national or national governments may be because regions such as Germany, Denmark and the UK are pioneers in promoting and developing community energy [29]. This geographical concentration of research may also explain why the focus is predominately on grid-connected communities.

Our analysis also provides several important observations to inform research and policy development on government instruments to support community energy. First, sensitivity to community context is essential to the success of government instruments in enabling community energy. Many of the instruments identified in the literature to support or incentivise energy transition do not necessarily offer the support or opportunities that communities need to pursue local energy projects. For example, RPS are identified as critical to supporting renewable energy development and thus energy transition [148], yet we identified only three papers in our sample that address RPS in the context of supporting community energy [24,104,105]. Ensuring the success of community energy initiatives requires government instruments that are appropriate to the local context of communities. Government instruments with provisions, restrictions, or eligibility criteria that are not sensitive to regional or local community contexts can stifle opportunities for, or limit the attractiveness of, community energy projects. We observed examples of this in the application of auction systems [144,149],

financial supports [150], and grid services instruments [136]. Related, instruments intended to support community energy must be sensitive to local capacity to adopt, comply with, or capitalize on such instruments. For instance, the 'first-come, first-served' scenario where FIT rates decline over time is not always conducive to encouraging community energy projects, as communities may not have the capacity to apply quickly enough and secure sustainable energy rates [28,133]. It can also be difficult for smaller communities, with limited capacity, to negotiate fair PPAs [151].

Second, the success of government instruments in supporting community energy often hinges on coordination and complementarity, both between instruments and between levels of government [125]. Complementarity between payment-based instruments, for example, is reflected in Bauwens et al. [100] who argue that FITs alone are insufficient to guarantee the success of community energy projects. Seyfang et al. [78] and Mirzania et al. [121] also emphasize the importance of a mix of financial supports. Coordination and complementarity between all levels of government is also essential to the development and sustainability of community energy projects. The success of community energy in Scotland, for example, is attributed in part to the coordination between bottom-up and top-down initiatives [152], whereby communities first began to look for better ways to get electricity, and subsequently, the Scottish government started to support community to develop the renewables sector. Yet, multi-layered decision-making authorities and the lack of coordination between them are commonly reported obstacles to the efficacy of government instruments for community energy [140,153], emphasizing the importance of mutually supporting national to local level instruments for supporting community energy [125,154]. The success of government instruments and the long-term viability of community energy projects depends on alignment between different levels of government, each in control of different instruments, from the supra-national to the national, and regional to local [155] and also complementarity between the various functions of government instruments.

Third, there is a need to better understand what government instruments are most appropriate for, and effective in, remote or off-grid communities. The majority of research on government instruments for community energy has focused on grid-connected communities, with relatively fewer papers addressing remote regions – particularly communities that rely heavily on diesel generators [68]. The literature that does exist draws attention to the limitations of existing instruments to remote contexts. Guerreiro and Botetzagias [127], for example, report that off-

grid communities in Indonesia are not eligible for the region's FIT program, which further constrains the ability of those communities to secure private financing and external investors for community energy projects. In Panama, Madriz-Vargas et al. [112] report that current regulations do not permit for grid extensions to distant communities. Across Arctic regions, remote, off-grid communities are well poised for community energy transition [67], but the dominant focus has been on national instruments and drivers [156,157] – typically designed to meet emissions reductions targets versus ensure community-appropriate energy solutions [66]. The literature is also sparse in addressing these instruments' merits in Indigenous government contexts, which may be complicated in autonomous territories [93] or where Indigenous self-government agreements are in play, such as in the Canadian Arctic. Much research attention is needed on the effectiveness of current government instruments for supporting community energy in remote, off-grid communities and ensuring energy solutions that are appropriate to the rural and remote community context.

Finally, it is generally acknowledged that the success of local energy initiatives depends in large part on community engagement [48,108]; the same can be argued for the development of effective government instruments to support community energy [152]. Government instruments for community energy are often conceptualized based on centralized, top-down values, treating community energy systems and the instruments for their governance as independent from the social fabric of the communities themselves [66,158]. Urmee and Md [159] argue that if the design and implementation of government instruments for community energy, especially in rural, remote, and off-grid settings, fail to incorporate social values, they are unlikely to be successful. Given past injustices in the distribution of energy risks and benefits [160], especially in rural and marginalized regions, communities need to be part of the design of government instruments for community energy, ensuring greater control over their own energy futures [161,162].

2.6 CONCLUSION

Improving local energy security and providing local economic benefits are some of the reasons behind the growth of community energy worldwide [23,24]. Thanks to community energy projects, off-grid communities have the potential to achieve self-sufficiency and more affordable energy rates. The growth in community energy is also a major contributor to energy transition, and it is through energy transition policies and regulations that the community energy sector has been advancing [47,49]. Government instruments used to promote energy

transition, such as energy regulations and policies, can pose both opportunities and barriers to community energy development [40,42,74]. The success of government instruments in supporting community energy is thus dependent, in part, on coordination and complementarity between the multiple levels of government and the multiple instruments that exist. However, there is also a need to better understand instruments that are potentially contradictory. There are numerous cases reported emphasizing how instruments developed by local governments to support community energy may conflict with national energy strategies.

Further research is also needed to ensure that instruments intended to support community energy are keeping pace with technological advances and opportunities, specifically research on energy storage instruments. In addition, not all instruments intended to support community energy are likely sustainable in the long-term, both economically and in terms of maintaining on-going government support. We thus suggest the need to identify the underlying factors that challenge the sustainability of government instruments. In other cases, however, certain instruments are widely used or promoted, but research is needed on the effectiveness of those instruments in different contexts and their transferability. For instance, 38 states of the United Stated have an RPS or renewables goal [163], but there is limited analysis in the literature about their role in promoting community energy. Understanding community context is essential to the success of government instruments in enabling community energy, ensuring that instruments are designed to consider the diversity of community technical and social capacities and needs, their access to intermediary organizations and supports, as well as geographic context. This suggests the need for greater engagement of communities in the shaping of the policies and instruments, at all levels, designed to support community energy, including engagement of Indigenous knowledge systems. Finally, our analysis indicates a critical need for research on appropriate government instruments to advance community energy in remote or off-grid communities, ensuring the development and implementation of policies, programs and regulations that ensure community-appropriate energy initiatives and solutions – especially in northern and indigenous community contexts.

CHAPTER 3 – MANUSCRIPT 2: GOVERNMENT INSTRUMENTS AND COMMUNITY ENERGY IN NORTHERN AND INDIGENOUS COMMUNITIES

Chapter 3 discusses the second objective of this thesis. It examines the scope and perceived impacts of government instruments for the advancement of community energy in northern and Indigenous communities, focusing on the Northwest Territories, Saskatchewan, and Manitoba. This chapter draws on the findings of Chapter 2 to develop a framework to analyze interviews with stakeholders in the three regions. It also identifies lessons and observations to advance community energy in northern regions, which contribute to the conclusions in Chapter 4.

This chapter was led by Renata Leonhardt under the supervision of Bram Noble and Greg Poelzer. Renata Leonhardt collected and analyzed the data, and Bram Noble and Greg Poelzer reviewed the findings. Patricia Fitzpatrick and Ken Belcher contributed to the final revision of the manuscript. Chapter 3 will be submitted for publication in the journal *Energy Policy*.

3.1 ABSTRACT

Limited or unreliable fuel supplies for home heating and electricity, high generation costs and limited generation capacity are just some of the energy challenges that northern and Indigenous communities face in Canada. Community energy, that is, renewable energy projects with community ownership or participation, is one of the alternatives available to improve this scenario. However, the development of community energy depends on supportive government instruments, such as energy policies and regulations. There has been limited research to identify the range of government instruments available to support northern and Indigenous communities in the pursuit and long-term sustainability of local renewable energy. Thus, this research aims to identify the government instruments supporting or hindering community energy in northern and Indigenous communities. To do so, we focused on current tools in the Northwest Territories, Manitoba, and Saskatchewan. Results show that there are multiple instruments available to support community energy in northern and Indigenous communities. However, localized government instruments may be more effective, considering the unique context of northern and remote communities. The results also reinforce the need to provide government instruments capable of serving communities with the most diverse capacity levels.

3.2 INTRODUCTION

Energy security, defined here simply as reliable access to energy to support a sustainable lifestyle [66], is widely discussed in recent scholarship and in the context of different regions

around the world [164–166]. In Canada, energy security is particularly important in the context of northern and Indigenous communities [66]. There are 270 remote communities in Canada, of which the majority are dependent on the power provided by diesel generators [17]. Relying on the long-distance delivery of fuel and on generators reaching their life expectancy [19,167], many of these communities experience high energy costs, unreliable fuel supplies, and increasing energy insecurity [6,8]. Energy insecurity is even a part of life for many grid-connected communities in the North, especially during the winter months, with high energy delivery costs and frequent outages due to increasing severe storm events. Energy insecurity and disruptions also affect food supplies and water availability, such as disruptions to water treatment [167], and communities can be without power for days when faced with limited local capacity to repair power systems [20].

Community energy, that is, renewable energy projects with a degree of community ownership or participation [168], is emerging as a viable solution to energy insecurity in northern, remote and Indigenous contexts. Recent scholarship argues that community energy can enable the creation of local capacity and local jobs [23,24], the development of more reliable sources of energy [24,25], lower energy generation costs [26,27], a reduction of environmental and land impacts [23,25], increased local acceptance of renewable energy projects [169], local control and encourages energy sovereignty [24,25], and support the process of reconciliation with Indigenous people [31,32]. Community energy, thus, can create new social and economic opportunities and provide alternatives to the energy insecurity associated with electrically remote communities and diesel dependency [23,67,68].

The development of community energy as an important component of promoting energy security in rural and remote regions hinges in part on supportive government instruments [46,47,170]. Government instruments, defined as the formal policies and rules used to advance energy transition, play an essential role in enabling community energy [78,108,119]. For example, Nolden [119] suggests that Feed-in Tariffs, contracts that offer fixed payments for renewable energy generation, have had an essential role in advancing community energy in the United Kingdom. While Bauwens et al. [100] show that financial incentives have been a vital support mechanism of community energy in Germany, specifically the loans offered by the German state-owned bank. However, government instruments might also pose as barriers to community energy. According to Madriz-Vargas et al. [112], grid services in Panama, such as grid connection, distribution and transmission regulations, do not allow grid extensions to rural communities.

A few researchers have also addressed the opportunities and challenges of government instruments supporting community energy in Canada. McMurtry [171], for example, provides an overview of government instruments across Canada and highlights the importance of enabling policies – such as the Green Energy Act of Ontario – to promote community energy in Canada. MacArthur [109] examines the emergence and political challenges involved in the advancement of community energy in Canada, emphasizing the "limited scope and short duration" of most government instruments available [109]. MacArthur [109] also introduces a discussion around Indigenous community energy, while Heerema and Lovekin [172] focus on a deep analysis of the policy environment supporting community-led projects in remote and diesel-dependent Indigenous communities. Heerema and Lovekin [172] argue that governments, regulators and utilities need to provide more appropriate government instruments to enable fair and equitable access to cleaner energy generation.

Despite the emerging literature on community energy and Indigenous-led projects, there is limited emphasis on the supporting government instruments for renewable energy in northern and Indigenous regions. Authors such as Mortensen et al. [67], who discuss renewable energy projects in remote Arctic communities, indicate that the net metering programs and financial incentives being offered are not enough to support the much-needed energy transition in remote communities. Rakshit et al. [20, 32] describe some of the regulatory issues that the Poplar Hill First Nation, northern Ontario, faced when transitioning from fossil fuels. The authors [173] explain that one of the options to promote energy transition in the community was the development of a local hydroelectric site, however "multi-level" and "multi-layered government regulatory processes" affected the continuity of the project.

However, notwithstanding the emerging literature on community energy, especially in Canada [109,171,174], and the recognized importance of renewable energy transitions to addressing energy insecurity across Canada's North [175], there has been limited research on government instruments to support community energy in northern and Indigenous communities. Thus, this paper aims to identify the government instruments supporting or hindering community energy in northern and Indigenous communities and the lessons and observations that can be extracted. To do so, we focus on current instruments for community energy in the Northwest Territories, Manitoba, and Saskatchewan and conduct a cross-jurisdictional comparison to identify common opportunities and lessons for supporting community energy in northern Canadian communities. Although focused on the Canadian context, the observations emerging are likely of value to other northern or remote regions and jurisdictions.

3.3 STUDY AREA

Canada has the 6th largest installed capacity of renewable energy generation in the world [176]. Around 66% of electricity generation in the country is obtained from renewable sources, with hydro accounting for about 90% of all renewable generation [177]. The energy scenario of Canada's northern and Indigenous communities, however, is dramatically different than the national energy mix. According to Natural Resources Canada's Remote Communities Energy Database [17], there are currently 270 remote communities in Canada, and at least 75% of these communities in Canada rely on fossil fuel to generate electricity. Fossil fuel dependency, primarily imported diesel, for electricity generation is as high as 84% when considering only remote and Indigenous communities. This fuel dependency scenario is evident in several jurisdictions, including the northernmost regions of Saskatchewan and Manitoba and the Northwest Territories - the target areas of this research. In total, there are 29 off-grid Indigenous communities in these three jurisdictions - one in Saskatchewan, three in Manitoba, and 25 in the Northwest Territories, representing a total population of 15,467 people [17].

Northern and Indigenous communities that are connected to the provincial or territorial grid also face energy security issues. Other than reliance on diesel, ageing generation, transmission and distribution infrastructure is a major threat to energy security for many northern and Indigenous communities [37–40]. In Saskatchewan, for example, one-third of power outages are caused by ageing infrastructure [52]. Other than reliability issues, according to the province's Crown energy utility, Saskatchewan's ageing energy assets are also less efficient and more expensive to maintain and operate [178]. Energy poverty, or insufficient access to adequate, affordable, reliable, high-quality, safe and environmentally benign energy to support economic and human development [179], is another challenge faced by many northern and Indigenous communities. A report published on behalf of the Assembly of Manitoba Chiefs [180], for example, notes that energy poverty is higher among First Nations when compared to the general population. The same is true in Saskatchewan; for instance, while the general population spends on average $170/month on their household electricity bill [181], communities of the Peter Ballantyne Cree Nation often pay more than $1,000/month in electricity bills [182].

