UNIVERSITY OF ALBERTA

2024

Knowledge, attitudes, and willingness to invest in renewable energy co-operatives in Alberta

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Project Report #24-01

Department of Resource Economics and Environmental Sociology

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August 2024

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Acknowledgements

Funding to support this research project was provided through the Social Science and Humanities Research Council (SSHRC) Insight Grant titled ‘Pathways to energy democracy in Canada’ (435-2023-0204). Thanks Manori Nimanthika Lokuge Dona, Sandra Odame, and Marina Giannitsos who supported the development of the questionnaire and the approach to analysis with best-worst scaling and payment card questions.

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Suggested Citation: Fejzulla, A., Pare, J., & Parkins, J. R. (2024). Knowledge, attitudes, and willingness to invest in renewable energy co-operatives. *Department of Resource Economics and Environmental Sociology*, *Project Report #24-01*, Edmonton, University of Alberta.

Abstract

Renewable energy co-operatives (RECs) provide citizens with opportunities to expand their roles within the energy system while providing environmental, economic and social benefits to local communities. Given the growth of renewable energy technologies and the long-standing use of the co-operative model in Alberta, Canada, the future of the REC sector in the province looks promising. However, because the sector is nascent in Canada, there are few studies that explore the motivating factors of REC participation in the Canadian context. For this purpose, our study asks, "What factors drive citizen participation and investment in RECs in Alberta?" and "Which attributes of RECs do Albertans prefer?" We answer these questions with survey results from household financial decision-makers in Alberta (n = 994). The survey, conducted in 2024, indicates there is substantial participation and investment potential in Alberta despite low levels of familiarity with RECs. Furthermore, our results emphasize the importance of economic incentives (energy cost savings, return on investment) and environmental considerations (participating in the renewable energy transition) in influencing an individual's decision to participate or invest in RECs. Results demonstrate the relevance of both financial and non-financial motivations for citizen investment in community renewable energy projects. Thus, methods to foster participation in RECs can include specific attention to the financial performance and environmental impact of RECs and REC investments.

Introduction

As an alternative to corporate ownership of energy generation, the co-operative business model is a pathway to facilitate the growth of decentralized energy resources (DER). DERs are recognized as a viable option for the renewable energy transition because of their ability to achieve sustainable, affordable, and resilient energy systems within local and regional settings (Schoolman et al., 2019). Wind, solar and biogas plants are examples of DERs in Canada. Through creative ownership structures, such as co-operatives, DERs can be achieved through community empowerment that inspires bottom-up actions, local support, local benefits, and contributes to the energy transition.

One example of this shift in ownership involves the development of renewable energy co-operatives (RECs). RECs are one tool for achieving decentralized energy development while allowing local citizens and communities to participate more directly in their energy systems, thereby democratizing energy systems (Thombs, 2019). Specifically, RECs are renewable energy organizations that are community-focused, democratic and collectively owned (Banack, 2024). In many regions, the renewable energy sector is rapidly growing as countries strive to meet their targets of net-zero emissions by 2050 (United Nations, 2024). This expansion requires a shift away from fossil fuel-based energy systems. The International Energy Agency reports that by 2028, 3,700 additional GW of renewable energy capacity will be connected to global electricity grids (Bojek, 2023). These contributions to renewable energy will come from various ownership structures, presenting an opportunity for RECs to play a part in this transition.

As is the case in other sectors of the economy (e.g., agriculture and housing), co-operatives play an important role in supporting small-scale and local economic activities. Co-operatives are people-centered organizations owned, controlled and operated by and for their members to achieve shared economic, social and cultural objectives (The International Cooperative Alliance, 2024). This form of ownership is value-driven, embracing democratic and equitable decision-making power. Co-operatives are typically categorized into five forms: consumer (retail), producer, worker-owner, multi-stakeholder, and investment co-operatives (Leonhardt et al., 2022). RECs can take any of these forms within the energy sector and are seeing much growth in Europe, the United States, and Canada (Leonhardt et al., 2022; NRECA, 2024; Tarhan, 2015).

Co-operatives in Alberta have a long history dating back to the late 19th century (Banack, 2024). These businesses played a key role in electrifying rural communities and developing the agricultural sector, contributing to the growth of Alberta's economy and society (Goddard, 2002; MacArthur, 2016). These co-operatives have created a foundation for today's modern co-operative movement and the emergence of RECs.

