



Original research article

Scaling renewable energy cooperatives for a net-zero Canada: Challenges and opportunities for accelerating the energy transition

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ABSTRACT

Employing a niche-management framework, we conduct a census of renewable energy cooperatives (RECs) to study their potential role in helping Canada achieve its net-zero greenhouse gas emission targets. Based on a review of more than 250 websites as well as 27 semi-structured interviews with representatives from RECs and cooperative associations across Canada, we find that Canada's REC sector is struggling to break out of its niche, with inconsistent and often unavailable data on energy production making it difficult to tally the sector's contribution. Nevertheless, based on the available data, we estimate that the sector contributed at most 73 MW, or less than 0.05 % to Canada's total installed capacity in 2021. We also find that the number of RECs declined by 44 % ($n = 40$) between 2016 and 2021. While we found evidence of REC merger activity, the overwhelming picture is of a sector where volunteers are stretched and often forced to wind-up their cooperative. Drawing on cooperative scholarship and a scan of other jurisdictions, we note that RECs could follow the path of other cooperative sectors and become an important part of the regime by forming a second-tier cooperative association.

1. Introduction

Countries representing successful energy transition models, such as Germany and the United Kingdom, have made community-owned renewable energy projects an important part of their strategy to address the climate crisis [1,2]. Germany, for example, has more than 800 locally-owned and controlled renewable energy cooperatives (RECs), collectively generating almost 4 % of the country's renewable energy [2,3]. While European community-owned models have been studied extensively, less is known about the potential place of the REC sector in the energy transition of countries with abundant natural resources like Canada, a country of 40 million people that has long relied on a mix of hydro and low-cost supplies of coal, gas and uranium to power an electrical grid traditionally governed by state-owned or regulated monopolies.

While over the last three decades, two provincial jurisdictions have deregulated their energy sectors, and while firms are increasingly taking

advantage of Canada's rich sun, wind, and geothermal energy sources, institutional structures have generally proven resistant to community-owned renewable energy producers. Given the challenging institutional context and climate urgency, this paper studies the potential role of RECs in helping Canada achieve its 2050 net-zero greenhouse gas emission targets. Based on a 2021 review of more than 250 websites – what we call our ‘census’ of the sector – as well as 27 semi-structured interviews with representatives from RECs and cooperative associations across Canada, we find that Canada's REC sector is struggling to break out of its niche. As evidence for this claim, our census found, for example, little in the way of consistent or reliable information on the sector's total energy production. Of the 49 active RECs identified by our census, only a handful made available production data, with total installed capacity equaling at most 73 MW, or less than 0.05 % of Canada's total installed capacity in 2021. As further evidence of the sector's struggles, we also find that the number of RECs declined by 44 % ($n = 40$) between 2016 and 2021. While there is some evidence that part

Abbreviations: CRE, Community Renewable Energy; FCPC, Federation of Community Power Cooperatives; FIT, Feed in Tariff; ICA, International Cooperative Alliance; IESO, Independent Electricity System Operator; IOF, Investor-Owned Firm; kWh, Kilowatt hour; LCE, Local Energy Community; MW, Megawatt; PPA, Power Purchase Agreement; REC, Renewable Energy Cooperative; SNM, Strategic Niche Management; RRSP, Registered Retirement Savings Plan; TFSA, Tax Free Savings Account; TREC, Toronto Renewable Energy Cooperative; USD, United States Dollar.

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of this decline can be attributed to merger activity, the overwhelming picture that emerges from our interviews is one of a sector struggling with volunteer burnout and frustration at the challenges posed by incumbents and unaware or disinterested policymakers.

Despite their ability to harness the power of communities and their related potential to make a meaningful contribution to Canada's energy transition, the country's RECs – as the decline in their numbers suggests – remain a niche within the Canadian energy landscape. This paper aims to document the sector's contribution to Canada's climate change objectives and offer a novel explanation for its anemic growth and its potential for a greater contribution by tying together two distinct bodies of literature – strategic niche management (SNM) and the study of co-operatives. In addition to this theoretical contribution, we present a novel perspective on potential practical pathways for RECs to scale up and amplify their impact.

The paper proceeds as follows. Section 2 sets out some important context on Canada's energy system. Section 3 situates our work in the context of the distinct niche management and cooperative bodies of scholarship, emphasizing key theoretical considerations. Section 4 sets out our methods. Section 5 reviews findings from our census and interviews. Section 6 discusses our findings. Section 7 concludes with a discussion of the state's potential role in supporting the REC niche and growing its role.

2. Background: Canada and its provinces

Under Canada's federal system of government, provinces are responsible for, and have considerable autonomy over, natural resource development, energy provisioning, and electricity infrastructure. While integrating Canada's grid could lead to carbon reductions, attempts at doing so have not yet materialized [4]. Power distribution in the provinces is governed by a wide range of different utility models and approaches to decarbonization [4]. The result is a patchwork of highly varied electricity governance models in each province. Alberta has an open electricity market, leaving generation and delivery primarily to private entities. Other Canadian provinces, like British Columbia, Ontario, and Quebec, have mixed public/private power systems, with government-owned utilities handling some of the load. Manitoba, Nova Scotia, Newfoundland and Labrador, Prince Edward Island, and Saskatchewan have vertically integrated electrical utility systems, where the province manages nearly all aspects of power generation, transmission, and distribution.

Consistent with these different frameworks, the provinces also differ in terms of their sources of electricity production. Ontario generates about 58 % of its electricity from nuclear power, with hydropower, wind

and gas accounting for the balance [5]. British Columbia generates two-thirds of its electricity from renewable sources (mostly hydro), while in Quebec, the share is 94 % [5]. The provinces of Newfoundland and Labrador and Prince Edward Island have committed to meeting all their electricity needs with renewable resources by 2030. Because of these regional differences, the potential for RECs as a niche varies widely by province.¹ Additionally, the opportunities for community-based renewable energy initiatives, like RECs, in BC, Ontario, and Quebec remain limited due to their provincial-owned utility companies' strategic emphasis on working with large-scale energy projects.

The Canadian energy landscape is also shaped by its vast fossil fuel deposits and the long distances between energy production and consumption areas [7]. Public perception of community energy is generally positive, with modest regional differences including, most notably, less support in fossil fuel producing provinces such as Alberta, Saskatchewan, and Manitoba [8]. These factors, combined with the governance structure, create unique challenges and opportunities for electricity development and decarbonization. Indigenous nations play a significant role in the Canadian energy sector, exerting their increasing power and influence with industry, utilities, and governments [9]. Canada's colonial history and ongoing issues make the connection between local and community benefits and resource development particularly significant.

3. Theoretical insights from the strategic niche management and cooperative literature

While the climate crisis is motivating governments to innovate and develop new approaches to accelerate the energy transition, the pace of the energy transition is lagging [10]. At the same time, utility companies are increasingly concerned with the future viability of their business model [11,12]. Considering these challenges, a considerable body of research has focused on strategies to advance political action, or “landscape” shifts [13]. Much has also been done to advance our understanding of strategies to support novel technological or “niche” innovations [14]. Recent work on intermediaries emphasizes the importance of actors, including community-based groups, that create alignment and opportunities across energy transition sectors [15]. There remains an underutilized window of opportunity [16] for policymakers to leverage the ability of RECs to draw on their roots in their community to fund and add legitimacy to the work needed for a rapid and successful energy transition [17–19].