There are limited examples of community-owned renewable energy projects in Saskatchewan, Manitoba and the Northwest Territories, but all three share a similar energy governance structure: vertical and centralized ownership, with a provincial Crown energy corporation

responsible for power distribution, transmission, and generation. Currently, government policies, programs, and other initiatives supporting community energy must operate inside the constraints of this centralized structure, which can present challenges to projects that focus on decentralized generation.

Enacted in 1961 via the *Manitoba Hydro Act*, Manitoba Hydro is the provincial Crown corporation exclusively responsible for the generation, distribution and transmission of electricity in Manitoba [183]. The utility coordinates 15 hydroelectric generating stations, representing 97.5% of all electricity generation in the province [184]. The success of hydropower development, however, has been controversial for many Indigenous communities in the province, with several First Nations communities in northern Manitoba adversely affected by floods and changes in river flow caused by the dams [185,186] and two First Nations communities completely displaced [187]. Four communities in Manitoba are still dependent on diesel generation [17]. Despite the limited support for community-owned projects in remote communities [172], one of the four diesel-dependent remote communities, the Northlands Dënesųłiné First Nation, is developing a biomass district heating, a geothermal district heating and a solar park [188].

In Saskatchewan, coal is the largest generation source, and renewables represent less than 20% of the province's generation [184]. Established in 1929, Saskatchewan Power Corporation (SaskPower) is the Crown energy utility of Saskatchewan. SaskPower has exclusive rights to supply, transmit, distribute and sell electricity guaranteed by the *Power Corporation Act* [189]. SaskPower also has partnerships with the First Nation Power Authority (FNPA) to support Indigenous Independent Power Producers in the province. FNPA is a not-for-profit responsible for supporting the inclusion and engagement of Indigenous people in the power sector [190]. Currently, there is only one remote and fuel-dependent Indigenous community in Saskatchewan – which has received funding from the federal government to develop a new energy plan [17,191]. However, several northern and Indigenous communities in the province face energy security challenges related to the ageing grid infrastructure [51].

In 1988, the Government of the Northwest Territories acquired the Northwest Territories Power Corporation (NTPC) from the federal government [192]. NTPC controls most of the energy generation in NWT. Out of the 33 communities in NWT, NTPC powers three communities with hydroelectric generation, one community with natural gas, and 25 diesel-dependent communities [193]. New renewable energy and energy efficiency projects are being developed

in diesel-dependent communities. For example, NTPC is currently running a biomass boiler and a variable speed generator in Aklavik [194]. However, community-owned renewable projects are not common in the region. To date, the solar array owned by Lutsel K'e Dene First Nation is the only independent solar power producer in NWT [172].

At the federal level, The Pan-Canadian Framework on Clean Growth and Climate Change is a central pillar of the energy transition in Canada. Its goals are to reduce the reliance on diesel of northern and Indigenous communities [195]. It also defines actions to support the energy transition in Indigenous communities – an action that is being implemented by programs such as the Green Municipal Fund and the Indigenous Off-grid Initiative. Regions such as Saskatchewan, Manitoba and the Northwest Territories also follow the movement of the federal government to support the energy transition in Indigenous communities. For example, the Government of Saskatchewan and SaskPower implemented in 2012 an Indigenous Procurement Policy [196], a policy that benefits development proposals that have Indigenous ownership or workforce. In Manitoba, the new crown corporation Efficiency Manitoba has an Indigenous Community Efficiency program [197] offering financial support for communities to hire an energy efficiency advocate to identify the efficiency gaps in the community. And the Government of the Northwest Territories has a GHG Grant Program that applies to Indigenous governments [198] to fund new renewable energy and efficiency projects. However, notwithstanding the instruments that do exist, there has been limited attention to the availability and efficacy of government instruments to support community energy in northern and Indigenous communities

3.4 METHODS

We conducted 43 individual and 2 group semi-structured interviews with a total of 48 participants who are to some degree involved with community energy in Canada's North. Participants were selected from six different types of sectors within the Canadian energy sector (Table 3.1). The sectors represented in this research include Indigenous community leadership, representatives of provincial and territorial crown energy utilities, representatives of the energy, environment, or Indigenous relations divisions from the federal and provincial governments, intermediary organizations involved in the development of renewable energy projects in Indigenous communities (e.g. NGOs, energy associations, social enterprises), energy researchers, and private companies who developed projects in partnership with Indigenous communities.

The interviewees were identified based on their involvement with energy projects in Manitoba, Saskatchewan, and the Northwest Territories. Federal government representatives and interviewees from regions other than these three comprise the "other regions" category. These included individuals from the Indigenous Services Canada, researchers from universities in Ontario, and members from private companies which developed projects in Indigenous communities. The purpose of interviewing participants from different sectors and regions was to explore the variety of government instruments available to advance CE in northern and Indigenous communities. The initial interviewees were recruited according to the need to obtain participants in the energy sector from the three jurisdictions studied. Subsequent participants were recruited following the snowball sampling technique [199]. Overall, we contacted 62 participants from all sectors and regions.

Table 3.1 – Research participants according to region and organization

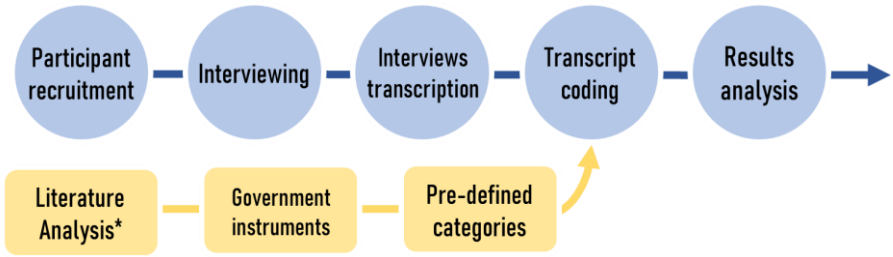
Sectors represented	**Manitoba**	**Saskatchewan**	**Northwest Territories**	**Other regions ***	**TOTAL**
Indigenous Leadership	0	3	12	0	15
Utilities	2	2	2	0	6
Government	3	1	0	1	5
Intermediary organizations	2	3	4	1	10
Researchers	3	1	3	2	9
Private companies	1	0	0	2	3
TOTAL	11	10	21	6	48

* Representatives from the federal government and other provinces (i.e., Alberta and Ontario) with insight to government instruments in the study regions.

The interviews were guided by a set of pre-defined questions exploring the government instruments supporting or constraining community energy development in northern and Indigenous communities. Interview questions explored topics such as the challenges faced by communities in pursuing locally owned or operated energy projects, and whether the current regulations or policies support these projects. Considering the travel restrictions imposed by COVID in 2020, the interviews were conducted by telephone or video conference and had an average duration of one hour. All interviews were recorded and transcribed verbatim.

To analyze interview transcripts, we used a qualitative content analysis methodology [53,54] combined with deductive thematic analysis [55] (Figure 3.1). The transcripts were coded using NVivo 12 software according to a set of pre-defined categories represented by nineteen government instruments [170]. The pre-defined categories, or government instruments, were

based on an analysis of international literature on community energy [170], which identified nineteen tools addressing community energy and four global categories (payment-based, grid access, community planning and capacity, and environmental protection instruments) that group instruments according to their functions (Figure 3.2). These categories or groupings emphasize the diversity of tools (existing or potential) that can help to achieve common objectives for advancing community energy, and reinforces that a common goal can be achieved through the implementation of multiple and complementary instruments. We coded the interviews considering these nineteen government instruments, and grouped results according to the four global categories. The content of the two most discussed categories by interview participants was then analyzed in order to identify lessons and recommendations.



* Literature analysis conducted by Leonhardt et. al. [170]

Figure 3.1 – Process used to analyze the interviews.

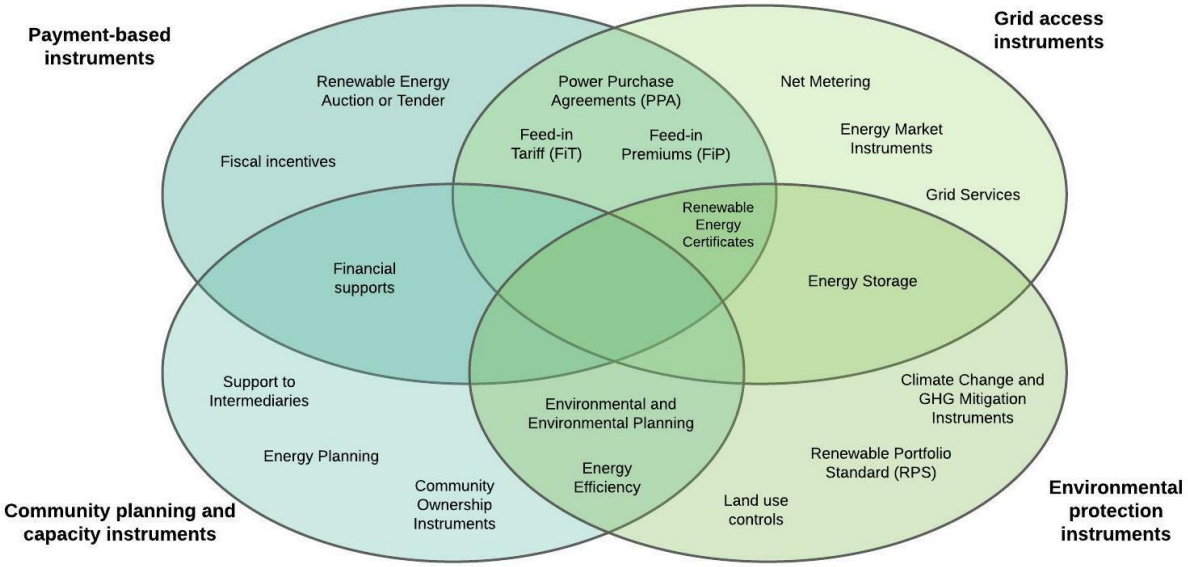


Figure 3.2 – The nineteen government instruments and its respective four global categories (Based on Leonhardt et al., [170]).

The methodology has limitations. The snowball sampling technique is effective when used to connect with often hard-to-reach participants such as large corporations and small

communities. However, the method does not always ensure representativeness [199], as participants sometimes recommend participants from the same sector or with similar perspectives. Considering this limitation and the multi-stakeholder scenario involved in community energy, we contacted at least one representative from each group in each jurisdiction to create the opportunity for all sectors and regions to participate.

3.5 RESULTS

A total of 18 different instruments intended to support community energy were identified by interview participants (Table 3.2). These include both tools that currently exist and mechanisms desired by participants. Of these instruments, financial supports, which include government-provided financial contributions, such as grants and funding programs, were mentioned the most often, by 78% of interviewees. This was followed by community ownership instruments (62%) – the policies and laws that encourage community ownership of renewable energy projects. Grid services was the third most identified instrument overall, but mentioned by less than half of participants, referring to laws and regulations that control the access to a grid system.

Results show a diversity of instruments with the potential to support community energy, each receiving different attention by participants across jurisdictions. Community ownership, for example, was the instrument most mentioned in Saskatchewan, with 80% of interviewees referring to this tool as crucial for advancing community energy in northern and Indigenous communities. Community ownership was the second most mentioned instrument by Northwest Territories participants (48%), and the third most referenced in Manitoba (75%). The relatively high attention to community ownership instruments is possibly related to the current ownership structure in each of the three regions, where a crown utility is responsible for most of the power generation, distribution, and transmission and, thus, new or revised government instruments are necessary to further develop and promote community-owned energy projects.

Table 3.2 – Distribution of interview codes by instrument and by region.

Government instruments	Interviewees addressing each government instrument, by region[1]								TOTAL	
	NWT		SK		MB		Other regions			
	#	%	#	%	#	%	#	%	#	%
Financial supports	17	81%	7	70%	8	100%	3	50%	35	78%
Community Ownership Instruments	10	48%	8	80%	6	75%	4	67%	28	62%
Grid Services	6	29%	3	30%	8	100%	5	83%	22	49%
Net Metering	5	24%	5	50%	4	50%	3	50%	17	38%
Energy Planning	7	33%	3	30%	3	38%	3	50%	16	36%
Climate Change and CHG Mitigation instruments	6	29%	6	60%	2	25%	1	17%	15	33%
Energy Efficiency	5	24%	3	30%	4	50%	3	50%	15	33%
Power Purchase Agreements (PPA)	3	14%	5	50%	4	50%	2	33%	14	31%
Energy Market Instruments	2	10%	2	20%	5	63%	4	67%	13	29%
Land use controls	6	29%	2	20%	1	13%	4	67%	13	29%
Support to Intermediaries	5	24%	1	10%	2	25%	2	33%	10	22%
Environmental and Environmental Planning	4	19%	0	0%	1	13%	0	0%	5	11%
Energy Storage	4	19%	0	0%	1	13%	0	0%	5	11%
Tax incentives	2	10%	0	0%	0	0%	1	17%	3	7%
Renewable Energy Auction or Tender	0	0%	2	20%	0	0%	1	17%	3	7%
Renewable Portfolio Standard (RPS)	0	0%	0	0%	0	0%	2	33%	2	4%
Feed-in Tariff (FiT)	0	0%	0	0%	0	0%	1	17%	1	2%
Renewable Energy Certificates (REC)	0	0%	1	10%	0	0%	0	0%	1	2%
Feed-in Premiums (FiP)	0	0%	0	0%	0	0%	0	0%	0	0%
Total number of interviews by region	**21**	**100%**	**10**	**100%**	**8**	**100%**	**6**	**100%**	**45**	**100%**

[1]The table shows the number of interviews that addressed the government instrument by region (#) and the relative percentage considering the total number of interviews by region (%).