Alberta's open-access grid allows for many different ownership structures and forms of electricity generation (AESO, 2024b; McHugh, 2024), enabling the expansion of the renewable energy sector (AESO, 2024a). This growth has established Alberta as a leader in the renewable energy sector within Canada. In 2023, 92% of all renewable energy and energy storage capacity built in Canada occurred in Alberta (Canadian Renewable Energy Association, 2024). RECs have the potential to utilize this growth and build on Alberta's co-operative history to contribute to this renewable energy transition.

Several studies analyze the determinants of citizen participation and investment in community renewable energy projects and RECs in the European context (Fischer et al., 2021; Guetlein & Schleich, 2023; Gutsche & Ziegler, 2019; Kalkbrenner & Roosen, 2016; Koirala et al., 2018). However, there are limited studies that investigate factors leading to citizen participation and investment in RECs in the Canadian context. Responding to the need for more insights in Canada, this study explores the individual factors influencing willingness to invest and participate in RECs within the Province of Alberta, Canada. Moreover, our study focuses on financial investment intentions, attitudes, public awareness, and knowledge related to renewable energy and RECs.

To that end, we seek to address the following research questions:

- How willing are Albertans to participate (i.e., invest time or volunteer, buy electricity, become a member, or invest financial resources) in renewable energy co-operatives?
- What is the preferred level of investment?
- What are the determinants of Albertans' participation in renewable energy co-operatives?
- What attributes of renewable energy co-operatives do Albertans prefer?

We answer these research questions through descriptive statistics, bivariate correlations, and binary logistic regression analysis using IBM SPSS statistical software.

Literature review

Renewable energy co-operatives

RECs have evolved and grown worldwide, especially in the United States, Europe, and Canada (Viardot, 2013). From 2016 to 2024 in the United States, RECs nearly doubled their installed energy capacity from 8.2 gigawatts to 15.8 gigawatts (NRECA, 2024). These co-operatives can power over 3.5 million homes with wind and solar energy generation alone (NRECA, 2024).

Wierling et al. (2018) find that in Europe, governmental financial and policy support is critical for the success of RECs. According to the European federation of energy communities, there are over 2,250 renewable energy co-operatives within Europe (REScoop.eu, 2023). Collectively, these RECs play an important role in the continent's energy transition away from fossil fuels (Wierling et al., 2018).

While less prevalent in Canada, RECs are beginning to gain traction. In spring 2023, Community Energy Co-operative Canada (CECC) was formed. The CECC helps facilitate the growth and development of the REC sector (Community Energy Cooperative Canada, 2024). Believing in the transformative potential of renewable energy for communities, the CECC aims to promote community control and management of energy through co-operatives

The CECC reflects the emerging organizational capacity to support advocacy and growth of the REC sector. A census done by Leonhardt et al. (2022) reveals there are 52 active RECs within Canada. The study also identifies significant interest among RECs to collaborate and learn from each other. Collaboration between RECs across Canada is expected to be essential to the overall growth of the sector (Leonhardt et al., 2022). The researchers created a comprehensive database from REC websites to identify the status of Canada’s REC sector. While the REC sector is small in Alberta, given the substantial growth in the renewable energy sector, there is potential for additional co-operatives to emerge (Canadian Renewable Energy Association, 2024; Leonhardt et al., 2022).

Attributes and benefits of renewable energy co-operatives

RECs can create environmental, economic, and social benefits. Collectively, these benefits impact local communities, the environment, and governments alike (Leonhardt et al., 2022). Environmental benefits include addressing climate change by directly engaging in the energy transition and shifting away from fossil fuels (Banack, 2024). RECs also present an

opportunity to increase renewable energy acceptance. The Not-In-My-Back-Yard attitude is common among the public regarding large-scale renewable energy projects (Leonhardt et al., 2022). Yet research suggests small-scale and community ownership attributes of RECs have the potential to shift these attitudes and public support for renewable energy.

RECs can strengthen local economic development through the reinvestment of profits back into the community (Leonhardt et al., 2022). Furthermore, RECs present local communities with the opportunity to have meaningful local control of the operation and the ability to utilize local skills, such as accounting and project management (Banack, 2024). This strengthens social capital and further develops local economies. Additionally, individual participants or members of RECs can benefit from lower energy costs and returns on investment (Fischer et al., 2021).

RECs offer numerous social benefits as well. The local ownership structure of RECs empowers communities, enhances access to climate solutions, and fosters increased democratic control of the energy sector (Banack, 2024; Leonhardt et al., 2022). For example, membership within RECs have enhanced social connections (Bauwens & Defourney, 2017; Leonhardt et al., 2022). Collectively, RECs provide numerous interdisciplinary benefits to the communities and members they serve.