For the time being, however, Canada's RECs operate largely as a niche within the Canadian energy regime. There are no dedicated policies to support RECs at the national or provincial level. There is no central authority that advocates on their behalf. RECs largely operate in

¹ The territories, including Yukon, Northwest Territories, and Nunavut, were not included in the scope of this work. This decision was made due to their distinct energy landscapes, governance structures, the absence of second-tier cooperative associations that often play a key catalytic role for new co-operatives, and the unique challenges they face compared to the provinces. These regions often rely on diesel generation and have limited infrastructure, making the context for implementing RECs different. By focusing on the provinces, this work aims to analyze the potential for RECs in regions with more established energy infrastructure and governance models. While, to our knowledge, there are no RECs in the Canadian territories, many rural and remote communities in these areas rely on diesel for their electricity – a noisy and costly form of energy – suggesting that the model could hold out some promise in terms of reducing or eliminating emissions and noise and reducing costs with the right set of incentives and supports (e.g., a second-tier cooperative association). To illustrate this potential, the remote community of Old Crow, Yukon, in 2021 began supplementing its diesel production with solar panels through a partnership with a private (not cooperative) power company, a move the community described as a re-assertion of their sovereignty that not only reduced reliance (and noise) on diesel but generated income for the community [6].

silos – within and across provinces – and as a result, struggle to optimize strategies to adapt to unwelcoming policy and grid environments [20]. And yet, as noted, RECs have established themselves as regime actors within other nations, achieving maturity most notably in Germany [21–23].

This paper offers SNM as a framework to understand the evolution of Canada's REC sector and the barriers that limit its growth. SNM refers to the creation, development, and controlled phase-out of protected niches to foster the advancement and implementation of innovations through experimentation, ultimately aiming to increase adoption rates. SNM emphasizes niches as spaces for examining, developing, and shielding technological innovations from market competition, and promoting the transition to sustainable alternatives [14,24,25]. The SNM literature stresses that niches are frequently unstable and fragile [26]. The future of the REC sector remains uncertain. Although RECs show promise and have successfully implemented innovative projects, there is, so far, limited protected space to support their growth in the regime.

While RECs are discussed with some regularity in the literature on niche management and community-owned renewable energy (CRE) [27–29], they neglect to underline how this distinct organizational form is itself, typically, operating as a niche relative to a regime consisting of publicly-traded, privately held, or state-owned companies and how its form may *itself* be an enabler – or barrier – to niche development and the energy transition.

Yet, the cooperative sector has a demonstrated ability to transition from a niche to a more integral – and sometimes dominant – part of a regime. Cooperatives, for example, play important roles at the regime level in several organizational fields such as agriculture (e.g., dairy, wheat), finance (banking, insurance), retailing (groceries, hardware), and health care (clinics, hospitals). To provide one concrete example, cooperative banks account for an estimated 33 % of the banking sector across 13 European countries [30], while in North America, credit unions serve an estimated one-third of the population in both Canada and the United States. The cooperative sector also plays an important role globally, with the “three hundred largest cooperatives or mutuals generating 2.4 billion USD in turnover while providing the services and infrastructure society needs to thrive” [31]. In every case, these large, integrated cooperatives began as small, locally-owned entities, struggling against hostile regimes and landscapes [32,33].

Cooperatives are distinct in that they combine three roles in one: people who make use of the cooperative by purchasing its goods and services also own (through membership shares), democratically control (one member, one vote), and benefit from the entity (through usage-based ‘patronage rebates’). Theoretically, this confluence of roles economizes on principal-agent-related governance costs relative to other organizational forms because principles, as users, can more effectively monitor for exploitative behaviour by management (the agents). To the extent the cooperative's users – the membership – are relatively homogenous, the cooperative form may also economize on marketing costs. As a result, cooperatives should be responsive to changing member needs. Lower governance and marketing costs, in turn, mean that member-owners should benefit from a combination of better prices and better and more responsive provision of goods and services, particularly in circumstances where “the dominant economic institutions are weaker or less adequate” [34].

Investor-owned firms and other private enterprises have often resisted attempts by communities to form cooperatives, or sought to block their attempts to secure favorable policy outcomes, partly because of their potential to self-provision in economically interesting ways. This opposition has expressed itself in lobbying for anti-trust legislation to prevent farmers (for example) from organizing cooperatives, advocating against tax measures tailored to the cooperative form, and casting cooperatives as socialist or communist [32,33]. This outward opposition from IOFs is less visible today. However, an important thread of the cooperative literature suggests that modern capitalist societies are inherently antagonistic to the cooperative form because of primacy

given to individual rather than collective agency [32,33,35–37].

One of the ways cooperatives have overcome this antagonism and established footholds in the regime is to organize themselves into Leagues or Federations that offer the opportunity for economies of scale by sharing (rather than duplicating) core services (e.g., accounting, human resources, software, marketing) but also by providing coherent and cohesive lobbying on behalf of the cooperative sector. Borrowing from the organizational studies literature, we can interpret this and other ‘second-tier’ activities as different forms of scaling [38]. By providing economies of scale, second-tier entities make it possible for their member-owner cooperatives to *scale deep*, i.e., provide goods and services at competitive prices equal to or better than competitors. In turn, second-tier organizations and their members can *scale up* or grow their business in their designated region or sector. As the second-tier entities acquire capacity, they typically *scale out* their services, making available an increasing array of goods and services. And finally, second-tier cooperatives have historically played an important role in *scaling across*, by devoting staff and resources to incubating other like cooperatives using field and extension officers. Notably, these scaling *across* activities have often extend to different types of cooperatives, with the second-tier organization serving as a vehicle to provide collective financial and in-kind support to the broader cooperative movement and its democratic ideals and values via organizations like the International Cooperative Alliance (ICA) and its national and sub-national counterparts. That is, the second-tier cooperatives, like their cooperative members, have often pursued both *mutual* (pure service to the member) and *general* (service to the cooperative movement) interests.

Associated with these scaling strategies, cooperatives have a long history of innovation, with grocery retail cooperatives being the first, for example, to offer fair weights and measures (unusual in the 19th century when they first emerged), or the ability for members choose their own grocery items (rather than ask a grocer to fetch them for them), or to establish what are today referred to as ‘grocery chains’ backstopped by jointly-owned wholesaler. In Canada, we see a similar pattern of innovation in banking (e.g., Canadian credit unions were the first to offer women checking accounts in their own names), mutual insurance (e.g., innovative, reliable, and low-cost forms of insurance), farming (e.g., heavy investments in new crop and farming technologies by agricultural cooperatives), and health care (e.g., pioneering practices such as interdisciplinary team-based patient-centric care) to name a few. In each case, these developments – while not always technological in nature – have been informed by member-owners through their democratic voice and have enjoyed the kind of legitimacy that gave them space and time for the experimental and shielding activities that are core to the SNM approach.