Grid services, although identified by participants in all jurisdictions, was the most frequently noted instrument only in Manitoba, and mentioned also by participants representing the federal government or from other jurisdiction, namely Alberta and Ontario. Most of the participants from Manitoba that mentioned this instrument discussed the lack of supportive grid services instruments for community energy. Climate change and GHG mitigation instruments, in

contrast, was identified by more than half of participants only in Saskatchewan. In each of the Northwest Territories and Manitoba, climate change and GHG mitigation instruments were raised by less than one-third of participants as essential to support community energy. This finding may be because more than 70% of the energy mix of Northwest Territories (73.7%) and Manitoba (99.6%) are generated by renewable energy, while in Saskatchewan it represents only 17.7% of the energy mix [184].The variability in attention given to each instrument is emphasized by power purchase agreements (PPA), energy market instruments, and land use controls. For example, 50% of participants from Saskatchewan and from Manitoba mentioned PPAs, while only 13% of Northwest Territories participants mentioned this instrument. Energy market instruments also highlight this variability, being the fourth most mentioned instrument in Manitoba (63%), while it was discussed by only 10% of participants from Northwest Territories. Results also highlight tools that received no attention in some regions. Renewable portfolio standards (RPS) and feed-in tariffs (FIT), for example, were only mentioned by participants in the 'other regions' category, and renewable energy certificates (REC) was only discussed by participants from Saskatchewan. Environmental and environmental planning, and energy storage instruments, were not mentioned in Saskatchewan, but were mentioned by participants from the Northwest Territories and Manitoba. Feed-in premiums (FiP) was the only instrument not mentioned in any region but identified in the literature by Leonhardt et al. [23].

Although it was not the purpose of this research to compare responses by participant groups, mainly because participant groups or categories, especially Indigenous leadership, are quite unevenly distributed across the jurisdictions, some notable similarities and variabilities were observed. One example where similarity emerged was between Indigenous leadership participants. Although most all Indigenous leadership participants were based in Northwest Territories, they most often recognized financial support instruments (83%). Similarly, in Saskatchewan, the importance of financial supports was also identified by all Indigenous leadership participants. Variability can be observed between intermediary organizations. Climate change and climate instruments, for example, were mentioned by all intermediary organizations in Saskatchewan but by none from Manitoba. In Manitoba, the most mentioned instruments by intermediary organizations were financial incentives and grid services; in the Northwest Territories it was energy efficiency instruments.

Following Leonhardt et al. [170], the 18 instruments identified by participants were grouped into four categories based on the functions they serve: payment-based instruments, grid-access instruments, environmental protection instruments, and planning and capacity instruments (Figure 3.3). Overall, the payment-based category was the most mentioned by participants (84%), and the environmental protection category the least identified (62%). Among payment-based instruments, financial supports dominated (78%) with fiscal incentives (7%) and renewable energy auctions or tenders (7%) receiving the least attention. Fiscal incentives refer to tax deductions or exceptions for energy development, and renewable energy auctions or tenders refer to the competitive bids used to procure renewable energy. The most mentioned instruments in the environmental protection category were climate change and GHG mitigation instruments (33%), and environmental and environmental planning (33%). These instruments represent, respectively, policies and regulations that establish GHG reduction targets, and control the environmental impacts of renewable energy projects. Renewable portfolio standards (4%) were the instrument that received the least attention in this category.

The other two categories, grid access instruments, and planning and capacity instruments, were mentioned by 73% and 80% of participants. Among the grid access category, 49% of participants identified grid services, followed by net metering (38%), and power purchase agreements (31%). Net metering are the credits received in exchange for excess electricity generated, and power purchase agreements refers to the electricity purchase agreements between the consumer and the energy generator. Energy storage (11%) was the least mentioned instrument in this category. Among planning and capacity instruments, community ownership instruments dominated and was identified by 62% of participants, followed by energy planning (36%), and support to intermediaries (22%). Energy planning represents the instruments used to guide the development of a region's energy system, and support to intermediaries refer to the tools available to support intermediary organizations that work with community energy.

In the sections that follow, the two instruments identified in almost 50% of the interviews in all three regions, and by participants from other regions, are explored in greater detail. Emphasis is placed on the relative strengths and constraints of those instruments, as identified by interviewees, for supporting community energy. The discussion focused on existing instruments primarily, but at times participants referred to instruments that had lapsed or were desired.

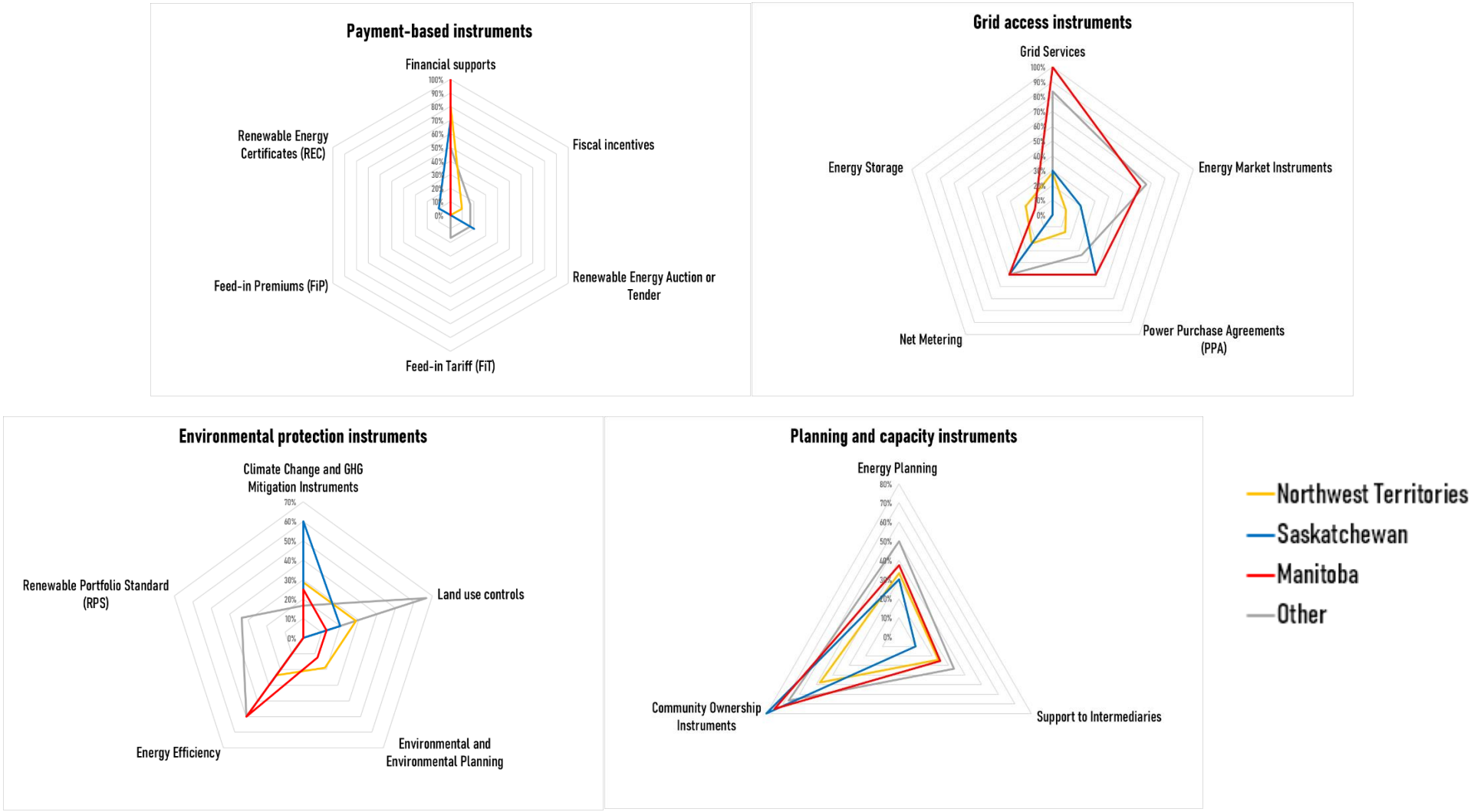


Figure 3.3 – Government instruments distribution by province according to their function.

3.5.1 Financial incentives

Financial incentives were mentioned in 35 out of the 45 interviews. Discussion focused on the organizations that provide funding; the areas to which financial incentives should be applied, such as renewable energy technology and infrastructure, offsetting the costs of local generating capacity, and energy efficiency projects; and the ability of communities to take advantage of financial programs. Participants from all regions identified federal funding initiatives as crucial for developing community energy in northern and Indigenous communities, with each program supporting multiple objectives (Figure 3.4)

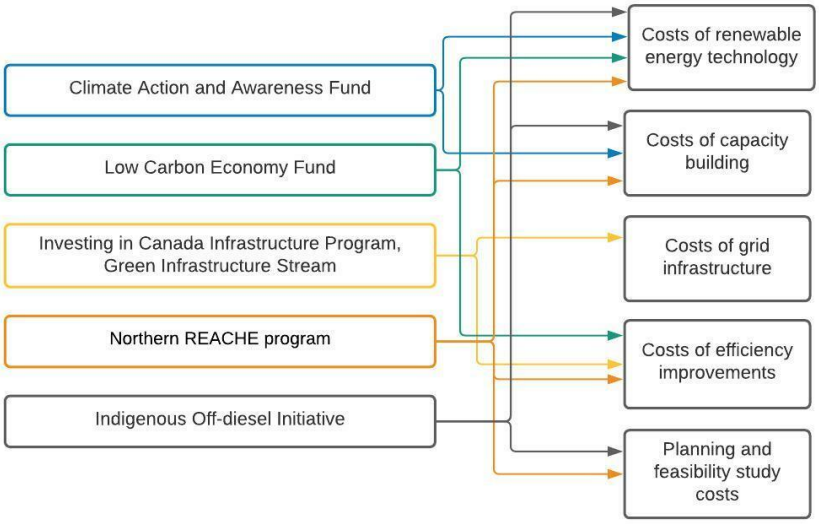


Figure 3.4 – Federal funding program opportunities identified by interview participants and program objectives.

As explained by a participant from an intermediary organization in Saskatchewan, "the federal government, since 2015, has put a lot of money into grants, not just for communities but even for individual households, and buildings and schools" and these programs "have really facilitated sort of a surge in community generation." Federal funding was also identified as essential to support infrastructure improvements, such as upgrades to electricity grids, and human resource capacity development through workshops and training. The Northern REACHE program, for example, which supports only communities in the territories, was identified as "working on funding a project for Tuk [Tuktoyaktuk, NWT] that can be anywhere from $200,000 to $400,000 for their new solar system for the hamlet" – a 51-kilowatt project that will "fill up the rest of their local

grid for alternative energy." Interviewees from Saskatchewan identified federal funding through the Indigenous Off-Diesel Initiative, with one Indigenous leadership indicating that Kinasao, the only off-grid diesel-based community in northern Saskatchewan, is part of the Indigenous Off-Diesel Initiative which is supporting one local community Indigenous entrepreneur and developer to embark on a community-wide solar initiative.

However, participants also expressed concern that financial incentives for community energy are not evenly accessible, over time or across regions. Several participants from Saskatchewan, for example, commented that there are limited opportunities available from the province, except for funding to retrofit specific community public buildings. A provincial government representative confirmed, noting that the two primary sources of financing for renewable energy are the federal government and private initiatives. Participants also indicated that northern and Indigenous communities in Saskatchewan are not often included in the priority areas to receive financial incentives to develop renewable energy, reporting that the high priority areas that exist within the province seem to be oil and gas communities.

Participants from the Northwest Territories, however, did identify funding opportunities available through the territorial government. For example, an Indigenous community leader from Fort McPherson explained that the community applied to receive funding from the Government of Northwest Territories to support equipment costs to generate power with woodchips: "We have applications in to Government of Northwest Territories…to get us equipment, so that we can build capacity, so we can have people working, collecting the chips and shipping it and storing it for the winter." However, in another instance, participants from the Gwich'in Tribal Council noted that the Council lost the funding that was supposed to cover half of the cost solar panels planned for installation in one of their communities, explaining "they were supposed to be free solar panels for anyone who applied, that was Gwich'in, but they [community members] lost half their funding sort of last minute" and the portion of the grid reserved for renewable energy projects ended up being filled by non-Indigenous people or people who "had the money and were waiting for this kind of opportunity."

In Manitoba, interviewees said that several energy-related programs once available through the province of Manitoba are either not available anymore or are now offered by the provincial energy utility – either Manitoba Hydro or Efficiency Manitoba. For example, participants referred to critical financial and organizational support to social enterprises, such as Aki Energy, that was once available to support community energy in the province. A government representative indicated that the province supports community in northern and Indigenous communities through regional regulations, specifically a regulatory requirement that 5% of the total Efficiency Manitoba's budget must be located to support "low-income First Nations, Indigenous communities". Efficiency Manitoba Regulations (2019) [200] defines that "(c) whether, if it is practical to do so, at least 5% of Efficiency Manitoba's budget for demand-side management initiatives is allocated to initiatives targeting low-income or hard-to-reach customers". In contrast, a representative from Northwest Territories Power Corporation (NTPC), the territorial energy utility, argued that financial incentives for community energy initiatives should come from outside the utility. According to the interviewee, NTPC should only help with technical and economic assessments, considering that financial incentives provided by NTPC would increase the rates paid by customers. The participant explained:

> "What happens when rates go up for other customers, other customers look to see what they can do to reduce their rates, how they can get off the utility system and become more energy self-sufficient which leads to other customers suffering the same fate. The problem is from an energy security perspective, it's the poorest customers that pay for that behavior 'cause the poorest customers have the least number of options. They're not financially able to go out and purchase their own generation system for instance or install solar panels to offset their rates. What happens is the more wealthy customers benefit and the more poor customers suffer."

A member of Indigenous Services Canada (ISC), a Federal government department, explained that, in general, current funding programs for community energy do not cover all project expenses and communities need to find additional sources to fund local projects. Thus, to cover all community energy project expenses, communities often need

to apply for multiple funding sources. Two interviewees from the Northwest Territories similarly noted that most renewable energy projects in the region are supported by funds from both the federal and territorial government. Participants also indicated that communities also apply for funding programs that are financed by different sources (e.g., governments, associations, private companies). One example provided is the Federation of Canadian Municipalities, which combines funding from federal, provincial, and territorial governments and other public and private sector partners to support sustainability projects through funding programs like the Green Municipal Fund. However, an interviewee from the Northwest Territories explained that one of the challenges related to accumulating funding from multiple sources is the fair distribution of funding: "there's only so much funding and one community gets it, and the other community has to wait until next year."