Factors affecting citizen participation and investment in renewable energy projects and RECs

Several factors play a role in citizens' willingness to participate or invest in community renewable energy projects. Surveys eliciting European citizens' willingness to invest in RECs or socially responsible investments identify prior participation in an environmental organization, pro-environmental orientation, financial literacy, sustainable investment experience, and ecological political orientation as positive predictors of investing (Fischer et al., 2021; Guetlein & Schleich, 2023; Kalkbrenner & Roosen, 2016). Socially responsible investments (SRIs), or sustainable investments, are an investment process that integrates social, environmental, and ethical considerations into investment decision-making (Renneboog et al., 2008).

Within the field of SRI research, political orientation and financial literacy are considered major determinants of willingness to invest in SRIs. Generally, left-wing political identification is associated with a higher willingness to pay for sustainable investments (Fischer et al., 2021; Gutsche & Ziegler, 2019). With respect to financial literacy, Fischer et al. (2021) report a positive relationship between financial literacy and investing in RECs. In contrast, in exploring

Japanese individual investors' intention to invest in sustainable investments, Gutsche et al. (2021) find no association between individual financial literacy and the intention to invest in sustainable investments. They also find that investors with prior sustainable investment experience are more likely to make future sustainable investments.

Several studies consider the relationship between risk preferences and intentions to invest in sustainable investments. Gutsche & Ziegler (2019) find that risk perceptions play a negligible role in determining willingness to pay for sustainable fixed-interest investment products in Germany. Similarly, Fischer et al. (2021) find no statistically significant relationship between risk-taking attitudes and willingness to invest in German RECs. In comparison, Gutsche et al. (2021) find a positive relationship between Japanese citizens' willingness to take risks and their intentions to invest in sustainable investments. In terms of comparing the perceived risk of sustainable investments with conventional investments, the risk associated with sustainable investments is generally considered higher than the average risk level (Gutsche et al., 2019; Salm et al., 2016).

Empirical studies identify environmental considerations as important motivators for participating in RECs and local renewable energy projects (Fiander et al., 2024; Fischer et al., 2021; Kalkbrenner & Roosen, 2016). Koirala et al. (2018) identify environmental concerns, climate change, and renewables acceptance as statistically significant motivators of citizen participation in community-based energy systems in the Netherlands. Their finding suggests that increasing public acceptance of renewables highlights the potential for renewables to play a larger role in the Dutch energy mix. Broughel & Hampl (2018) also find that positive attitudes and beliefs related to renewable energy have an important impact on sustainable investment decision-making. Gutsche & Ziegler (2019) further observe that German investors with high environmental awareness were more willing to invest in sustainable investments. Likewise, Fischer et al. (2021) find that German citizens with high environmental awareness showed a higher willingness to participate in RECs. In contrast with the aforementioned studies, Gutsche et al. (2021) find that Japanese citizens with strong environmental values are less likely to invest in sustainable investments, suggesting that environmental values may be less important in financial decision-making in Japan relative to European countries.

Social norms, often measured in the form of peer influence and expectations, also influence willingness to participate and invest in community energy projects and sustainable

investments. Notably, Kalkbrenner & Roosen (2016) find that peer influence had the highest impact on willingness to engage in local energy projects, followed by general trust and environmental concern. Similarly, Koirala et al. (2018) identify community trust as the most important factor in determining willingness to participate in community energy systems. Likewise, social norms were positively related to the willingness to invest in renewable energy communities in France, Germany, and Poland (Guetlein & Schleich, 2023). In line with these studies, Riedl & Smeets (2017) find that social preferences and social signaling (word-of-mouth learning) have a greater influence on sustainable investment decision-making than financial motives (see also Gutsche et al., 2021). Fischer et al. (2021) further examine the effect of social preferences on willingness to participate in RECs, finding a positive relation between negative reciprocity (intention to punish the negative actions of others) and intended investment in RECs.

The relevance of community identity on citizen willingness to participate in community energy projects is also empirically researched. Kalkbrenner & Roosen (2016) find that community identity is positively related to the willingness to participate (i.e., volunteer or invest financial resources) in community energy projects. However, in comparison to social norms, interpersonal trust, and environmental concern, community identity was one of the weaker predictors of participation intentions. Guetlein & Schleich (2023) also consider the influence of place identity on individuals' propensity to invest in renewable energy communities, thereby finding a positive relationship.