While cooperatives' user-owner, user-control, and user-benefitting nature offer potential governance and marketing benefits, it also comes with some well-known governance challenges [39]. Cooperatives must be alert to free rider problems – members who fail to exercise their monitoring role because they assume others will bear the cost or who, in the formative years of the cooperative, fail to take on volunteer duties. Associated with this problem, cooperatives may struggle to find qualified board members. As they mature, cooperatives and their second-tier organizations may also struggle to govern an increasingly diverse and heterogeneous membership, with divisions based on size, ethnicity, age, geography, economic capacity, and other factors [40]. These divisions and related governance challenges can also make it costly for cooperatives to engage in political advocacy as it becomes increasingly unclear whose interests the cooperative represents [41]. In second tier organizations, there is the added challenge of minimizing disparities in the growth of member cooperatives, a situation that can cause tensions and erode the legitimacy of the League or Federation and which the most successful cooperatives (such as Credit Mutuel in France or Desjardins in Canada) have carefully managed by encouraging strategic mergers or policies that keep rough parity and set out clearly defined geographic or business areas of operation [42]. Finally, it is important to stress that

cooperatives do not always live up to the principles and values set out by the ICA. For example, while credit unions have “benefited from the historical glow of an origin story rich with struggle for the betterment of the community,” there are no guarantee that this translates into ethical behaviour today [43]. Large agricultural cooperatives have been criticized for their environmental practices [44] and large grocery retail cooperatives have come under criticism for their labour relations [45] and governance practices [46]. While cooperatives have been associated with emancipatory movements [47] they also have been used as tools of colonial and other forms of oppression [48], with white males tending to dominate leadership and board governance structures in many present-day cooperatives [49]. As we will see, many of these opportunities – and challenges – are relevant for interpreting our census findings and interview data.

In organizing the census data, we used a traditional cooperative classification system that focuses on what the cooperative member does in the value-production chain — are they consumers, producers, funders, or something else? This approach gives primacy to the member–ownership perspective and is associated with five distinct cooperative models: consumer (retail), producer, worker-owner, multistakeholder, and investment cooperatives. In most jurisdictions, RECs take the form of consumer cooperatives [50], but our findings suggest that investment cooperatives dominate the REC niche in Canada. Table 1 summarizes this classification system. (Tables 2 and 4).

4. Methods

We used qualitative and quantitative methods to conduct our REC census. We began the process with a grey literature review. Based on the findings of this review, and in particular a 2016 effort to tabulate the number of Canadian RECs, we created a database to validate and expand on those earlier findings [51]. Whereas the earlier study did not specify its search methodology and reported on a narrow range of variables (e. g., type of REC and estimated energy capacity), our census efforts applied a consistent and replicable methodology (see below) and sought to gather a wide range of REC data, including a literature-grounded taxonomy of organizational type (see Table 1), the kind and amount of renewable energy produced (if any), financial information, information on the governance structure and associated board composition, the presence (or not) of paid staff, the vision and mission for the organization, and the organization's age in years.

We analyzed over 250 websites from April 2021 to October 2021, beginning with REC websites and newsletters and then expanding to social media platforms (e.g., Facebook and LinkedIn). When website and social media searches proved insufficient, we consulted local online news sources. In Ontario, we also drew on a publicly available government registry of cooperatives to identify missing RECs. Finally, we complemented these online searches with follow-up calls and emails in instances where the RECs had limited or no online presence. We

Table 1

A Cooperative Classification of Renewable Energy Cooperatives — what members do.

Typology	Description
Consumer/Retail	Members purchase goods and/or services from the cooperative (e.g., solar panels, renewable energy).
Producer	Members use the cooperative to sell their output (e.g. solar energy).
Worker/Owner	Members pool their skills/capacity to secure contracts/work (e. g., energy efficiency consulting cooperatives).
Multistakeholder	Members internalize and minimize coordination, contractual, and administration costs by sharing governance amongst consumers, producers, workers and other stakeholders
Investment	Members pool funds to invest in solar, wind, biomass, or other types of renewable energy that generate a return based on the size of their investment.

Source: Adapted by authors based on cooperative typologies.

Table 2

Distribution of Interview Participants by Province (excluding Fall 2022 interviews).

Provinces	Number of Participants by Province
British Columbia (BC)	2
Alberta (AB)	8
Saskatchewan (SK)	2
Manitoba (MB)	1
Ontario (ON)	6
Quebec (QC)	3
New Brunswick (NB)	1
Newfoundland and Labrador (NL)	1
Nova Scotia (NS) *	0
Prince Edward Island (PEI) *	0
TOTAL	24

* Despite repeated emails and phone calls, we could not obtain interviews with targeted participants in NS and PEI.

aggregated and graphed the resulting data to identify past and current trends. We also created a map to facilitate access to the database and allow the RECs to correct errors and identify and add missing data.²

In parallel, we conducted 24 semi-structured interviews³ in the summer and fall of 2021 with representatives from RECs and the cooperative associations that, in many provinces, provided vital support in developing the REC sectors.⁴ Of the 24 participants, eight respondents were active board members, four were former board members, five worked for cooperative associations, and seven were RECs employees; 20 of the 24 interviewees had some form of post-secondary degree, and 15 held professional (paid) positions outside the cooperative in energy and the environment as well as education and other non-energy-related sectors. Participants were first contacted by email, and then the recruitment followed the snowball sampling method [52]. We sent out 80 invitations to personal and general RECs emails. The interviews followed a set of 15 theory-informed questions asking about the benefits, barriers, and future perspectives for RECs in Canada. We interviewed participants by phone or video conference.

To analyze interview transcripts, we employed NVIVO 12, a tool that facilitates qualitative content analysis [53]. With our literature review in mind, interview excerpts were organized and classified following a list of emerging themes. In the fall of 2022, we conducted three additional interviews with former leaders of the Federation of Community Power Co-operatives (FCPC), an entity created by Ontario RECs in the 2010s to coordinate and scale their activities but which was wound down because of inadequate resourcing and concerns about free riding. These latter interviews were not coded or included in the census data. Rather, they informed our discussion (see below) on scaling REC contributions.

4.1. Limitations: active and inactive RECs, data gaps, and classification challenges

Two main limitations are associated with our data gathering and categorization, each of which has implications for data interpretation. First, it was often difficult to determine whether a REC was still operational, had merged or had been wound down. We were unable, for example, to find a functioning website, social media presence, mailing address and/or phone number for many of the RECs identified in the earlier, 2015 effort to catalogue the sector. Second, even where a website existed, we were often unable to obtain targeted census data,

² See: <https://usaskstudies.coop/renewable-energy-co-operatives-special-project.php#ACensusofRenewableEnergyCooperativesinCanada>

³ Three follow-up interviews were conducted after the initial 24 interviews.

⁴ These associations are funded by credit unions, mutuals, and retail co-operatives not directly involved in the renewable energy sector. See the earlier ‘scaling’ discussion.

including most notably installed energy capacity. We were similarly unable, for example, to locate *any* formal annual reports or audited financial statements for what we call (see below) the ‘active’ RECs. Similarly, knowing when a REC had come into being was often difficult. In Quebec, for example, all but one of the entities we classified as renewable energy cooperatives began as worker-owned forestry co-operatives in the 1970s before moving into the biomass business in the early 2010s, incentivized by subsidies for boilers and high fossil fuel energy prices. In this instance, we chose to indicate the “start date” of these RECs as 2011 even though they formally came into legal being well before. While these limitations constrained our ability to provide a thorough depiction of Canada's REC sector, we also viewed them as, themselves, a finding – the inability of many RECs to compile and share financial, governance, energy production and other data underscores a key finding from our interviews, namely that many RECs suffer from volunteer fatigue and associated resource constraints.