Participants also expressed a diversity of views on the preferred focus or intent of financial incentives for community energy. Some participants mentioned that the funding should be more focused on energy efficiency improvements as opposed to renewable energy technologies. For example, a participant from an intermediary organization argued that the money required to develop new renewable energy projects could be saved with energy efficiency measures, stating: "At the end of the day, if you're gonna to be saving money with the energy efficiency, you can finance it." An intermediary organization participant from Saskatchewan suggested that the shift in the focus of federal funding from energy efficiency improvements to new renewable energy technologies can make communities susceptible to "experimentation":

> "I've seen a shift in some of their [Federal government] programs to new tech, like high tech, in the energy field. And while I think obviously there is a need to support that kind of thing, it doesn't necessarily do a lot for northern and remote communities because sometimes it actually facilitates industry coming and saying: "Hey community of Inuvik, we wanna install this random piece of equipment that we have no idea whether it's going to work in your climate and we are gonna promise you the world and hope for the best". So, a lot of times, northern and remote Indigenous communities get caught in the middle of that,

> where they're sort of being the experiment ground for new tech, and I think that's not going to help them at all in terms of achieving energy security and reducing energy poverty."

In Manitoba, most of the current programs identified are related to efficiency improvements, including loans and grants provided by Efficiency Manitoba for home energy improvements. The Northwest Territories government also funds home improvements; however, a member of the Gwich'in Tribal Council explained that it is hard to access those funds: "There's the NWT housing program that you can apply to help with the cost of renovations and they'll pay a certain amount, but it's very specific. And it's very hard to access. Your income has to be under a certain amount and if it's your second home, you're out of luck" [i.e., it is only available for first-time home buyers].

Other participants highlighted the importance of funding programs for capacity building in communities. How participants spoke of capacity, however, was multi-dimensional. For example, participants identified the importance of retaining trained people in the community, meaning that resources are needed to support community members to travel to participate in training. A participant from the Northwest Territories referred to an example of a workshop in Yellowknife, the territory's capital, which would require thousands of dollars for a community member from a remote region or hamlet to attend – and "it's unlikely the hamlet or any organization…would buy into that." Training and education programs funded partially by the federal government do exist, such as the Catalysts program, ECO Canada and Climate Action and Awareness Fund, and training support from Indigenous Service Canada. A government representative from Manitoba indicated that the provincial government and Manitoba Hydro used to fund social enterprises, such as Aki Energy, that trained people in Indigenous communities, but those programs of financing are no longer available. Nevertheless, interviewees from all three jurisdictions identified the importance of financial support for training programs through utilities and intermediary organizations, such as Efficiency Manitoba, SaskPower, FNPA and NTPC.

Despite the availability of renewable energy funding programs, including training initiatives, many participants from Saskatchewan and Northwest Territories report that the local capacity to prepare funding applications is a concern and one of the barriers to community-owned projects. For example, one participant stated that "more Indigenous-owned renewable energy companies would be a huge thing (but), on the support and building side, it's proposal writing and knowing how and where to find funding for these projects." A representative from the Gwich'in Tribal Council in the Northwest Territories explained that although funding opportunities are available, they are not easily accessible, explaining:

> "They (government) should come into the community, come and sit down, and say "Look, we have this pot of money and these are the things you can do with it." And maybe they should provide someone in each of the communities, bring in someone and say, "Look, this person can help you achieve and get what you need." But sometimes they'll announce it, maybe on their government site, but who is gonna be on their government site 24-hours a day to see what they have going?".

Participants from Indigenous leadership and intermediary organizations stated that having a funding coordinator who can apply for the opportunities available to support community energy is essential. One Indigenous community in the south of Saskatchewan, for example, has a dedicated community member who only deals with funding proposals. A representative from this community stated: "The money is flowing like crazy from the federal government right now….I don't know if First Nations have the capacity to make stuff happen when that money's available to them, so we've just created a position that…just only deals with funding proposals and getting and keeping and maintaining funding." The individual went on to indicate that for many First Nations communities, however, the capacity simply isn't there to secure available resources, commenting: "That's what makes it hard, is just watching all this federal money come and then knowing the Nations aren't ready for it…they're never gonna get that opportunity again." A participant from Manitoba's crown corporation suggested that communities are not making full use of the resource available due to limited capacity, and indicated that the

corporation is offering simplified applications for the energy programs and making internal staff available support with these issues. A member of the Gwich'in Tribal Council, however, indicated they are struggling to find someone to fill a similar position with the resources that are currently available to the Council, saying: "We need a coordinator to go out and get these fundings and create jobs for the communities and help us move forward" but adding that even if an individual can be identified "we really don't have housing, we don't have office space" to support the role.

3.5.2 Community ownership instruments

More than 60% of participants mentioned ownership instruments as critical to advancing community energy, with several expressing that remote and Indigenous communities are increasingly interested in having greater control over their means of energy generation. According to an Indigenous community leader from northern Saskatchewan, having more control and ownership of energy generation allows for more local job creation opportunities, new financial opportunities, and a better understanding of the local capacity development needs to ensure that local energy projects are inclusive of Indigenous culture. The interviewee explained that when projects are "built by the community, for the community….then you're incorporating culture, you're incorporating language, and all of those teachings that, now, that community can identify with that and the interpretation of what the project actually means and the impact of it".

Notwithstanding the importance of local ownership, 16 out of the 25 participants that discussed community ownership instruments identified the constraints, or lack, of current ownership instruments to support community energy – largely owing to the dominant role of crown energy utilities in each of the three jurisdictions. Participants from all three jurisdictions discussed the impact of current legislation, which only allows the crown utilities to generate, transmit and distribute electricity, as a major constraint to community ownership. According to an intermediary organization participant from Saskatchewan, the way that Crown corporations operate, controlling the generation and distribution of power in the province, is not beneficial for encouraging or supporting community-based power generation. The interviewee went on to explain that even though there are policies

to support renewable energy, Crown energy utilities serve as "the source, and the seller, and the customer", which "has a lot of benefits but… unknowingly hinders, at least, distributed renewable energy generation because there isn't this freedom of access to the grid." Another participant, an Indigenous leaders from Saskatchewan, raised similar constraints but went on to question "Why can't we (Indigenous communities) have our own grid, and they (Crown utilities) can sell to our grid" and expressing frustration in that: "I just really don't like the idea of having to use somebody else's infrastructure when we're a sovereign nation, why don't we have our own?".

For Manitoba participants, regulations such as the *Manitoba Hydro Act*, which offers exclusivity over the generation and sale of electricity in the province to Manitoba Hydro, was noted as an obstacle to community ownership. A participant from an Intermediary organization of Manitoba explains that the act gives Manitoba Hydro exclusive rights to sell electricity, and while this "may make sense in southern Manitoba. it absolutely does not make sense up there [northern Manitoba]." The interviewee explained "the structure that's required up there is – if a community puts in a solar array, they have to sell that electricity to Manitoba Hydro [who] runs it through their wires for half a kilometer and then sells it back to the community." The interviewee described this as "an absurd situation" in that "it has to be possible for the community to make their own power, both electricity and heat", especially because "they (community) can do that for heat, but they can't do that for electricity".

However, representatives from both provincial governments and utilities in Manitoba and Saskatchewan explained that there are other ways to support community ownership, which do not necessarily require changes in the nature and function of provincial crown energy utilities. These participants often identified PPAs and competitive procurement programs as ways to access the local grid. For example, a representative from SaskPower explained that "there's no shared ownership of our power grid [but] we do have programs that have come and gone for a time where people can generate power and feed it back into the system." The interviewee explained that the current offering is a Power Generation Partners program to which businesses or people can apply to have renewable systems that they fund and build and connect into the provincial grid." Such power

purchase and generation partnerships were described as instruments that facilitate First Nations ownership of projects through eligibility criteria that not only consider the price of the offer, but also the participation of Indigenous communities. A representative from First Nations Power Authority reinforced that the provincial Crown energy utility has been active in facilitating other forms of ownership in the province's generation monopoly by integrating independent power producers (IPPs) into the energy market through competitive procurement. An interviewee from an intermediary organization in Manitoba, however, cautioned that changes in ownership regulations alone are not enough to guarantee successful community ownership and energy security; government needs to help build the local capacity to support energy security.

Ownership regulations were also mentioned as barriers in the Northwest Territories to facilitating community energy, with an Indigenous leader indicating: "my experience with regulations in general are that they are often developed for large systems that don't prioritize the needs of flexibility in small communities." According to an interviewee from the Arctic Energy Alliance, an intermediary organization in the Northwest Territories focused on promoting energy efficiency, the way regulations are designed in the territory, limiting the participation of IPPs, is a barrier to local electricity generation. The participant explained that the current structure is one where "the [territorial] utility provides power, and if the community wants to produce power, they have to sell it to the utility." In contrast, it was noted that in the adjacent state of Alaska, "most of the communities there, the remote communities there, they work on a co-op based system, so the community is a part of the electric utility in the sense that they're a part of that co-op [and] they can do a lot of things that are, in the Canadian territories, very challenging to do." That said, community power generation as IPPs is already happening in Aklavik, Northwest Territories. According to a representative from NTPC, the Nihtat Gwich'in owns a high penetration solar project in the region. The interviewee claims it as a "real game changer for the north". However, notwithstanding community ownership, under the current NTPC policy only a maximum of 20% of electricity generation can come from intermittent renewable generation.

Although participants focused primarily on regulatory constraints and opportunities, several also raised the costs associated with community-owned projects. A representative of Northern Energy Innovation, a research program at Yukon University, suggests that when comparing community-owned generation and utility generation, the costs of community-owned projects are often higher than utility generation A participant from Efficiency Manitoba similarly suggested that generating energy independently can sometimes mean high energy storage costs; and in case that the province decides to support locally owned projects those costs would have to be spread among other energy consumers. However, a contrasting perspective was offered by a representative from the Government of Saskatchewan, arguing that if northern communities have ownership over the energy system, they have "the opportunity to generate power [let's] say from wind, or solar, or biomass, at a *cheaper* rate than what they are currently receiving from the state-owned utility.". A member of an intermediary organization in Manitoba also argued that it is not sustainable to *not* provide community ownership. The interviewee explained that the current model, "where a utility from the south owns your energy system and manages your energy system for you, if you're a remote northern community, that's not a sustainable model - the costs are horrendous, if something goes wrong…just to get somebody up there if it's entirely owned and operated by a southern utility."

3.6 DISCUSSION

There is a diversity of instruments that impact community energy. Similarly to what was identified in the literature by Leonhardt et al. [170], several different tools are available to support the advancement of community energy in northern and Indigenous regions. Out of the 19 instruments identified in the literature, only feed-in premiums were not discussed by study participants - an absence that is likely explained by the fact that no similar programs exist in any of the three jurisdictions. Consistent with the current focus of international scholarship on community energy [23], financial supports were the most discussed instrument. Community energy scholars and interviewees collectively highlight the importance of financial supports for capacity development, the need for sustainable tools over time, and the negative impacts that changes in funding programs can have to the long-term viability of community energy initiatives. However, while the literature

frequently mentions the importance of loans for community energy projects [100,119], it was not widely mentioned instrument by interviewees - only two participants specifically talked about loans. In contrast, community ownership often dominated the interview conversations, but has not received the same relative attention in the literature compared to other instruments. Research focusing of tools supporting community ownership often speak simultaneously to energy sovereignty [201], especially in the context of northern and remote communities. This may explain why ownership instruments were mentioned more in interviews, given the quest of Indigenous people for Indigenous rights and energy sovereignty in northern Canada [202].

Results also show a variability of instruments across participant groups and regions. For example, only financial supports dominated the discussion of Indigenous leaders from Saskatchewan and Northwest Territories, while intermediary organizations from Saskatchewan identified most frequently climate change and climate instruments; energy efficiency instruments were the most mentioned by intermediaries in Northwest Territories. There is also a diversity of instruments that serve the same function. At least three tools were frequently mentioned to perform grid access, environmental protection, and planning and capacity functions. The diversity and variability across participant groups and instruments operating the same function points to the need for complementarity, coordination and alignment between the array of tools [170]. For example, participants highlighted that energy storage is expensive, and therefore having those technologies in communities depends on having an external source of funding – such as funding from the federal or provincial government.

There is limited consensus on the intended role or purpose of the instruments supporting community energy. This is the case for community ownership and, especially, financial supports. For example, there are several financial incentives available but the results showed a diversity of perspectives on the best focus of these programs, whether energy efficiency, supporting new renewable energy technologies, or building local capacity. This emphasizes the need to reconcile interests (e.g. governments, Indigenous communities, etc.) and conditions of northern and Indigenous communities, to provide comprehensive and effective government instruments [23]. Furthermore, the different

focus of government instruments and the variety of needs of each community, emphasizes the need for place-based tools to promote a just energy transition [203].

Given the diversity of instruments, there is no one-stop shop to support communities in energy transition. Communities must have the capacity to identify, explore, and seek out multiple opportunities to meet the needs of any single community energy initiative. This seems to be a constraint for many communities – especially those that lack the local capacity to identify and apply for such programs, or who lack the financial resources to hire external expertise to do so. This raises a question of equitable access to energy services – one of the main components of energy security [66,204]. Whilst various instruments and programs may be available, communities require the capacity to engage in these programs, and when they do engage, they are competing against other communities for limited resources. Capacity is restricted in many northern and remote communities [67,94]; where local capacity does not exist to take advantage of programs, community energy initiatives are sometimes implanted by external businesses or interests. The literature shows that these types of externally-driven projects are less likely to be successful over the long-term [205]. Such externally-driven interests can result in significant opportunity costs and communities can become more vulnerable to energy insecurity [206,207].

The results also lead to a reflection on the opportunities for community energy inside rigid and vertically integrated systems. The energy monopoly and the consequent impossibility to access the grid or to generate power was a topic frequently mentioned when discussing community ownership and grid services instruments. The historically centralized governed systems in these three regions, however, raises a question on whether the rules and regulations embedded in these systems are flexible to the changing needs of communities as they transition to community energy generation. The importance of alignment is also relevant in the context of communities' needs and government opportunities - supporting the development of community energy directly implies in a need for having alternatives to the centralized structure of generating energy.

3.7 CONCLUSIONS

Community energy can provide multiple benefits for local communities and governments embracing renewable energy adoption targets [23]. It is also capable of alleviating energy insecurity in northern and Indigenous communities, if adequate government instruments are available and accessible. Our research identified that there are multiple instruments to support community energy in the study regions but that localized government instruments may be the more effective, considering the unique context of northern and remote communities. Our results also reinforce the relevance of financial supports and community ownership to support community energy, but caution that many northern and remote Indigenous communities either do not have the capacity to access such supports when they are available or are competing against each other for limited resources.