Finally, with respect to socio-demographic characteristics, extant literature suggests that women are less likely to invest in community energy systems than men (Fischer et al., 2021; Guetlein & Schleich, 2023). Generally, age is negatively related to the likelihood to invest in renewable energy projects and RECs (Cohen et al., 2021; Fischer et al., 2021; Guetlein & Schleich, 2023). However, Fleiß et al. (2017) find a positive relation between age and willingness to invest in solar energy projects. Regarding income, Fischer et al. (2021) and Kalkbrenner & Roosen (2016) observe a strong association between higher income and willingness to participate in local renewable energy projects. While some studies find educated groups more likely to make community renewable energy investments (see Cohen et al., 2021 and Broughel & Hampl, 2018), Fischer et al. (2021) observed no statistically significant effect of education on REC investment intentions.

Our contribution

With the momentum shifting towards renewable electricity and more options for DER, RECs are increasingly recognized for their potential to fulfill renewable energy generation goals while providing economic and social benefits to local communities and the environment. With Alberta's commitment to achieving a carbon neutral economy by 2050 (Environment and Protected Areas, 2024) and reducing emissions in its electricity sector, RECs may play a key role in the path to decarbonization. As citizen participation is an essential antecedent to the expansion of renewable energy projects, we seek to identify individual prerequisites for citizen participation and investment in renewable energy co-operatives in Alberta. While previous studies have explored the determinants of REC participation and investment intention, none have focused on Alberta. Moreover, we focus on the investment intentions of household financial decision-makers in Alberta.

While the renewable energy co-operative sector is a young but growing sector in Alberta and Canada at large, a major barrier to the growth of the sector is the public's general lack of awareness that these co-operatives exist. In addition to investigating public knowledge and attitudes related to renewable energy and RECs in Alberta, we include educational text about RECs to inform our survey respondents and address some of the existing knowledge gaps within the general population. Furthermore, we use statistical approaches, including a best-worst scaling choice modeling technique, to measure relative public preferences for REC benefits. As a result, the study provides a more detailed outlook on the future of REC development in Alberta.

Study setting

History of co-operatives in Alberta

Dating back to the late 19th century, co-operatives have supported the growth and development of Alberta's economy and society (Banack, 2024), allowing the province to remain competitive in the global economy. Emerging from economic concerns, electricity transmission and agriculture co-operatives in Alberta played an important role in developing rural communities (Goddard, 2002). By the early 20th century, the agricultural sector in western Canada was expanding rapidly and needed organizational bodies to protect producers (Goddard, 2002). In light of this, the United Farmers of Alberta co-operative was established, supplying farmers with essential goods and services and preventing local farmers from being squeezed out

of the market. Collectively, these community initiatives contributed to the success of Alberta's agricultural sector we see today.

In the mid-20th century, electricity co-ops were established to meet the electricity needs of rural residents (MacArthur, 2016). The provincial government at the time did not support investing in public infrastructure and, therefore, did not build the infrastructure necessary to provide electricity to rural areas. This resulted in the community collaborating and forming electricity co-operatives, which were focused on increasing access to electricity for underserved rural communities primarily through the construction of power lines and distribution grids (MacArthur, 2016). Between 1940-1990, 381 out of 549 electricity co-operatives across Canada were in Alberta. Early electricity co-operatives in Alberta were successful due in part to supportive provincial public policy initiatives. In 1947, Alberta implemented a rural electricity program, which led to co-operatives spearheading efforts to connect over 90% of Alberta farms to electricity within a single decade. This is a legacy that continues to underpin the success of present-day co-operatives in the province.

Alberta's electricity market

Alberta's deregulated electricity market presents an opportunity for the private sector and co-operatives to participate in the electricity market (AESO, 2024b). In a deregulated market, multiple companies participate in a competitive market for the generation, transmission, and distribution of electricity (McHugh, 2024). Therefore, consumers have increased autonomy in choosing their energy suppliers based on their preferences, needs, and values. Deregulation in Alberta began in 1996 with the passing of the Electric Utilities Act (Electric Utilities Act, 2003). More competition and less regulation created a market environment for economic players of all sizes, including small community-scale energy companies like co-operatives, to have increased market access. As a result of deregulation, there are roughly 426 qualified generating units connected to the electricity grid – many of which come from renewable energy generation – supporting 4.3 million Albertans (Affordability and Utilities, 2024). These market conditions have resulted in the growth of the renewable electricity sector in Alberta and hold potential for the further development of the sector.