5. Census and interview findings⁵

5.1. Active and inactive RECs by province and over time

Our census counted 97 RECs, 32 fewer than Lipp et al.'s found in their 2015 study [51]. We classified 49 of these 97 RECs as “active” – meaning we located evidence of a functioning or recently updated website, social media page, or of a long-term power purchasing contract. Given the challenges with data collection, our “active” estimate should be considered generous – the 2021 census counted seven RECs as “active” that, as of late 2022 (after our census), appear to have been dissolved or merged away. Returning to our 2021 census, we classified 48 of the 97 RECs as inactive because of the absence of any observable website, social media, contact information (phone, mailing address) or other activity. By contrast, Lipp et al. describe 89 of the RECs identified in that earlier census as “active and operating” and 40, all in Ontario, as inactive. Fig. 1 summarizes these findings.

Consistent with the results from the earlier study, Ontario continues to be the focal point for REC activity in Canada, accounting for 47 % of the active and 81 % of the inactive RECs in 2021. The number of active RECs in Ontario dropped from 2016 to 2021: whereas there were an estimated 34 operating Ontario RECs in 2015, our 2021 census found only 23. We see a similar trend in some other provinces. For example, we were unable to identify any online or physical presence for the three Manitoban RECs documented as operating in 2015. On the other hand, the RECs in British Columbia, Quebec, and New Brunswick identified in the earlier study remain active. Finally, we note that the growth in the number of RECs peaked in 2012 and 2013 and has since tapered off. This can be seen in Fig. 2, which plots our best effort (see data limitations) to identify the year of incorporation of the 97 active and inactive RECs

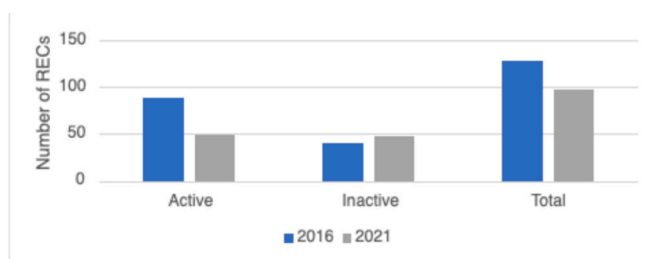


Fig. 1. The Decline of RECs, 2016 vs 2021 Census Data.

⁵ The information in this section draws heavily from, and recalculates some of the data, from our earlier public-facing report (Leonhardt et al., 2021).

from our census database. Fig. 2 also shows Ontario's important contribution to Canada's REC sector and Fig. 3 shows the geographic distribution of RECs across Canada.

5.2. Energy mix

Canada's active RECs universally generate, invest in, or work with one or more types of renewable energy: solar, wind, and biofuels (i.e., biogas and biodiesel). Of the 49 active RECs identified in our 2021 Census, we classified 26 or 53 % as engaged primarily in solar energy, either by means of investments in solar arrays or by providing solar-related consulting services. We classified another 20 % ($n = 10$) as engaged in *both* wind and solar investments and/or services. A further nine RECs, a bit more than 18 % of the active entities, engaged in biofuel production, while another three worked exclusively with wind. Finally, one Ontario REC focused its efforts on providing its members with home retrofits rather than energy generation or installation per se. Fig. 4 summarizes these data.

5.3. Typology

Drawing on the cooperative typology in Table 1, the Census data show that members are usually investors. Members had an investor relationship with almost 60 % of the 49 active RECs identified by our 2021 census, a consumer or retail relationship with 20 %, and were employee/owners in another 16 %. In 2 % of the RECs, members were simultaneously investors and consumers, while in the final 2 %, there were several different member classes, including community members, workers, and farmer-producers. The investment cooperative form dominates in Ontario because of its legacy feed-in-tariff (FIT) program, and the potential to secure long-term financing and rates of return. The retail model is most common in British Columbia and, relatively speaking, in Alberta (which has a unique rural electrical cooperative sector). Quebec's forestry cooperatives and British Columbia's consultancies account for the employee/owner RECs. Fig. 5 summarizes the typology findings using count data.

5.4. Vision statement

Most but not all active RECs had identifiable vision statements ($n = 44$ or just under 90 % of active RECs). Fig. 6 depicts a word cloud drawn from these statements. After the words “renewable” and “energy,” the most frequent word in REC vision statements was “community.” This word appears in all forty-four available vision statements, underlining the importance of local practices to the success of RECs. The next most prominent word is “sustainable,” underscoring the REC sector's climate change orientation.

5.5. Projects

The 2021 Census also collected information about the number and size of applicable REC projects. As with much of our data, there were significant data gaps. Nevertheless, based on available data, we estimate that Canada's REC sector had, at most, 73 MW of installed capacity in 2021, accounting for less than 0.05 % of Canada's total capacity. Most of this capacity is concentrated in a handful of larger RECs. SolarShare Co-op in Ontario for example operates 51 projects consisting of solar roof-tops, solar fields, and ground mounts. They have a combined installed capacity of 15 MW and annual revenue of \$7.4 million; by contrast, the smallest operating RECs have only one or two active projects, typically solar, and generate less than one megawatt of energy. Another mid to large REC, the Ottawa Renewable Energy Cooperative, has absorbed several small struggling cooperatives and has installed a capacity of 3 MW.

Some of the largest REC are in wind and biofuel, both of which entail high startup costs and development challenges. For example, the multi-

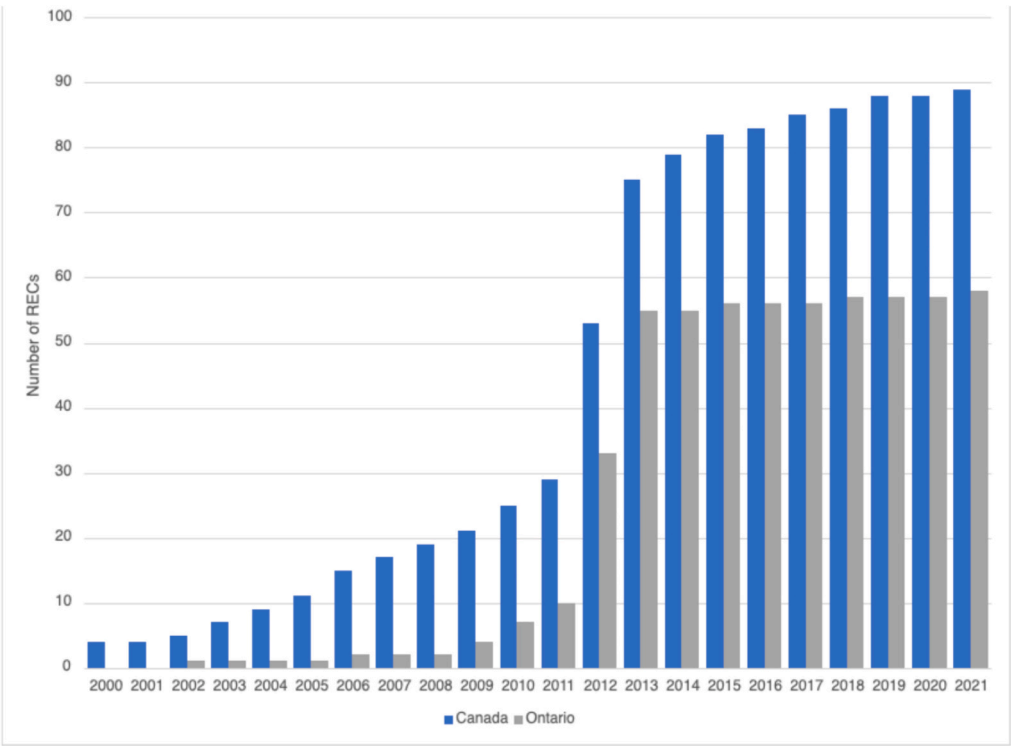


Fig. 2. Cumulative Count of Active and Inactive RECs: Canada and Ontario.