In conclusion, there is no single instrument that is a magic bullet capable of providing the necessary support for community energy in all northern and Indigenous communities. Instead, a diversity of complimentary and reinforcing instruments is essential. Understanding community needs, capacities, and the options available to support community energy goals is an important first step in the development of tools to support transition. Further research is necessary to understand when government instruments complement each other, when they are predatory to each other, and when they create competition. For example, a community might use multiple funding programs to develop the necessary local capacity for a community energy initiative, however some programs can prohibit the community to receive funding from other sources. Communities might also need to compete to access financing, which emphasize the need for careful consideration of the fair distribution and fair access of support, and the relationship between energy sovereignty and government instruments. The results also show evidence of variability of government instruments across jurisdictions, suggesting that further research is required to understand these differences, the underlying reasons, and implications for equitable access to and support for community energy. This research captures only a segment of the current scenario in northern Canada. Further research is also required to provide a comprehensive and cross-country comparison to identify lessons and opportunities from a broader perspective.

CHAPTER 4 – THESIS CONCLUSIONS

Community energy can provide several benefits to communities, the environment, and governments [208]. Community energy projects are also a potential solution for the energy insecurity faced by many northern and Indigenous communities [25]. The development of community energy, however, hinges on the support of appropriate government instruments, such as energy policies and regulations [46,47]. However, there is limited research on the nature and implications of these instruments for enabling community energy, especially in the context of northern and Indigenous communities. Therefore, this research explored the role of government instruments in facilitating community energy in northern and Indigenous communities. To do so, an analysis of the current emphasis of scholarly research on government instruments was presented, followed by an exploration of government instruments supporting or hindering community energy in northern and Indigenous communities in Canada, specifically Saskatchewan, Manitoba, and Northwest Territories.

The first manuscript presented in this thesis (Chapter 2), examined the current scholarly research on government instruments for community energy. There is an increasing recognition of the importance of government instruments in enabling energy transition [48,49], yet there is limited research on the nature and implications of these instruments for enabling community energy. Little is known about the nature and diversity of government instruments identified in current literature, and the relative strengths and limitations to supporting community energy. The analysis of the scholarly research presented in this thesis identified 19 instruments, which could be grouped into four categories based on the main functions they serve, namely payment-based, grid access, community planning and capacity, and environmental protection instruments. The analysis suggests that there is no shortage of tools with the potential to support community energy, however financial supports, feed-in tariffs, grid services, and fiscal incentives instruments tend to dominate the scholarly conversation. Several important observations emerged from this research for advancing scholarship on government instruments to support community energy. First, the success of government instruments in enabling community energy depends in large part on their sensitivity to local context – especially in the case of remote or Indigenous communities. Second, the success of government

instruments in supporting community energy require coordination and complementarity, both between the diversity of tools that exist that serve similar or competing functions and between levels of government. Third, there is a need to better understand what government instruments are most appropriate for, and practical in, remote or off-grid communities – a region that has received limited attention in the scholarship in comparison to more organized and grid-connected places. Finally, the success of local energy initiatives requires community engagement; the same is true for the development of effective government instruments to support community energy.

The second manuscript presented in this thesis (Chapter 3), examined the range of government instruments supporting or hindering community energy in northern and Indigenous communities of Saskatchewan, Manitoba, and Northwest Territories. The literature states that the advance of community energy in northern and Indigenous regions hinges in part on supportive government instruments [46,47]. Thus, this manuscript explores the government instruments supporting or hindering community energy in northern and Indigenous communities in Canada. The results reinforce the diversity of government instruments identified in the scholarly literature, identifying several different instruments available to support the advancement of community energy in northern and Indigenous regions, of which financial incentives and community ownership instruments dominated. However, results also show a diversity of views on the most appropriate instruments to advance community energy in the north. Such variety can be seen both across regions and across participant groups. There is also limited consensus on the most appropriate role or purpose of instrument, and the barriers that vertically integrated systems might pose to advance community energy. Perhaps most importantly, communities must often pursue multiple financial programs or instruments to meet the needs of community energy initiatives, yet many northern and Indigenous communities lack the capacity or financial resources to do so. Notwithstanding the diversity and availability of different programs and instruments, it does not mean that they are appropriate to northern and Indigenous contexts or that they ensure equitable access to community energy opportunities.

In conclusion, this thesis explored the nature and role of government instruments in facilitating energy transition and renewable energy development in northern and Indigenous communities. The research findings emphasize that the advance of community energy, especially in the context of remote and energy insecure communities, requires appropriate tools. It indicates that localized policies and regulations are required to offer equitable and meaningful opportunities for community-owned renewable energy projects in northern and Indigenous communities.

Nevertheless, much research is still necessary to develop government instruments that are able to create a just transition, where communities with different needs have the opportunity to benefit from energy transition. Indigenous communities often face challenges to access to existing opportunities, such as funding for project development or energy efficiency, because of the lack of local capacity to search and apply for those funds. Thus, to promote a just energy transition, the creation of programs and policies needs to be tied to the development of local capacities. Future research on how government instruments can promote local capacity is required to promote equitable access to opportunities. Comparisons on the instruments supporting communities of interest and communities of place might be required to understand how to provide more appropriate instruments to remote, northern and Indigenous communities.

The literature emphasizes the diversity of tools serving the same or multiple functions, but the interview results show that there is limited consensus on the most appropriate role for many instruments. Further research is needed to provide a deep analysis of each tool, and identify the most influential role or function of each instrument within the different remote and northern community energy contexts. Future research on the interaction of available government instruments, coupled with assessments of local capacities is also needed. Considering that there is no one-stop shop to support communities, complementarity and coordination between instruments is essential to guarantee access to energy opportunities to communities with limited capacity. Understanding how instruments interact by comparing communities that have had multiple opportunities and also a lack of opportunities can help to design more equitable instruments.

Our research focused on the formal instruments applied by federal, provincial, territorial and municipal governments. Further research is still required to understand the informal instruments and the different actors involved in the current shaping of community-based energy transitions worldwide. Understanding which local instruments support or hinder community energy, and how those tools interact with other governments, such as Indigenous governments, might be a way to promote greater engagement and the advancement of locally-owned renewable energy projects. It is also important to develop research on the informal mechanisms used to promote intergovernmental relationships, specially on the relationships between Indigenous communities and utilities, federal and provincial governments.

The main limitations of this research are related to the narrow geographic scope. This research only provided a deep analysis of three northern regions of Canada – Northwest Territories, Saskatchewan and Manitoba. However, the overarching findings of this research may be applicable to advance community energy in regions with similar socio-economic and geographic settings. Another limitation is that the three studied regions have a vertically-integrated power generation, transmission and distribution system. Such a limitation implies that the findings may not be applicable in regions with different energy system structures. Further research is required to understand how government instruments impact northern and Indigenous community-owned projects in a decentralized energy system structure. A comparison between these two energy governance systems could provide additional valuable lessons.

REFERENCES

[1] IPCC, Climate Change 2014: Synthesis Report, Geneva, Switzerland, 2014. https://www.ipcc.ch/report/ar5/syr/.

[2] R. Bronen, Forced Migration of Alaskan Indigenous Communities Due to Climate Change, in: Environ. Forced Migr. Soc. Vulnerability, 2010: pp. 87–98. https://doi.org/https://doi.org/10.1007/978-3-642-12416-7_7.

[3] A. Spring, B. Carter, A. Blay-Palmer, Climate change, community capitals, and food security: Building a more sustainable food system in a northern Canadian boreal community, Can. Food Stud. / La Rev. Can. Des Études Sur l'alimentation. 5 (2018) 111–141. https://doi.org/10.15353/cfs-rcea.v5i2.199.

[4] L. Suter, D. Streletskiy, N. Shiklomanov, Assessment of the cost of climate change impacts on critical infrastructure in the circumpolar Arctic, Polar Geogr. 42 (2019) 267–286. https://doi.org/10.1080/1088937X.2019.1686082.

[5] Centre for Indigenous Environmental Resources, How climate change uniquely impacts the physical, social and cultural aspects of first nations, 2006. https://www.afn.ca/uploads/files/env/report_2_cc_uniquely_impacts_physical_social_and_cultural_aspects_final_001.pdf.

[6] UNFCCC, Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015, Paris, France, 2016. https://unfccc.int/resource/docs/2015/cop21/eng/10.pdf.

[7] C. Chen, M. Pinar, T. Stengos, Renewable energy consumption and economic growth nexus : Evidence from a threshold model, Energy Policy. 139 (2020) 111295. https://doi.org/10.1016/j.enpol.2020.111295.

[8] K. Saidi, A. Omri, The impact of renewable energy on carbon emissions and economic growth in 15 major renewable energy-consuming countries, Environ. Res. 186 (2020) 109567. https://doi.org/10.1016/j.envres.2020.109567.

[9] M. Bhattacharya, S. Reddy, I. Ozturk, S. Bhattacharya, The effect of renewable energy consumption on economic growth : Evidence from top 38 countries, Appl. Energy. 162 (2016) 733–741. https://doi.org/10.1016/j.apenergy.2015.10.104.

[10] International Renewable Energy Agency (IRENA), Renewable Energy and Jobs: Annual Review 2019, Abu Dhabi, United Arab Emirates, 2019.

https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jun/IRENA_RE_Jobs_2019-report.pdf.

[11] International Renewable Energy Agency (IRENA), Global Renewables Outlook: Energy Transformation 2050, Abu Dhabi, United Arab Emirates, 2020. https://www.irena.org/publications/2020/Apr/Global-Renewables-Outlook-2020.

[12] A. Alvarez-herranz, D. Balsalobre-lorente, M. Shahbaz, Energy innovation and renewable energy consumption in the correction of air pollution levels, Energy Policy. 105 (2017) 386–397. https://doi.org/10.1016/j.enpol.2017.03.009.

[13] Y. Zhu, Z. Wang, J. Yang, L. Zhu, Does renewable energy technological innovation control China ' s air pollution ? A spatial analysis, J. Clean. Prod. 250 (2020) 119515. https://doi.org/10.1016/j.jclepro.2019.119515.

[14] S.V. Valentine, Emerging symbiosis : Renewable energy and energy security, Renew. Sustain. Energy Rev. 15 (2011) 4572–4578. https://doi.org/10.1016/j.rser.2011.07.095.

[15] G.E. Francés, J.M. Marín-quemada, E.S.M. González, RES and risk: Renewable energy's contribution to energy security. A portfolio-based approach, Renew. Sustain. Energy Rev. 26 (2013) 549–559. https://doi.org/10.1016/j.rser.2013.06.015.

[16] J. Lee, M.M.C. Shepley, Benefits of solar photovoltaic systems for low-income families in social housing of Korea: Renewable energy applications as solutions to energy poverty, J. Build. Eng. 28 (2020) 101016. https://doi.org/10.1016/j.jobe.2019.101016.

[17] Natural Resources Canada (NRCan), The Atlas of Canada - Remote Communities Energy Database, (2018). https://atlas.gc.ca/rced-bdece/en/index.html (accessed

July 9, 2021).

[18] Canada Energy Regulator, Canada Energy Future 2020, 2020. https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2020/index.html.

[19] J. Knowless, Power Shift: Electricity for Canada's Remote Communities, 2016. https://www.conferenceboard.ca/temp/230f8af1-edf9-4c53-8768-e88eab769394/8249_PowerShift_RPT.pdf.

[20] N. Mercer, P. Parker, A. Hudson, D. Martin, Off-grid energy sustainability in Nunatukavut, Labrador: Centering Inuit voices on heat insecurity in diesel-powered communities, Energy Res. Soc. Sci. 62 (2020) 101382. https://doi.org/10.1016/j.erss.2019.101382.

[21] J. Watson, P. Devine-Wright, Centralization, decentralization and the scales in between: What role might they play in the uk energy system?, in: Futur. Electr. Demand Cust. Citizens Loads, 2012: pp. 280–297. https://doi.org/10.1017/CBO9780511996191.017.

[22] E.M. Gui, I. Macgill, Typology of future clean energy communities: An exploratory structure, opportunities, and challenges, Energy Res. Soc. Sci. 35 (2018) 94–107. https://doi.org/10.1016/j.erss.2017.10.019.

[23] J. Hicks, N. Ison, An exploration of the boundaries of 'community' in community renewable energy projects: Navigating between motivations and context, Energy Policy. 113 (2018) 523–534. https://doi.org/10.1016/j.enpol.2017.10.031.

[24] G. Walker, What are the barriers and incentives for community-owned means of energy production and use?, Energy Policy. 36 (2008) 4401–4405. https://doi.org/10.1016/j.enpol.2008.09.032.

[25] L. Cameron, I. Mauro, K. Settee, "A Return to and of the Land": Indigenous

Knowledge and Climate Change Initiatives across the Canadian Prairies, J. Ethnobiol. 41 (2021) 368–388. https://doi.org/10.2993/0278-0771-41.3.368.

[26] J.D. Stephen, W.E. Mabee, A. Pribowo, S. Pledger, R. Hart, S. Tallio, G.Q. Bull, Biomass for residential and commercial heating in a remote Canadian aboriginal community, Renew. Energy. 86 (2016) 563–575. https://doi.org/10.1016/j.renene.2015.08.048.

[27] F. Hvelplund, S. Djørup, Consumer ownership, natural monopolies and transition to 100% renewable energy systems, Energy. 181 (2019) 440–449. https://doi.org/10.1016/j.energy.2019.05.058.

[28] F. Goedkoop, P. Devine-Wright, Partnership or placation? the role of trust and justice in the shared ownership of renewable energy projects, Energy Res. Soc. Sci. 17 (2016) 135–146. https://doi.org/10.1016/j.erss.2016.04.021.

[29] A. Savaresi, The rise of community energy from grassroots to mainstream: The role of law and policy, J. Environ. Law. 31 (2019) 487–510. https://doi.org/10.1093/jel/eqz006.

[30] G. Walker, P. Devine-wright, Community renewable energy : What should it mean ?, 36 (2008) 497–500. https://doi.org/10.1016/j.enpol.2007.10.019.

[31] C.E. Hoicka, K. Savic, A. Campney, Reconciliation through renewable energy? A survey of Indigenous communities, involvement, and peoples in Canada, Energy Res. Soc. Sci. 74 (2021) 101897. https://doi.org/10.1016/j.erss.2020.101897.