Renewable sector in Alberta

Alberta's renewable sector is primarily composed of hydroelectric power, biomass, wind, and solar energy generation. Between 2018-2023, the installed capacity of renewables has more

than doubled, resulting in renewables accounting for 16.5 percent of Alberta's energy generation in 2023 (AESO, 2024a). Advancements have been driven by growth in wind and solar energy generation in particular.

Early policy environment

This growth in renewable energy can be attributed to Alberta's plentiful wind and solar resources, as well as a favorable policy environment. Renewable energy sector growth in Alberta has occurred throughout two governments, the New Democratic Party (NDP) (2015-2019) and the Conservative Party (2019-present) (Stamp & James-Abra, 2023). The NDP created a favorable and supportive policy climate for renewable energy by implementing the *Renewable Electricity Act* in 2016, which established the goal of achieving 30% of total electricity generation in Alberta to come from renewable electricity sources by 2030 (Renewable Electricity Act, 2016). Similarly, the NDP introduced the Climate Leadership Plan in 2015, which implemented carbon pricing and other programs focused on reducing greenhouse gas emissions (Alberta Climate Change Office, 2018).

With the change in government in 2019, the current United Conservative Party (UCP) government eliminated many of these programs, including the Renewable Electricity Plan (REP) established under the Renewable Electricity Act (Stephenson, 2019). This initiative provided financial support to renewable energy projects by ensuring a guaranteed price for electricity from community-scale projects even if market prices fell below the contracted rate (Stephenson, 2019). This REP is widely acknowledged for driving the industry's early expansion. Despite this strategy no longer being in effect, the renewable energy industry has continued to expand in Alberta.

Current policy environment

In 2018, the NDP government implemented the Small Scale Generation Regulation to provide policy support for small-scale and community energy projects (Alta Reg 194, 2018). Specifically, this regulation targets small-scale generation projects that utilize renewable or alternative energy. Community generation is defined as projects that benefit community groups socially, environmentally, or economically. This regulation aided in the reduction of regulatory and financial barriers for community energy generation projects, such as renewable energy co-operatives. The regulation is currently in effort and supports the growth of community renewable energy within the province.

Despite these supportive policies and regulations, the current policy environment under the conservative government has been significantly less welcoming to the renewable energy sector. For example, the government enforced a seven-month moratorium on renewable energy project approvals between August 2023 and February 2024 (Canadian Renewable Energy Association, 2024). The moratorium affected 13 projects initially, but projects scheduled for completion in 2025 and beyond are at risk of being impacted (Communications and Public Engagement, 2023). Although the long-term impacts of this moratorium are unclear, a report by the Pembina Institute in August 2024 identifies 53 cancelled projects (Noel et al., 2024).

Current renewable energy sector and RECs in Alberta

Despite these policy setbacks, Alberta continues to lead renewable energy generation in Canada (Banack, 2024). As of 2022, Alberta accounted for over 75% of all wind and solar energy projects built across Canada (Environment and Natural Resources, 2023). Notably, the province alone added 2.2 GW of installed renewable energy capacity in 2023 (Canadian Renewable Energy Association, 2024), likely due to the combination of Alberta's deregulated market and its abundance of sunshine and wind. RECs have played a key role in Alberta's energy transition. A 2022 census revealed five active and two inactive RECs within Alberta (Leonhardt et al., 2022). REC leaders note considerable growth within the sector in Alberta.

According to researchers at the University of Saskatchewan, there are two primary ways of classifying RECs (Leonhardt et al., 2022). One uses the traditional method of classifying co-operatives broadly and another specifically for RECs. The categories in the traditional methodology are consumer (retail), producer, worker-owner, multi-stakeholder, and investment. The REC-specific system includes distribution, generation, and consultancy. Within Alberta, noting the legacy of co-operatives that built and owned rural transmission lines starting in the 1940s, retail co-operatives are the primary REC form at the present time, providing members with renewable energy to purchase (Boucher & Pigeon, 2024). Rocky Mountain Community Energy and Foothills Energy Co-op are examples of retail co-operatives (Utilitynet, 2024). These organizations focus on providing competitive energy prices for members and investing profits back into the community.

Survey methods

Data collection

To gauge the knowledge, attitudes, and willingness to invest among Albertans, we surveyed household financial decision-makers in Alberta (n=994). The survey was developed and administered through an online software platform, Qualtrics, and a third-party polling firm, Dynata, which distributed the survey with the approval of the University of Alberta's Research Ethics Board. Data collection occurred between June and July 2024. In line with Fischer et al. (2021), we targeted individuals who were the primary financial decision-makers in their household and who were familiar with investment products. We used two investment screening questions adapted from Fischer et al. (2021) as criteria for our survey completion:

> i) Are you mainly or equally responsible for the financial decisions in your household?
>
> ii) How familiar are you with stocks, equity funds, bonds, bond funds, or other investment products with flexible returns (e.g., options, certificates, open real estate funds, closed-end funds, or mixed funds)?