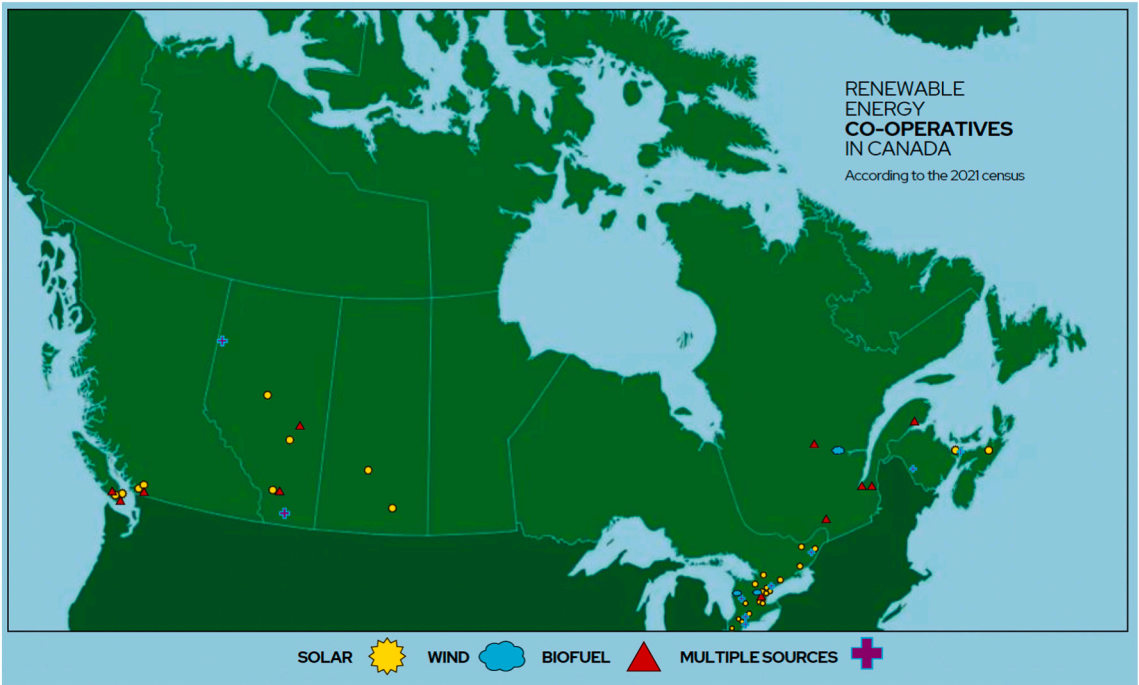


Fig. 3. Map of RECs in Canada.

stakeholder cooperative, Val-Éo in Quebec, was incorporated in 2005 with a plan to invest in windmills capable of generating 24 MW annually but only started generating electricity in 2022, 17 years later. Another wind producer, Huron Community Power Cooperative in Ontario, had plans for five wind turbines with a total installed capacity of approximately 50 MW, but progress toward this objective is unclear. Other cooperatives have pursued different strategies to tap into the potential of wind. Peace Energy Cooperative for example has royalty rights to a 102

MW wind farm in British Columbia that is 99.99 % owned by TriSummit Utilities.

5.6. Board statistics

Our census found that RECs generally have operational and purely volunteer boards, meaning members are responsible for routine tasks such as finance, human resources, and communications. To better

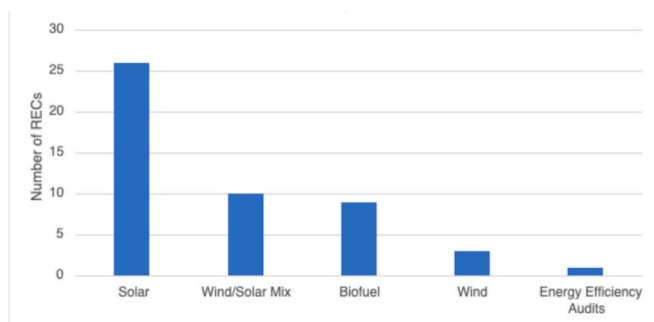


Fig. 4. RECs by Energy Production/Activity (Active RECs Only).

understand board makeup, we also collected data on board size and membership from active RECs. We found that board size ranged from three to eleven members, with an average of six board members. REC board members have diverse educational and professional backgrounds. For example, the Solar Power Investment Cooperative of Edmonton counts on the experience of engineers, a physician, a project manager, an electrician, and a political scientist. However, this kind of professional diversity is not mirrored in the gender composition of REC boards. Overall, 73 % of the board members at Canadian RECs are men, and only 27 % are women. We only found one REC board – the Toronto Renewable Energy Cooperative (TREC) in Ontario – with an equal number of men and women.

5.7. Summary of census findings

The picture that emerges from our census is of a niche struggling to break into the regime, with almost half the RECs identified in earlier research inactive by 2021. Meanwhile, the remaining RECs operate websites that are infrequently updated, poorly documented, and contain limited information about finances, energy generation, board composition, and sometimes missing basic information like mission and vision statements. That said, the information we gathered points to a sector governed by experienced and skilled, if overwhelmingly white and male, volunteers committed to community-owned renewable energy.

The Census findings also speak to the potential and limitations of the REC model of community energy. The potential resides in the cohesion, motivation, and shared vision of the people who volunteer their time to operate RECs with no financial compensation. These are individuals committed to their communities and to doing their part to address climate change. This cohesiveness is an important element of any successful cooperative, particularly in its early stages. However, the demise of dozens of RECs since 2015, combined with the ongoing struggles of active RECs, suggests that the volunteers may lack a core condition for a successful (enterprising) cooperative, namely, a strong economic rationale or motivation of the kind that would generate sufficient revenue to hire staff, maintain websites, and grow the business. This economic theme emerged forcefully in our interview findings.

5.8. Interview findings

5.8.1. Barriers

Consistent with Census results, the interview findings reveal that RECs face a set of internal and external barriers that impede their growth and capacity to be regime players. Table 3 sets out six categories of internal and external barriers largely consistent with the barriers identified in earlier scholarly literature. The literatures emphasizes for example an absence of, or instability in, government funding programs [54] that parallels our categories of economic, regulatory and political barriers as set out in Table 3. Similarly, inadequate or non-existent political support [54,55] matches the “political” barrier. And finally, organizational challenges such as dependence on voluntary work, and lack of experience [55] are consistent with the operational, technical and social barriers set out below.

5.8.2. Internal barriers

We grouped the internal barriers into two main categories: economic and operational. Economic barriers involve the expenses required to operate the cooperative and develop new projects. They include the cost of hiring experts such as accountants and lawyers, developing business plans and environmental assessments, and paying for staff. Operational barriers include, most notably, difficulties recruiting a board with the necessary expertise, particularly in the areas of accounting and law. This in turn means RECs often struggle with the process of writing offering statements to raise the money needed to build and grow the business.