[32] C. Henderson, C. Sanders, Powering reconciliation: A survey of Indigenous participation in Canada's growing clean energy economy., 2017. https://indigenouscleanenergy.com/wp-content/uploads/2017/10/Powering-Reconciliation-A-Survey-of-Indigenous-Participation-in-Canadas-Growing-Clean-Energy-Economy.pdf.

[33] J. Chilvers, N. Longhurst, Participation in transition(s): Reconceiving public engagements in energy transitions as co-produced, emergent and diverse, J. Environ. Policy Plan. 18 (2016) 585–607. https://doi.org/10.1080/1523908X.2015.1110483.

[34] J. Naus, B.J.M. Van Vliet, A. Hendriksen, Households as change agents in a Dutch smart energy transition: On power, privacy and participation, Energy Res. Soc. Sci. 9 (2015) 125–136. https://doi.org/10.1016/j.erss.2015.08.025.

[35] M.C. Brisbois, Powershifts: A framework for assessing the growing impact of decentralized ownership of energy transitions on political decision-making, Energy Res. Soc. Sci. 50 (2019) 151–161. https://doi.org/10.1016/j.erss.2018.12.003.

[36] J. Meadowcroft, What about the politics? Sustainable development, transition management, and long term energy transitions, Policy Sci. 42 (2009) 323–340. https://doi.org/10.1007/s11077-009-9097-z.

[37] M.B. Lindberg, J. Markard, A.D. Andersen, Policies, actors and sustainability transition pathways: A study of the EU's energy policy mix, Res. Policy. 48 (2019) 103668. https://doi.org/10.1016/j.respol.2018.09.003.

[38] T.J. Foxon, G.P. Hammond, P.J.G. Pearson, Developing transition pathways for a low carbon electricity system in the UK, Technol. Forecast. Soc. Change. 77 (2010) 1203–1213. https://doi.org/10.1016/j.techfore.2010.04.002.

[39] B.K. Sovacool, How long will it take? Conceptualizing the temporal dynamics of energy transitions, Energy Res. Soc. Sci. 13 (2016) 202–215. https://doi.org/10.1016/j.erss.2015.12.020.

[40] P. Andrews-Speed, Applying institutional theory to the low-carbon energy transition, Energy Res. Soc. Sci. 13 (2016) 216–225.

https://doi.org/10.1016/j.erss.2015.12.011.

[41] P. Thornley, D. Cooper, The effectiveness of policy instruments in promoting bioenergy, Biomass and Bioenergy. 32 (2008) 903–913. https://doi.org/10.1016/j.biombioe.2008.01.011.

[42] M. Lockwood, C. Kuzemko, C. Mitchell, R. Hoggett, Historical institutionalism and the politics of sustainable energy transitions: A research agenda, Environ. Plan. C Gov. Policy. 35 (2017) 312–333. https://doi.org/10.1177/0263774X16660561.

[43] V. Lowndes, M. Roberts, Why Institutions Matter: The New Institutionalism in Political Science, Palgrave Macmillan, New York, NY, 2013.

[44] T. Blanchet, Struggle over energy transition in Berlin: How do grassroots initiatives affect local energy policy-making?, Energy Policy. 78 (2015) 246–254. https://doi.org/10.1016/j.enpol.2014.11.001.

[45] T. Hargreaves, S. Hielscher, G. Seyfang, A. Smith, Grassroots innovations in community energy: The role of intermediaries in niche development, Glob. Environ. Chang. 23 (2013) 868–880. https://doi.org/10.1016/j.gloenvcha.2013.02.008.

[46] K.S. Rogge, K. Reichardt, Policy mixes for sustainability transitions: An extended concept and framework for analysis, Res. Policy. 45 (2016) 1620–1635. https://doi.org/10.1016/j.respol.2016.04.004.

[47] J. Rosenow, F. Kern, K. Rogge, The need for comprehensive and well targeted instrument mixes to stimulate energy transitions: The case of energy efficiency policy, Energy Res. Soc. Sci. 33 (2017) 95–104. https://doi.org/10.1016/j.erss.2017.09.013.

[48] I. Capellán-Pérez, Á. Campos-Celador, J. Terés-Zubiaga, Renewable Energy

Cooperatives as an instrument towards the energy transition in Spain, Energy Policy. 123 (2018) 215–229. https://doi.org/10.1016/j.enpol.2018.08.064.

[49] F. Kern, A. Smith, Restructuring energy systems for sustainability? Energy transition policy in the Netherlands, Energy Policy. 36 (2008) 4093–4103. https://doi.org/10.1016/j.enpol.2008.06.018.

[50] J. Attride-Stirling, Thematic networks: an analytic tool for qualitative research, Qual. Res. I(3) (2001) 385–405. https://doi.org/10.1177%2F146879410100100307.

[51] B.M. Bigland-pritchard, P. Prebble, Transforming Saskatchewan's Electrical Future, Regina, Canada, 2010. https://www.policyalternatives.ca/sites/default/files/uploads/publications/reports/docs/SK Transforming Sask Electrical Future I.pdf.

[52] D. Giles, Aging infrastructure causes one-third of power outages: SaskPower, Glob. News. (2016). https://globalnews.ca/news/3036400/aging-infrastructure-causes-one-third-of-power-outages-saskpower/ (accessed October 29, 2021).

[53] B.K. Sovacool, J. Axsen, S. Sorrell, S. Policy, S. Businees, U. Kingdom, Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design, Energy Res. Soc. Sci. 45 (2020) 12–42. https://doi.org/10.1016/j.erss.2018.07.007.

[54] M. Schreirer, Qualitative Content Analysis, in: U. Flick (Ed.), SAGE Handb. Qual. Data Anal., SAGE publications, London, UK, 2013: pp. 170–183. http://dx.doi.org/10.4135/9781446282243.

[55] L.S. Nowell, J.M. Norris, D.E. White, N.J. Moules, Thematic Analysis : Striving to Meet the Trustworthiness Criteria, 16 (2017) 1–13. https://doi.org/10.1177/1609406917733847.

[56] R.J. Hewitt, N. Bradley, A.B. Compagnucci, C. Barlagne, A. Ceglarz, R. Cremades, M. McKeen, I.M. Otto, B. Slee, Social innovation in community energy in Europe: A review of the evidence, Front. Energy Res. 7 (2019) 1–27. https://doi.org/10.3389/fenrg.2019.00031.

[57] D. Gielen, F. Boshell, D. Saygin, M.D. Bazilian, N. Wagner, R. Gorini, The role of renewable energy in the global energy transformation, Energy Strateg. Rev. 24 (2019) 38–50. https://doi.org/10.1016/j.esr.2019.01.006.

[58] B. Lennon, N.P. Dunphy, E. Sanvicente, Community acceptability and the energy transition: a citizens' perspective, Energy. Sustain. Soc. 9 (2019). https://doi.org/10.1186/s13705-019-0218-z.

[59] S.J.W. Klein, S. Coffey, Building a sustainable energy future, one community at a time, Renew. Sustain. Energy Rev. 60 (2016) 867–880. https://doi.org/10.1016/j.rser.2016.01.129.

[60] C. Haggett, M. Aitken, Grassroots Energy Innovations: the Role of Community Ownership and Investment, Curr. Sustain. Energy Reports. 2 (2015) 98–104. https://doi.org/10.1007/s40518-015-0035-8.

[61] A.L. Berka, J.L. MacArthur, C. Gonnelli, Explaining inclusivity in energy transitions: Local and community energy in Aotearoa New Zealand, Environ. Innov. Soc. Transitions. 34 (2020) 165–182. https://doi.org/10.1016/j.eist.2020.01.006.

[62] F. Mey, M. Diesendorf, Who owns an energy transition? Strategic action fields and community wind energy in Denmark, Energy Res. Soc. Sci. 35 (2018) 108–117. https://doi.org/10.1016/j.erss.2017.10.044.

[63] P. Honvári, I.S. Kukorelli, Examining the renewable energy investments in Hungarian rural settlements: The gained local benefits and the aspects of local

community involvement, Eur. Countrys. 10 (2018) 74–88. https://doi.org/10.2478/euco-2018-0005.

[64] Y. Yamamoto, The role of community energy in renewable energy use and development, EDP Sci. 18 (2016) 1–4. https://doi.org/10.1051/rees/2016040.

[65] Canada Energy Regulator, Market Snapshot: Overcoming the challenges of powering Canada's off-grid communities, Canada Energy Regul. Ottawa,. (2018) 1–8. https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/market-snapshots/2018/market-snapshot-overcoming-challenges-powering-canadas-off-grid-communities.html.

[66] Y. Hossain, P.A. Loring, T. Marsik, Defining energy security in the rural North — Historical and contemporary perspectives from Alaska, Energy Res. Soc. Sci. 16 (2016) 89–97. https://doi.org/10.1016/j.erss.2016.03.014.

[67] L. Mortensen, A.M. Hansen, A. Shestakov, How three key factors are driving and challenging implementation of renewable energy systems in remote Arctic communities, Polar Geogr. 40 (2017) 163–185. https://doi.org/10.1080/1088937X.2017.1329758.

[68] R. Rakshit, C. Shahi, M.A. (Peggy. Smith, A. Cornwell, Energy transition complexities in rural and remote Indigenous communities: a case study of Poplar Hill First Nation in northern Ontario*, Local Environ. 24 (2019) 809–824. https://doi.org/10.1080/13549839.2019.1648400.

[69] C. Emelianoff, C. Wernert, Local energy, a political resource: dependencies and insubordination of an urban "Stadtwerk" in France (Metz, Lorraine), Local Environ. 24 (2019) 1035–1052. https://doi.org/10.1080/13549839.2018.1506754.

[70] J. Krupa, L. Galbraith, S. Burch, Participatory and multi-level governance: applications to Aboriginal renewable energy projects, Local Environ. 20 (2015)

81–101. http://dx.doi.org/10.1080/13549839.2013.818956%0AParticipatory.

[71] D. Loorbach, J. Rotmans, The practice of transition management: Examples and lessons from four distinct cases, Futures. 42 (2010) 237–246. https://doi.org/10.1016/j.futures.2009.11.009.

[72] M. Markantoni, Low Carbon Governance: Mobilizing Community Energy through Top-Down Support?, Environ. Policy Gov. 26 (2016) 155–169. https://doi.org/10.1002/eet.1722.

[73] A. Cherp, V. Vinichenko, J. Jewell, E. Brutschin, B. Sovacool, Integrating techno-economic , socio-technical and political perspectives on national energy transitions : A meta-theoretical framework, Energy Res. Soc. Sci. 37 (2018) 175–190. https://doi.org/10.1016/j.erss.2017.09.015.

[74] L. Fuenfschilling, B. Truffer, The structuration of socio-technical regimes - Conceptual foundations from institutional theory, Res. Policy. 43 (2014) 772–791. https://doi.org/10.1016/j.respol.2013.10.010.

[75] B.D. Solomon, K. Krishna, The coming sustainable energy transition: History, strategies, and outlook, Energy Policy. 39 (2011) 7422–7431. https://doi.org/10.1016/j.enpol.2011.09.009.

[76] A. Roos, R.L. Graham, B. Hektor, C. Rakos, Critical factors to bioenergy implementation, Biomass and Bioenergy. 17 (1999) 113–126. https://doi.org/10.1016/S0961-9534(99)00028-8.

[77] M. Aklin, J. Urpelainen, Renewables: The politics of a global energy transition, 2018. https://doi.org/10.7551/mitpress/11112.001.0001.

[78] G. Seyfang, J. Jin, A. Smith, J.J. Park, A. Smith, A thousand flowers blooming? An examination of community energy in the UK, Energy Policy. 61 (2013) 977–

989. https://doi.org/10.1016/j.enpol.2013.06.030.

[79] D. Soares da Silva, L.G. Horlings, The role of local energy initiatives in co-producing sustainable places, Sustain. Sci. 15 (2020) 363–377. https://doi.org/10.1007/s11625-019-00762-0.

[80] S. Baykoucheva, Selecting a Database for Drug Literature Retrieval: A Comparison of MEDLINE, Scopus, and Web of Science, in: Sci. Technolohy Libr., Routledge, 2010: pp. 276–288. https://doi.org/10.1080/0194262X.2010.522946.

[81] N.J. Temple, N.P. Steyn, Food prices and energy density as barriers to healthy food patterns in Cape Town, South Africa, J. Hunger Environ. Nutr. 4 (2009) 203–213. https://doi.org/10.1080/19320240902915474.

[82] S. Viti, A. Lanzini, F.D. Minuto, M. Caldera, R. Borchiellini, Techno-economic comparison of buildings acting as Single-Self Consumers or as energy community through multiple economic scenarios, Sustain. Cities Soc. 61 (2020) 102342. https://doi.org/10.1016/j.scs.2020.102342.

[83] A. El Mekaoui, R. Tariq, O.B. Ramírez, P.E. Méndez-Monroy, Sustainability, sociocultural challenges, and new power of capitalism for renewable energy megaprojects in an indigenous Mayan Community of Mexico, Sustain. 12 (2020). https://doi.org/10.3390/SU12187432.

[84] P. Velasco-Herrejon, T. Bauwens, Energy justice from the bottom up: A capability approach to community acceptance of wind energy in Mexico, Energy Res. Soc. Sci. 70 (2020) 101711. https://doi.org/10.1016/j.erss.2020.101711.

[85] A.M. Muniz, T.C.O. Guinn, Brand Community, J. Consum. Res. 27 (2001) 412–432. https://doi.org/10.1086/319618.

[86] E. Delzendeh, S. Wu, A. Lee, Y. Zhou, The impact of occupants ' behaviours on building energy analysis : A research review, Renew. Sustain. Energy Rev. 80 (2017) 1061–1071. https://doi.org/10.1016/j.rser.2017.05.264.

[87] C. Sassanelli, P. Rosa, R. Rocca, S. Terzi, Circular economy performance assessment methods : A systematic literature review, J. Clean. Prod. 229 (2019) 440–453. https://doi.org/10.1016/j.jclepro.2019.05.019.

[88] M. Bottero, F.D. Anna, V. Morgese, Evaluating the Transition Towards Post-Carbon Cities: A Literature Review, Sustainability. 13 (2021) 28. https://www.mdpi.com/2071-1050/13/2/567.

[89] G. Maggio, A. Nicita, G. Squadrito, T. Avanzate, E. Nicola, V. Salita, S.L. Sopra, How the hydrogen production from RES could change energy and fuel markets : A review of recent literature, Int. J. Hydrogen Energy. 44 (2019) 11371–11384. https://doi.org/10.1016/j.ijhydene.2019.03.121.