Fig. 6. Word cloud of REC vision/mission statements, 2021 Census.



Fig. 5. RECs by Type of Cooperative (Active RECs Only).

Table 3
Internal and external barriers.

Type	Theme	Examples Mentioned by Interviewees
Internal	Economic	Cost of hiring specialists
		High upfront costs
		Operational costs
		Low investment return rates
		Costs involved in writing an offering statement
	Operational	High membership fee
		Finding members with accounting or legal background
		Lack of appropriate insurance products or broker support
		Complex process to raise money for projects
		Finding engagement members with available time and dedication
External	Economic	Poor digital infrastructure
		Volunteer burnout
		Difficulties in finding energy-related technicians
		Transmission and distributions costs
		High-interest loans for RECs
	Technical	High grid connection costs
		Low-interest loans for the public seeking to invest in energy
		RECs biodiesel price is not competitive
		High biofuel taxes
		Low commercial electricity rates
	Political	Poor grid infrastructure and capacity
		Lack of support from distribution and transmission
		Long grid connection waitlist
		Lack of support from the provincial government and federal government
		Utility bias toward large-scale, centralized generation
	Regulatory and Policy	Electoral and political changes in recent years
		Lack of continuous and long-term incentives
		Complex and cost-prohibitive securities regulations
		Regulated electricity market
		Cooperative regulations
	Social	Lack of strong community renewable energy programs (i.e., FIT, PPA, net metering)
		Prohibitive grid transmission and distribution legislation
		Banks' unwillingness to invest in RECs
		Lack of public awareness to invest in RECs
		Public unwillingness to use REC products

Source: Authors, based on interview coding.

Table 4
Internal and External REC Enablers.

Type	Theme	Examples Mentioned by Interviewees
Internal	Economic	Capital raising
	Operational	Board with expertise
		Dedicated staff
External	Economic	Government funding
		Loans from credits unions
		Tax-saving accounts
	Policy	Small scale generation regulation
		Feed-in Tariff (FIT)

Source: Authors, based on interview coding.

5.8.3. External barriers

We grouped external barriers into five categories: economic, political, regulatory, technical, and social barriers. The main external economic barrier was the costs of accessing and using the grid. In Alberta for example, one participant said that most of what consumers pay consists of distribution and transmission fees rather than costs related to production over which RECs have some control. Interviewees also said they struggled to secure loans for new projects and rarely found a bank or credit union willing to provide financing. Where they did find a willing

lender, the interest rate tended to be too high given the expected returns from the investment. On the other hand, some interviewees from investment RECs said that if the government or banks were to provide cheap loans for energy-related projects, it might perversely undermine the legitimacy of their cooperative by weakening their ties with members: "I think in the end, ironically, if it (low-interest loans) was very widely accepted, it would actually contribute to the weakening of our renewable energy cooperative" because it would lessen the need to secure member investments.

Interviewees also identified politics as a barrier to the development of RECs, with most saying the sector was held back by a lack of support from federal and provincial governments, who had a bias toward large-scale and centralized generation. Even where politicians indicated notional support for RECs, they said this rarely translated into meaningful or enduring support. Relatedly, interviewees repeatedly cited regulatory and policy obstacles as another significant barrier to REC growth, particularly in moving energy onto the grid, securities legislation, and cooperative regulations. They criticized frequent and costly changes in rules around grid access and policies such as net metering, power purchase agreements, and FIT programs. In short, interviewees generally had a very negative view of policymakers, saying they were inflexible and not sufficiently knowledgeable or open toward RECs.

Finally, participants identified a series of technical and social barriers. Technically, participants noted issues with grid infrastructure and capacity and the complex process involved with grid connection. Socially, participants noted that the public is generally unaware of the cooperative model, underlining the fact that the cooperative sector is – in many sectors – itself a niche.

5.8.4. Enablers

Notwithstanding these barriers, RECs have succeeded in developing projects, engaging the public, and in some cases, building up internal capacity in the form of staff, earnings, and organizational ability. In this section, and building on the internal/external categories discussed earlier, we present a list of the main drivers and enablers behind successful RECs.

Raising capital is a crucial factor in community energy development, as the costs involved in building renewable energy projects can be significant. Almost all RECs struggled to generate the funds necessary to start and grow their businesses. Nonetheless, one interviewee reported that their cooperative had raised close to \$70 million since its creation in the early 2000s. Since most of Canada's RECs operate as investment cooperatives, interviewees made repeated mention of the importance of tax-sheltered plans such as tax-free saving accounts (TFSAs) and registered retirement savings plans (RRSPs) for fundraising. Their experience with debt financing is mixed. One interviewee noted that they were winding down their bond sales as they had reached their capital requirements, having raised close to \$10 million in a single year. On the other hand, interviewees said that banks generally only make prohibitively expensive high-interest loans available but that credit unions, while not perfect, sometimes offer low-interest loans to cover upfront costs. One participant stressed that their REC would not have survived without the support of a local credit union.

Governments are often critical sources of start-up funding, with one participant receiving nearly \$40,000 from the Ontario government to cover costs associated with their offering statement. Retrofit funding was also identified as a crucial funding source for creating new business opportunities. Participants reported that a recently introduced federal grant to make homes more "green" generated strong interest amongst potential customers of their consulting cooperative.

The policy environment can be an enabler in other ways. Interviewees cited Alberta's small-scale generation program as a particularly important enabler of community energy. In Ontario, the FIT program significantly boosted the REC sector, prioritizing projects with the participation of municipalities, Indigenous communities, and other community-led projects, including cooperatives. However, the

discontinuation of the FIT program in 2018 led to a decline and stagnation of the REC sector in Ontario, as noted by interviewees and supported by census data. Similarly, the net metering program launched by the provincially-owned utility Saskatchewan (SaskPower) in 2008 had been a major driver of REC development, leading to a wave of new solar energy developments, including two new solar cooperatives. However, the utility's decision to reduce the price per kWh paid to net metering customers in 2019 has impeded the growth of the province's small REC sector.

Board expertise and dedicated staff are also critical drivers of REC development. Interviewees stressed the importance of tapping into a pool of volunteers, especially for the board, with strong professional or educational backgrounds. Participants noted that finding people with accounting and legal experience is crucial for keeping costs down and avoiding hiring accounting and legal firms. The ability to recruit skilled volunteers for the board helps RECs benefit from “super skilled, super committed, and passionate” individuals, as one participant noted. Successful RECs also benefit from having dedicated employees who can help reduce the workload for board members and ensure that administrative tasks are handled efficiently.

In sum, while raising capital for RECs is a significant challenge, local funding sources, government funding, low-interest loans, TFSA's and RRSPs, small-scale generation programs, FITs, net metering, board expertise, and dedicated staff are critical factors that enable RECs to develop and thrive.

5.8.5. Attempts at scaling

Our census investigation revealed previous attempts to form a second-tier organization. To understand these efforts, we conducted three additional semi-structured follow-up interviews with individuals associated with the now-defunct Federation of Community Power Cooperatives (FCPC). The organization was formed during the growth phase of RECs in Ontario, following the introduction of its FIT program through the 2010 Ontario Green Energy and Green Economy Act. According to their website (last updated in 2016), the FCPC was an “umbrella organization for renewable energy coops that are developing community-owned projects. We exist to unite, represent, grow and serve the community power community.”