[90] G. Dall'O', P. Fragnito, A network of local energy agencies in the Lombardy Region, Italy, Renew. Energy. 22 (2001) 223–228. https://doi.org/10.1016/S0960-1481(00)00021-5.

[91] V. Leaney, D. Jenkins, A. Rowlands, R. Gwilliam, D. Smith, Local and community ownership of renewable energy power production: Examples of wind turbine projects, Wind Eng. 25 (2001) 215–226. https://doi.org/10.1260/0309524011496033.

[92] International Renewable Energy Agency (IRENA), Electricity Storage and Renewables: Costs and Markets to 2030, 2017. https://www.irena.org/publications/2017/Oct/Electricity-storage-and-renewables-costs-and-markets.

[93] L. Heininen, H. Exner-Pirot, J. Barnes, Redefining Arctic Security: Arctic

Yearbook 2019, Arctic Portal, Akureyri, Iceland, 2019. https://www.arcticyearbook.com.

[94] G. Poelzer, G. Gjorv, G. Holdman, N. Johnson, B. Magnusson, L. Sokka, M. Tsyiachinouk, S. Yu, Developing renewable energy in Arctic and sub-Arctic regions and communities, University of Saskatchewan/International Centre for Northern Governance and Development, 2016. https://www.usask.ca/icngd/FulbrightArcRenewableEnergy.pdf.

[95] M. Rezaei, H. Dowlatabadi, Off-grid : community energy and the pursuit of self-sufficiency in British Columbia's remote and First Nations communities, Local Environ. 21 (2016) 789–807. https://doi.org/10.1080/13549839.2015.1031730.

[96] D. Magnusson, J. Palm, Come together-the development of Swedish energy communities, Sustain. 11 (2019) 1–19. https://doi.org/10.3390/su11041056.

[97] E. Trutnevyte, M. Stauffacher, R.W. Scholz, Supporting energy initiatives in small communities by linking visions with energy scenarios and multi-criteria assessment, Energy Policy. 39 (2011) 7884–7895. https://doi.org/10.1016/j.enpol.2011.09.038.

[98] P. Maleki-Dizaji, N. del Bufalo, M.R. Di Nucci, M. Krug, Overcoming barriers to the community acceptance of wind energy: Lessons learnt from a comparative analysis of best practice cases across Europe, Sustain. 12 (2020). https://doi.org/10.3390/SU12093562.

[99] B. Warbroek, T. Hoppe, Modes of governing and policy of local and regional governments supporting local low-carbon energy initiatives; exploring the cases of the dutch regions of Overijssel and Fryslân, Sustain. 9 (2017) 1–36. https://doi.org/10.3390/su9010075.

[100] T. Bauwens, B. Gotchev, L. Holstenkamp, What drives the development of

community energy in Europe? the case of wind power cooperatives, Energy Res. Soc. Sci. 13 (2016) 136–147. https://doi.org/10.1016/j.erss.2015.12.016.

[101] C. Romero-Rubio, J.R. de Andrés Díaz, Sustainable energy communities: A study contrasting Spain and Germany, Energy Policy. 85 (2015) 397–409. https://doi.org/10.1016/j.enpol.2015.06.012.

[102] O. Langniss, R. Wiser, The renewables portfolio standard in Texas: an early assessment, Energy Policy. 31 (2003) 527–535. https://doi.org/10.1016/S0301-4215(02)00095-2.

[103] A.S. Kydes, Impacts of a renewable portfolio generation standard on US energy markets, Energy Policy. 35 (2007) 809–814. https://doi.org/10.1016/j.enpol.2006.03.002.

[104] E.C. van der Waal, Local impact of community renewable energy: A case study of an Orcadian community-led wind scheme, Energy Policy. 138 (2020) 111193. https://doi.org/10.1016/j.enpol.2019.111193.

[105] J. Burton, K. Hubacek, Is small beautiful? A multicriteria assessment of small-scale energy technology applications in local governments, Energy Policy. 35 (2007) 6402–6412. https://doi.org/10.1016/j.enpol.2007.08.002.

[106] International Energy Agency (IEA), Energy Storage, IEA. (2020) 1–11. https://www.iea.org/reports/energy-storage.

[107] G. Baldinelli, F. Bianchi, M. Cornicchia, F. D'Alessandro, G. De Micheli, G. Gifuni, A. Monsignori, M. Ruggiero, M. Cenci, F. Bonucci, F. Zepparelli, C. Mariotti, MuSAE: A European project for the diffusion of energy and environmental planning in small-medium sized municipalities, Sustain. 7 (2015) 16435–16450. https://doi.org/10.3390/su71215823.

[108] E. Bomberg, N. Mcewen, Mobilizing community energy, Energy Policy. 51 (2012) 435–444. https://doi.org/10.1016/j.enpol.2012.08.045.

[109] J.L. MacArthur, Trade, Tarsands and Treaties: The Political Economy Context of Community Energy in Canada, Sustainability. 9 (2017) 1–20. https://doi.org/10.3390/su9030464.

[110] A. Pinker, L. Argüelles, A. Fischer, S. Becker, Between straitjacket and possibility: Energy initiatives and the politics of regulation, Geoforum. 113 (2020) 14–25. https://doi.org/10.1016/j.geoforum.2020.04.016.

[111] H. Kim, A community energy transition model for urban areas: The energy self-reliant village program in Seoul, South Korea, Sustain. 9 (2017). https://doi.org/10.3390/su9071260.

[112] R. Madriz-Vargas, A. Bruce, M. Watt, The future of Community Renewable Energy for electricity access in rural Central America, Energy Res. Soc. Sci. 35 (2018) 118–131. https://doi.org/10.1016/j.erss.2017.10.015.

[113] S. Ruggiero, H. Busch, T. Hansen, A. Isakovic, Context and agency in urban community energy initiatives: An analysis of six case studies from the Baltic Sea Region, Energy Policy. 148 (2021) 111956. https://doi.org/10.1016/j.enpol.2020.111956.

[114] M. Dreyfus, R. Allemand, Three years after the French energy transition for green growth law: Has the “energy transition” actually started at the local level?, J. Environ. Law. 30 (2018) 109–133. https://doi.org/10.1093/jel/eqx031.

[115] J. Allen, W.R. Sheate, R. Diaz-Chavez, Community-based renewable energy in the Lake District National Park - local drivers, enablers, barriers and solutions, Local Environ. 17 (2012) 261–280. https://doi.org/10.1080/13549839.2012.665855.

[116] C. Sebi, A.L. Vernay, Community renewable energy in France: The state of development and the way forward, Energy Policy. 147 (2020). https://doi.org/10.1016/j.enpol.2020.111874.

[117] K. Izutsu, M. Takano, S. Furuya, T. Iida, Driving actors to promote sustainable energy policies and businesses in local communities: A case study in Bizen city, Japan, Renew. Energy. 39 (2012) 107–113. https://doi.org/10.1016/j.renene.2011.07.033.

[118] J.A.M. Hufen, J.F.M. Koppenjan, Local renewable energy cooperatives: revolution in disguise?, Energy. Sustain. Soc. 5 (2015). https://doi.org/10.1186/s13705-015-0046-8.

[119] C. Nolden, Governing community energy-Feed-in tariffs and the development of community wind energy schemes in the United Kingdom and Germany, Energy Policy. 63 (2013) 543–552. https://doi.org/10.1016/j.enpol.2013.08.050.

[120] Local Energy Communities (LECo), Finance Options for Local Energy Communities, 2019. https://leco.interreg-npa.eu/subsites/leco/LECo_Finance_Options_for_Local_Energy_Communities_Ireland_03_2019_vedos.pdf.

[121] P. Mirzania, A. Ford, D. Andrews, G. Ofori, G. Maidment, The impact of policy changes: The opportunities of Community Renewable Energy projects in the UK and the barriers they face, Energy Policy. 129 (2019) 1282–1296. https://doi.org/10.1016/j.enpol.2019.02.066.

[122] C.A. Adams, S. Bell, Local energy generation projects: assessing equity and risks, Local Environ. 20 (2015) 1473–1488. https://doi.org/10.1080/13549839.2014.909797.

[123] T. Roesler, Community resources for energy transition: Implementing bioenergy

villages in Germany, Area. 51 (2019) 268–276. https://doi.org/10.1111/area.12444.

[124] L. Tozer, Community energy plans in Canadian cities: Success and barriers in implementation, Local Environ. 18 (2013) 20–35. https://doi.org/10.1080/13549839.2012.716406.

[125] S. Cebotari, Against all odds: Community-owned renewable energy projects in North-West Romania, Int. J. Crit. Geogr. 18 (2019) 513–528. https://acme-journal.org/index.php/acme/article/view/1556.

[126] Y. Parag, J. Hamilton, V. White, B. Hogan, Network approach for local and community governance of energy: The case of Oxfordshire, Energy Policy. 62 (2013) 1064–1077. https://doi.org/10.1016/j.enpol.2013.06.027.

[127] S. Guerreiro, I. Botetzagias, Empowering communities–the role of intermediary organisations in community renewable energy projects in Indonesia, Local Environ. 23 (2018) 158–177. https://doi.org/10.1080/13549839.2017.1394830.

[128] E. Heaslip, G.J. Costello, J. Lohan, Assessing good-practice frameworks for the development of sustainable energy communities in Europe: Lessons from Denmark and Ireland, J. Sustain. Dev. Energy, Water Environ. Syst. 4 (2016) 307–319. https://doi.org/10.13044/j.sdewes.2016.04.0024.

[129] S. Ruggiero, T. Onkila, V. Kuittinen, Realizing the social acceptance of community renewable energy: A process-outcome analysis of stakeholder influence, Energy Res. Soc. Sci. 4 (2014) 53–63. https://doi.org/10.1016/j.erss.2014.09.001.

[130] M. Mudasser, E.K. Yiridoe, K. Corscadden, Economic feasibility of large community feed-in tariff-eligible wind energy production in Nova Scotia, Energy Policy. 62 (2013) 966–977. https://doi.org/10.1016/j.enpol.2013.07.108.

[131] L. Holstenkamp, F. Kahla, What are community energy companies trying to accomplish? An empirical investigation of investment motives in the German case, Energy Policy. 97 (2016) 112–122. https://doi.org/10.1016/j.enpol.2016.07.010.

[132] M. Lemon, M.G. Pollitt, S. Steer, Local energy policy and managing low carbon transition: The case of Leicester, UK, Energy Strateg. Rev. 6 (2015) 57–63. https://doi.org/10.1016/j.esr.2015.02.001.

[133] G. Dóci, B. Gotchev, When energy policy meets community: Rethinking risk perceptions of renewable energy in Germany and the Netherlands, Chem. Phys. Lett. 22 (2016) 26–35. https://doi.org/10.1016/j.erss.2016.08.019.

[134] T. Meister, B. Schmid, I. Seidl, B. Klagge, How municipalities support energy cooperatives: Survey results from Germany and Switzerland, Energy. Sustain. Soc. 10 (2020) 1–20. https://doi.org/10.1186/s13705-020-00248-3.

[135] B. Schmid, T. Meister, B. Klagge, I. Seidl, Energy Cooperatives and Municipalities in Local Energy Governance Arrangements in Switzerland and Germany, J. Environ. Dev. 29 (2020) 123–146. https://doi.org/10.1177/1070496519886013.

[136] G. Lakshmi, S. Tilley, The “power” of community renewable energy enterprises: The case of Sustainable Hockerton Ltd., Energy Policy. 129 (2019) 787–795. https://doi.org/10.1016/j.enpol.2019.02.063.

[137] J. Bere, C. Jones, S. Jones, M. Munday, Energy and development in the periphery: A regional perspective on small hydropower projects, Environ. Plan. C Gov. Policy. 35 (2017) 355–375. https://doi.org/10.1177/0263774X16662029.

[138] R.W. Saunders, R.J.K.K. Gross, J. Wade, Can premium tariffs for micro-generation and small scale renewable heat help the fuel poor, and if so, how? Case studies of innovative finance for community energy schemes in the UK, Energy

Policy. 42 (2012) 78–88. https://doi.org/10.1016/j.enpol.2011.11.045.

[139] D. Dragan, Legal barriers to the development of energy clusters in Poland, Eur. Energy Environ. Law Rev. 29 (2020) 14–20. https://kluwerlawonline.com/journalarticle/European+Energy+and+Environmental+Law+Review/29.1/EELR2020002.

[140] P. Yadav, Y. Malakar, P.J. Davies, Multi-scalar energy transitions in rural households: Distributed photovoltaics as a circuit breaker to the energy poverty cycle in India, Energy Res. Soc. Sci. 48 (2019) 1–12. https://doi.org/10.1016/j.erss.2018.09.013.

[141] K. Berlo, O. Wagner, M. Heenen, The incumbents' conservation strategies in the german energy regime as an impediment to re-municipalization-An analysis guided by the multi-level perspective, Sustain. 9 (2017) 12. https://doi.org/10.3390/su9010053.

[142] F. Fuentes González, E. Sauma, A.H. van der Weijde, F. Fuentes, E. Sauma, A. Van Der Weijde, The Scottish experience in community energy development: A starting point for Chile, Renew. Sustain. Energy Rev. 113 (2019) 109239. https://doi.org/10.1016/j.rser.2019.06.046.

[143] C. Inês, P.L. Guilherme, M.G. Esther, G. Swantje, H. Stephen, H. Lars, Regulatory challenges and opportunities for collective renewable energy prosumers in the EU, Energy Policy. 138 (2020) 11. https://doi.org/10.1016/j.enpol.2019.111212.

[144] C. Hager, N. Hamagami, Local Renewable Energy Initiatives in Germany and Japan in a Changing National Policy Environment, Rev. Policy Res. 37 (2020) 386–411. https://doi.org/10.1111/ropr.12372.

[145] P. Hamman, Local governance of energy transition: sustainability, transactions and social ties. A case study in Northeast France, Int. J. Sustain. Dev. World Ecol. 26

(2019) 1–10. https://doi.org/10.1080/13504509.2018.1471012.

[146] Government of Canada, The Federal Gas Tax Fund, Gov. Canada. (2020). https://www.infrastructure.gc.ca/plan/gtf-fte-eng.html (accessed March 30, 2021).

[147] D. Brookshire, N. Kaza, Planning for seven generations: Energy planning of American Indian tribes, Energy Policy. 62 (2013) 1506–1514. https://doi.org/10.1016/j.enpol.2013.07.021.

[148] S. Carley, E. Baldwin, L.M. MacLean, J.N. Brass, Global Expansion of Renewable Energy Generation: An Analysis of Policy Instruments, Environ. Resour. Econ. 68 (2017) 397–440. https://doi.org/10.1007/s10640-016-0025-3.

[149] K. Tews, The crash of a policy pilot to legally define community energy. Evidence from the German auction scheme, Sustain. 10 (2018) 12. https://doi.org/10.3390/su10103397.

[150] J.J. Hain, G.W. Ault, S.J. Galloway, A. Cruden, J.R. Mcdonald, Additional renewable energy growth through small-scale community orientated energy policies, 33 (2005) 1199–1212. https://doi.org/10.1016/j.enpol.2003.11.017.

[151] F. Mey, M. Diesendorf, I. MacGill, Can local government play a greater role for community renewable energy? A case study from Australia, Energy Res. Soc. Sci. 21 (2016) 33–43. https://doi.org/10.1016/j.erss.2016.06.019.

[152] B. Van Veelen, Making Sense of the Scottish Community Energy Sector – An Organising Typology, 133 (2017) 1–20. http://dx.doi.org/10.1080/14702541.2016.1210820%0AMaking.

[153] E.K. Oikonomou, V. Kilias, A. Goumas, A. Rigopoulos, E. Karakatsani, M. Damasiotis, D. Papastefanakis, N. Marini, Renewable energy sources (RES) projects and their barriers on a regional scale: The case study of wind parks in the

Dodecanese islands, Greece, Energy Policy. 37 (2009) 4874–4883. https://doi.org/10.1016/j.enpol.2009.06.050.

[154] E. Fouché, A. Brent, Journey towards renewable energy for sustainable development at the local government level: The Case of Hessequa municipality in South Africa, Sustain. 11 (2019) 18. https://doi.org/10.3390/su11030755.

[155] Y. Rydin, C. Turcu, Revisiting urban energy initiatives in the UK: Declining local capacity in a shifting policy context, Energy Policy. 129 (2019) 653–660. https://doi.org/10.1016/j.enpol.2019.02.054.

[156] G. Holdmann, P. Asmus, What is a microgrid today?, Distrib. Energy. (2019). https://bluetoad.com/publication/?i=626872&article_id=3503710&view=articleBrowser (accessed March 30, 2021).

[157] L.C. Jensen, G. Hønneland, Handbook of the politics of the arctic, Edward Elgar, Cheltenham, United Kingdom, 2015.

[158] J. Corntassel, Re-envisioning resurgence: Indigenous pathways to decolonization and sustainable self-determination, Decolonization Indig. Educ. Soc. 1 (2012) 86–101. http://decolonization.org/index.php/des/article/view/18627/15550.

[159] T. Urmee, A. Md, Social, cultural and political dimensions of off-grid renewable energy programs in developing countries, Renew. Energy. 93 (2016) 159–167. https://doi.org/10.1016/j.renene.2016.02.040.

[160] C.A. Miller, J. Richter, Social Planning for Energy Transitions, Curr. Sustain. Energy Reports. 1 (2014) 77–84. https://doi.org/10.1007/s40518-014-0010-9.

[161] P. Devine-Wright, H. Devine-Wright, Public engagement with community-based energy service provision: An exploratory case study, Energy Environ. 20 (2009) 303–317. https://doi.org/10.1260/095830509788066402.

[162] B.J. Kalkbrenner, J. Roosen, Citizens' willingness to participate in local renewable energy projects: The role of community and trust in Germany, Energy Res. Soc. Sci. 13 (2016) 60–70. https://doi.org/10.1016/j.erss.2015.12.006.

[163] Energy Information Administration (EIA), Renewable energy explained: Portfolio Standards, U.S. Energy Inf. Adm. (2020). https://www.eia.gov/energyexplained/renewable-sources/portfolio-standards.php (accessed August 20, 2021).

[164] F. Gökgöz, M.T. Güvercin, Energy security and renewable energy efficiency in EU, Renew. Sustain. Energy Rev. 96 (2018) 226–239. https://doi.org/10.1016/j.rser.2018.07.046.

[165] B. Wang, Q. Wang, Y.M. Wei, Z.P. Li, Role of renewable energy in China's energy security and climate change mitigation: An index decomposition analysis, Renew. Sustain. Energy Rev. 90 (2018) 187–194. https://doi.org/10.1016/j.rser.2018.03.012.

[166] J. Nyman, Rethinking energy, climate and security: A critical analysis of energy security in the US, J. Int. Relations Dev. 21 (2018) 118–145. https://doi.org/10.1057/jird.2015.26.

[167] M. Arriaga, E. Nasr, H. Rutherford, Renewable energy microgrids in northern remote communities, IEEE Potentials. 36 (2017) 22–29. https://doi.org/10.1109/MPOT.2017.2702798.

[168] G. Seyfang, J. Jin, A. Smith, A thousand flowers blooming? An examination of community energy in the UK, Energy Policy. 61 (2013) 977–989. https://doi.org/10.1016/j.enpol.2013.06.030.

[169] A.L. Berka, E. Creamer, Taking stock of the local impacts of community owned renewable energy: A review and research agenda, Renew. Sustain. Energy Rev. 82

(2018) 3400–3419. https://doi.org/10.1016/j.rser.2017.10.050.

[170] R. Leonhardt, B. Noble, G. Poelzer, P. Fitzpatrick, K. Belcher, G. Holdmann, Advancing local energy transitions: A global review of government instruments supporting community energy, Energy Res. Soc. Sci. 83 (2022) 102350. https://doi.org/10.1016/j.erss.2021.102350.

[171] J. McMurtry, Canadian Community Energy: Policy, Practice, and Problems, in: Handb. Energiewende Und Partizipation, Springer VS, Wiesbaden, 2018: pp. 975–996. https://doi.org/10.1007/978-3-658-09416-4_57.

[172] D. Heerema, D. Lovekin, Power Shift in Remote Indigenous Communities A cross-Canada scan of diesel reduction and clean energy policies, Calgary, Canada, 2019. www.pembina.org.

[173] R. Rakshit, C. Shahi, M.A. (Peggy. Smith, A. Cornwell, Bridging Gaps In Energy Planning for First Nation Communities, Strateg. Plan. Energy Environ. 37 (2018) 17–42. https://doi.org/10.1080/10485236.2018.11958658.

[174] C.E. Hoicka, J.L. MacArthur, From tip to toes: Mapping community energy models in Canada and New Zealand, Energy Policy. 121 (2018) 162–174. https://doi.org/10.1016/j.enpol.2018.06.002.

[175] M. Arriaga, C.A. Cañizares, M. Kazerani, Northern Lights: Access to Electricity in Canada's Northern and Remote Communities, IEEE Power Energy Mag. (2014) 50–59. https://doi.org/10.1109/MPE.2014.2317963.

[176] International Renewable Energy Agency (IRENA), Country Rankings, IRENA Data Stat. (2020). https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Country-Rankings (accessed July 10, 2021).

[177] Natural Resources Canada (NRCan), Energy Fact Book 2019-2020, 2019.

https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/Energy Fact Book_2019_2020_web-resolution.pdf.

[178] SaskPower, Annual Report (2019-20), (2020).

[179] A. Reddy, Energy and social issues, in: World Energy Assess. Energy Chall. Sustain., United Nations Development Programme, New York, NY, 2000. http://www.undp.org/content/dam/undp/library/Environment and Energy/Sustainable Energy/wea 2000/chapter2.pdf.

[180] P. Raphals, Energy Poverty on First Nation Reserves in Manitoba, 2019. http://www.pubmanitoba.ca/v1/proceedings-decisions/appl-current/pubs/2019-mh-gra/amc-ex/amc-3-raphals-evidence-final.pdf.

[181] Canada Energy Regulator, Saskatchewan - Electricity Generation and Consumption, Canada Energy Regul. (2018). https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/canadian-residential-electricity-bill/saskatchewan.html (accessed August 30, 2021).

[182] J. Quesnel, “Something wrong here”: Southend, Sask. residents schocked by $1K/month power bills, (2019). https://www.cbc.ca/news/canada/saskatoon/something-wrong-here-southend-sask-residents-shocked-by-1k-month-power-bills-1.5063186 (accessed October 29, 2021).

[183] Manitoba Hydro, A History of Electric Power in Manitoba, Winnipeg, MB, 2010. https://www.hydro.mb.ca/corporate/teachers/pdf/history_of_electric_power_book.pdf.

[184] National Energy Board, Canada’s Renewable Energy Market Analysis 2017, 2017. https://www.cer-rec.gc.ca/nrg/sttstc/lctrct/rprt/2016cndrnwblpwr/2016cndrnwblpwr-eng.pdf.

[185] K. Liénafa, T. Martin, Beyond the Conflict: The Reconstruction of the O-Pipon-Na-Piwin First Nation Community in, Geogr. Res. Forum. 30 (2010) 50–65. https://grf.bgu.ac.il/index.php/GRF/article/view/364.

[186] S.M. Hoffman, Engineering Poverty: Colonialism and Hydroelectric Development by, Univ. Winnipeg. (2004) 1–22. https://hydroimpacted.ca/wp-content/uploads/2018/03/Colonialism-and-Hydroelectric-Development-in-MB.pdf.

[187] S. Thompson, Flooding of First Nations and Environmental Justice in Manitoba: Case Studies of the Impacts of the 2011 Flood and Hydro Development in Manitoba, Manit. Law J. 38 (2014) 222–259. https://journals.library.ualberta.ca/themanitobalawjournal/index.php/mlj/article/view/928.

[188] Boke Consulting, Northlands Dënesųłiné Renewable Energy & Remediation, (2017). https://bokeconsulting.com/northlands-denesuline-renewable-energy-remediation/ (accessed October 30, 2021).

[189] Government of Saskatchewan, The Power Corporation Act, 2019. http://www.qp.gov.sk.ca/m/index.cfm?action=browse&p=760.

[190] First Nations Power Authority (FNPA), The path we've travelled, (n.d.). https://fnpa.ca/about-us/ (accessed November 1, 2021).

[191] N. Dove, Northern Saskatchewan village hopes federal funding will mean alternatives to diesel power, Glob. News. (2020). https://globalnews.ca/news/7546698/northern-sask-village-alternatives-diesel-power/ (accessed November 1, 2020).

[192] NTPC, History of the corporation, (n.d.). https://www.ntpc.com/about-ntpc/history (accessed November 1, 2021).

[193] Government of Northwest Territories, Electrical Generation in the NWT, 2015. https://www.inf.gov.nt.ca/sites/inf/files/resources/electrical_generation_in_the_nwt_4_converted.pdf.

[194] Government of Northwest Territories, Energy initiatives report 2018 – 19, 2018. https://www.inf.gov.nt.ca/sites/inf/files/resources/7467_inf_report_web.pdf.

[195] Government of Canada, Pan-Canadian Framework on Clean Growth and Climate Change : Canada's plan to address climate change and grow the economy., 2016. https://publications.gc.ca/site/eng/9.828774/publication.html.

[196] Government of Saskatchewan, Indigenous Procurement Policy, (n.d.). https://www.saskatchewan.ca/government/partnerships-for-success/profiles/indigenous-procurement-policy (accessed October 7, 2021).

[197] Efficiency Manitoba, Indigenous Community Energy Efficiency Program, (n.d.). https://efficiencymb.ca/community/indigenous-community-energy-efficiency-program/ (accessed October 7, 2021).

[198] Government of Northwest Territories, GHG Grant Program for Government.pdf, (n.d.). https://www.inf.gov.nt.ca/en/services/energy/ghg-grant-program-government (accessed October 7, 2021).

[199] M.S. Lewis-Beck, A. Bryman, T.F. Liao, Snowball Sampling, in: SAGE Encycl. Soc. Sci. Res. Methods, SAGE publications, Thousand Oaks, CA, 2011: p. 3. http://dx.doi.org/10.4135/9781412950589.

[200] Government of Manitoba, Efficiency Manitoba Regulation, 2019. http://www.pubmanitoba.ca/v1/about-pub/pubs/em-regulation-119-2019.pdf.

[201] C. Schelly, D. Bessette, K. Brosemer, V. Gagnon, K.L. Arola, A. Fiss, J.M. Pearce, K.E. Halvorsen, Energy policy for energy sovereignty : Can policy tools enhance

energy sovereignty ?, Sol. Energy. 205 (2020) 109–112. https://doi.org/10.1016/j.solener.2020.05.056.

[202] C. Blackburn, Differentiating indigenous citizenship: Seeking multiplicity in rights, identity, and sovereignty in Canada, 36 (2009) 66–78. https://doi.org/10.1111/j.1548-1425.2008.01103.x.

[203] M.D. Bazilian, S. Carley, D. Konisky, H. Zerriffi, S. Pai, Energy Research & Social Science Expanding the scope of just transitions : Towards localized solutions and community-level dynamics, Energy Res. Soc. Sci. 80 (2021) 102245. https://doi.org/10.1016/j.erss.2021.102245.

[204] B.K. Sovacool, I. Mukherjee, Conceptualizing and measuring energy security : A synthesized approach, Energy. 36 (2011) 5343–5355. https://doi.org/10.1016/j.energy.2011.06.043.

[205] E.C.X. Ikejemba, P.B. Mpuan, P.C. Schuur, J. Van Hillegersberg, The empirical reality & sustainable management failures of renewable energy projects in Sub-Saharan Africa (part 1 of 2), Renew. Energy. 102 (2017) 234–240. https://doi.org/10.1016/j.renene.2016.10.037.

[206] E. Tenenbaum, C. Greacen, T. Siyambalapitiya, J. Knuckle, From the bottom up: How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa, Washington, DC, 2014. https://doi.org/10.1177/1070496508326432.

[207] B. Johansson, Security aspects of future renewable energy systems-A short overview, Energy. 61 (2013) 598–605. https://doi.org/10.1016/j.energy.2013.09.023.

[208] F. Mey, J. Hicks, Community Owned Renewable Energy: Enabling the Transition Towards Renewable Energy?, in: Decarbonising Built Environ. - Charting Transit.,

Palgrave Macmillan, Singapore, 2019: pp. 65–82. https://doi.org/10.1007/978-981-13-7940-6_4.