Operationally, the FCPC worked to share best practices, develop common standards, help communities form new RECs, connect with RECs outside of Ontario, and advocate on the sector's behalf – what we might refer to as scaling deep and across activities. While focused primarily on lobbying the Ontario government and its FIT program, the FCPC volunteers briefly contemplated a more nationwide presence but abandoned the idea due to volunteer constraints and the reality of Canada's provincially-siloed grid systems (see the section on Background of Canada and the Provinces).

The FCPC was run by volunteers who pulled together funding from ad hoc sources, including academic grants, one-time support from government or affiliated entities (e.g., the Independent Electricity System Operator (IESO) of Ontario), and other grants. It also benefited greatly from support by TREC, a large developer of community-owned energy that shared its executive director with the FCPC. While the intention was that the FCPC would eventually become self-sustaining through membership dues and other funding, contributions from other member organizations were almost non-existent. A former representative from the FCPC explains,

When I joined, I found that almost none of the member coops had, in fact, contributed their membership share fees that year. TREC was supporting FCPC by effectively paying for the role of president. And we had a couple of grants from the IESO that we worked on. And each year, I was able to get one or two grants to do additional work. And that IESO funding helped as well (FCPC Interviewee #1).

The FCPC also struggled with lobby activities. An interviewee noted

that “I don't think we really got anywhere with the provincial government. I feel like they just eroded and eroded and eroded out of the feed-in tariff program” (FCPC Interviewee #2). The interviewees noted that their strategy did not involve any extensive lobbying of the municipal and federal governments. The Ontario REC sector's challenges highlight the need for a comprehensive and collaborative approach to supporting community energy initiatives. Lacking stable funding, access to staff support, and a solid lobby victory, the FCPC – like so many Ontario RECs in Ontario – ultimately did not survive the cancellation of the province's FIT program.

6. Discussion

Drawing on our census findings and interview data, we next explore the potential for RECs to play a larger role in Canada's energy transition by means of scaling their efforts and operations. The discussion begins with a short recap of our census and interview findings, moves to a discussion of challenges associated with measuring impact and what we call the policymaker's dilemma, and concludes with a discussion of approaches to scaling.

6.1. The niche is struggling

As the literature on sustainability transitions makes clear, many niche actors are formed but few are able to penetrate the regime [14,24,56,57]. As niche actors, our results indicate that RECs must overcome obstacles such as confronting unsupportive public policy, difficulty accessing capital, lack of familiarity with the cooperative model, and challenges with grid integration. Consistent with other jurisdictions, our census and survey findings paint a clear picture of a REC sector that despite a few success stories, is struggling to develop a sustainable model within the regime. The REC sector in Canada also struggles with the fact that for the most part, Canadian consumers are well-provisioned with reliable electricity production that, in many provinces, is generated from low-emitting sources (e.g., hydro). There are no pressing operational gaps or market failure to fill or fix, at least not yet⁶ [58].

Changes in the policy environment further exacerbate this struggle. Our findings suggest that RECs can be severely hindered and are vulnerable to the decisions of policymakers. While Ontario's FIT program led to a boom in new REC formation, as it has in other countries [59–61], its subsequent cancellation was associated with an equally dramatic dissolution of many RECs (see Fig. 2). While never intended as a long-term program, the FIT and policies such as net metering drew criticism to the fact that the cross-subsidization of decentralized energy from consumers to small-scale producers can pose a challenge to the business model of the existing utility [4,62]. For RECs to reach scale in Canada, they must overcome their capacity challenges and adopt a business model that does not rely on programs that pose an existential threat to existing utilities. To do that, they need scale.

6.2. Accounting for positive impacts

When addressing climate change, the challenge is not solely about crafting strategies but also about effectively measuring impact. A robust metric system is imperative, whether it's RECs demonstrating their sustainability, potential funders evaluating investment value, utilities analyzing integration opportunities, or governments monitoring their progress toward environmental objectives. In each instance, potential REC supporters need some way of tracking progress and accountability. Our findings, for instance, showed a recognition from RECs that they

⁶ That said, the current approach to the energy transition does not address questions of energy equity or democracy, two areas where cooperatives offer much promise.

struggle to obtain initial capital and articulate the positive impacts of what they do (see Table 3) but lack the tools to help others see or understand these facts.

There is little question that with a sustainable financial model, RECs can deliver on these objectives. There is a robust literature on the measurable benefits of community energy and the capture of positive externalities [63,64]. In their systematic review of the literature on community energy projects, Berka and Creamer, for example, report that community energy enhances skills development, social capital, access to affordable energy, energy literacy, and support for the transition to renewable energy more generally [65]. They emphasize that these benefits must be well-defended by evidence if community energy is to be broadly supported by policymakers. Reflective of this research, Canada's RECs claim a broad array of societal benefit flow from their efforts, including empowerment, local procurement, education, and access to affordable and clean energy. Both our interviews and our analysis of REC websites indicate that RECs recognize and advocate for these benefits. Furthermore, the mission and vision statements of REC often emphasize "community" as a central objective of their organizations (see Fig. 5). Our findings reveal that RECs perceive their role not just in the context of emissions reduction but also as pillars of community-building and providing social value. This supports research from Bauwens et al showing that RECs often operate as hybrid social enterprises, advancing member benefits as well as broader social goals [38].

Yet, when it comes to tangible evidence to substantiate the impact of Canada's REC sector, there is very little in the way of objective measurement. Our census and interview data point to the sector's limited and in some cases non-existent capacity to quantify or otherwise collect evidence that could substantiate its impact or potential impact. If RECs struggle to make available basic financial data or data on their generation capacity, it is difficult to see how they could report on more ambitious, less measurable outcomes. And yet, we know that policymakers and third-party agencies need clear evidence of positive community impact given their objectives but also to justify financial support to RECs. This is a chicken-and-egg problem for RECs. To obtain government support, they need to measure impact. To measure impact, they need government support. To break this impasse, RECs need scale.

6.3. Governing scalability of cooperatives

Cooperatives have a long history of facing the challenge of scaling while maintaining local significance. To address this challenge, they have often formed second-tier organizations called Leagues or Federations, which they own and control. In finance, insurance, agriculture, fisheries, grocery retailing and many other sectors, cooperatives have taken up an important place in the regime through this form of collective action. Brussels-based REScoop⁷ is a recent example of this kind of Federation in the renewable energy space. Established in 2014, REScoop represented more than 3000 RECs across Europe in 2022, with 80 % residing in Denmark and Germany [63]. REScoop's primary function is advocacy on behalf of European RECs, but it also supports REC formation and education, offering a set of tools to assist with vital functions including measurement of contributions to climate change. While there are important differences between European and Canada, there are enough similarities to suggest there is potential to emulate this approach in Canada. Canadian provinces and European countries, for example, both have jurisdiction over electricity provisioning. As a result, coordination challenges amongst nation-states in Europe parallel, in many ways, the challenges of working across provinces in Canada. A key difference in the European context is the formal recognition of local energy communities (LCE) as part of the EU legal framework and many national governments. This legal and policy support has been a boost for RECs in

Europe [66,67]. Unlike the supportive policy environment for European RECs, Canada's RECs face a less favorable policy landscape. This difference underscores the need for Canadian RECs to be proactive in advocating for policy changes that could provide a more conducive environment for their growth and development.

In considering the idea of a Canadian REScoop equivalent, Canada's RECs can also learn from the demise of the FCPC. As our earlier discussion noted, its rise and fall were tied to Ontario's FIT program, suggesting that Canada's REC leaders would be wise to avoid tying the formation of any new entity to a single program. The FCPC's struggle with obtaining funding and operational support also suggests that any future national-level equivalent would need to secure medium to long-term financial capacity to hire staff and secure some early policy victories that have broad benefits for member RECs.

While the formation of the FCPC speaks to the intuitive appeal to a League or Federation approach to achieving scale, cooperatives and other organizations may also scale informally through networks of intermediaries and innovation hubs. Novkovic and Holm, for example, have argued that multi-stakeholder networks within cooperatives offer an opportunity to adapt to complex systems [68]. This ecosystem approach is consistent with research by Rogdriguez and Schneider into a network of cooperatives in and around the solar industry operating out of Colorado [69]. In this case, actors developed a set of specialized entities – solar generation, consulting, equipment and parts, and financial (e.g., a green credit union) – that constituted a network of mutually supportive organizations. There is literature suggesting that the existence of these kinds of intermediary organizations can play an important role in supporting the development of RECs [18,64]. In their study of German RECs, Punt et al. found that a greater presence of other cooperatives was associated with stronger growth of RECs in German districts [18]. In the Canadian context, the absence of supportive and networked organizations limits the ability of RECs to support each other, coordinate efforts across the country, and lobby governments. And yet, we know these gaps are important. Wageman et al. [64] for example reported five governance dimensions that support the development of local RECs: mobilizing the public, brokering between government and citizens, providing context-specific knowledge, initiating accepted change, proliferating the integration of sustainability [64]. Thus, the potential of strong intermediary networks, underpinned by effective governance, becomes central to RECs' sustainable growth and operational synergy, thereby amplifying their role in advancing their shared objectives.

In reflecting on the need for a second-tier entity or a more informal networked approach in Canada, it is also important to recognize that "at some level, provincial legislative and/or economic support has always been instrumental to the growth of successful cooperative enterprises in Canada" [37]. Indeed, this support has often proven necessary because cooperatives – including RECs – "enter an environment that is shaped by the interaction between large capitalist firms and a powerful state" [37]. For that reason, "state-assisted cooperative development is most effectively rationalized as a way of making up for the unfairness and other shortcomings of a capitalist market economy, which includes massive state financial assistance to private sector firms for economic development" [37].

At the same time, cooperatives have tended to resist explicit support from the government out of concern that any support might encroach on their autonomy and independence and undermine the legitimacy and trust on which they are based. And yet, as Fairbairn stresses, the issue is less one of "opposition to state intervention" and more one of "being consistently opposed to state control" [34]. As they contemplate their future in an increasingly competitive renewable energy market, RECs are wrestling with just how much they value their independence from government relative to their ongoing existence. To that end, some have suggested that government adoption of a virtual net metering policy could represent a viable path forward [70–72]. It is "universal" in that it applies across organizational forms but is especially well suited to the

⁷ REScoop stands for the Federation of Groups of Cooperatives of Citizens for Renewable Energy in Europe.

cooperative form in that it allows RECs to effectively sell their energy production to consumers rather than to the grid. In so doing, investment RECs could build a user-relationship with their members, and in doing so, convert their businesses into conventional user-owned, controlled, and benefitting cooperatives.

6.4. The policymaker dilemma

As RECs grapple with the tension between their desire for autonomy but also government support, policymakers simultaneously face their own challenges in steering the energy transition. Policymakers are in the business of trade-offs – more here means less there [73,74]. In the case of the energy transition, they must use their limited time and resources, plus the constraints of political capital, to achieve maximum impact.

This reality creates a dilemma: while policymakers might recognize that RECs are effective in building social acceptance and contribute to reducing emissions, they also find seductive the idea that they can achieve significant emissions impact by working with large private energy companies capable of deploying large sums of money on wind farms and solar installations whose impact can and will be easily measured [75,76]. Even if sympathetic to RECs, the average policymaker will typically opt for the former over the latter, trading off long-term social acceptance for short-term large-scale climate action. To solve this problem, RECs need a second-tier entity to help them achieve the scale needed to be viable both economically and policy-wise.

7. Conclusion

The evidence from other jurisdictions is clear that RECs have the potential to make meaningful contributions to the energy transition. Yet, our research finds that the sector in Canada is struggling. Based on a review of more than 250 websites and 27 REC leader interviews we find that at best, the REC sector accounts for less than 0.05 % of Canada's installed electrical capacity. We also find that the number of RECs fell by 44 % from 2016 to 2021, as the sector struggles to overcome significant obstacles such as restricted access to funds, domain expertise, and volunteer burnout. Unlike other niches, however, RECs must also overcome poor to non-existent understanding of the cooperative model.

Yet, these challenges are not unfamiliar to cooperatives, who have often struggled against powerful incumbents and unfriendly or unaware policymakers. They have traditionally overcome these obstacles by working together and forming a second-tier cooperative association that can accelerate and scale their contribution, even in situations where gaps and market failures are sometimes less than obvious or the result of policy design. The same can happen with RECs. If that were to happen, RECs could better leverage a model grounded in local and democratically-controlled electricity generation, which, in turn, may improve grid and foster support for and raise public knowledge of renewable energy. By integrating this understanding of the evolution of cooperatives in other sectors, our study contributes to the expanding literature on niche dynamics within socio-technical transitions and offers insights for furthering the use of RECs as a critical component of a sustainable energy future.

7.1. Future research

Our findings also highlight the need for legal and regulatory measures that support and encourage the scaling of RECs, as well as collaboration across government, civil society, and the private sector. It is rare for a cooperative sector to grow a second-tier and scale up in the face of completely hostile government. Indeed, the dramatic rise and then fall of the REC sector in Ontario and the FCPC – aligned with the introduction and then withdrawal of a FIT program — underscores just how important the public policy context can be in fostering the growth of a cooperatively-structured REC sector. Renewable energy policies across Canadian provinces vary significantly, reflecting regional

priorities, governance, and resources. Unlike some cooperative sectors, RECs must operate in a heavily regulated and shifting policy environment within the various provincial electricity regimes. This, in turn, suggests the need for additional research into which types of policies are most strongly associated with an impactful and resilient REC sector. It also suggests that more research needs to happen to understand better how cooperatives, and RECs in particular, are able to mobilize and collaborate effectively with government.

While our paper is focused on Canada, we also see the need for more research of this kind that evaluates the potential for RECs to contribute to the energy transition in other jurisdictions, with particular emphasis on locally relevant strategies for scaling and entering the regime. Theoretically, there is ample opportunity to enrich the scholarship on 'scaling' by connecting the thin theoretical literature on second-tier cooperatives with public policy and strategic niche management scholarship. Finally, we see a rich opportunity for scholars to explore the mindset of policymakers and other actors outside RECs (and community energy) to understand how they perceive the sector in the context of the existing regime. While RECs must ultimately shoulder the responsibility for organizing themselves into more effective and impactful organizations, the urgency of the climate crisis reminds us of the interdependencies that bind us together in challenges and opportunities.

CRedit authorship contribution statement

Martin Boucher: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Marc-André Pigeon:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

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Data availability

Data will be made available on request.

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