While Fischer et al. (2021) targeted individuals who were at least 18 years of age, we choose to consider respondents who are at least 20 years of age due to the census data used to establish quotas. This data included the age groups 15-19 and 20-25 in their reporting of the Alberta population. Therefore, we included the older age group due to the increased likelihood that these individuals would be primary financial decision-makers. Quotas were implemented both on Dynata's recruitment side and the technical side of Qualtrics to screen participants on demographic variables. 2021 Canadian census data was used to establish quotas for age, gender, household income, and education (Statistics Canada, 2023). Political affiliation quotas were established using Elections Alberta data from the 2023 provincial election (Elections Alberta, 2023).

Additionally, a quota was placed on rural and urban participants. According to the 2021 census data, about 15% of the Albertan population are from rural areas (Charbonneau et al., 2022), and a large proportion of RECs are located in rural regions of the province. Dynata screened participants for rural demographics based on profile information the participant provided during their recruitment process. Within Qualtrics, our screening criteria utilized postal codes to

determine rural vs urban participants. Therefore, these differences in screening criteria yielded slight differences in how respondents were categorized within the dataset.

Table A1 in Appendix A compares socio-demographic characteristics of our sample to the general population of Albertans in 2021. We find that, on average, our respondents have high levels of education, live in households within the moderate-income brackets "$45,000-$99,999", are older, and live mainly in urban areas. Due to discrepancies in Dynata's recruitment process and our short sampling period, our sample is not representative of the Alberta population on several key variables (Table A1). To correct these differences, we applied weighting factors to our survey data to improve representativeness in the analysis.

Individual-specific variables

The online survey contains questions about environmental risk, environmental identity, place identity, social norms, experiences with participating in an environmental organization, sustainable investment experience, sustainable investment risk, financial literacy, renewable energy, and renewable energy co-operatives. All survey questions are presented in Appendix B. The variables are constructed as follows.

We measure Albertans' willingness to participate and invest in renewable energy co-operatives in two ways. First, we ask respondents to indicate their willingness to invest their time in or volunteer for a REC, buy electricity from a renewable energy co-operative, become a member, and invest money in a REC. Responses are recorded on a five-point scale from "completely unwilling" to "completely willing." The mean of the four items (Cronbach's α = 0.892) represents the variable "willingness to participate." In preparation for binary logistic regression analysis, we transform this ordinal variable into a binary variable where zero is equal to unwilling (completely unwilling and unwilling) and one is equal to willing (somewhat willing, moderately willing, very willing). Similarly, the ordinal variable "willingness to invest," a five-point scale asking respondents to indicate how willing they are, in general, to contribute financially and invest money in a REC, is transformed into a binary variable, taking on the value of zero for unwilling and one for willing. Second, we ask respondents to indicate their likelihood to invest in a renewable energy co-operative based on minimum investment amounts ranging from $100 to $2,000. Following the stochastic payment card approach that uses numeric likelihood values (Ichoku et al. 2009), response options include "Definitely Yes (100% Likely)",

"Probably Yes (51-99% Likely)," "Probably No (1-49%% Likely)," and "Definitely No (0% Likely)."

We measure public attitudes towards renewable energy with three statements assessed on a five-point scale ranging from "strongly disagree" to "strongly agree." We use the average scores for the three items (Cronbach's $\alpha = 0.634$) to develop the variable "attitudes towards renewable energy." Attitudes toward REC are measured using the same five-point scale. We created the variable "attitudes towards renewable energy co-operatives" (Cronbach's $\alpha = 0.719$) using the mean of the three items. Both variables take three values, respectively: one for respondents who, on average, indicated negative attitudes towards renewable energy or RECs, two for respondents who mainly responded neutral, and three for respondents who, on average, indicated positive attitudes.

Environmental values are captured using the four-item myths of nature scale by Steg & Sievers (2000). The scale reflects perceptions towards environmental risk and environmental concern. Each response item, assessed on a five-point scale from "strongly disagree" to "strongly agree," represents a distinct view of nature, natural resources, environmental risk perception, and preference for environmental risk management strategies. The response items include "egalitarian" (nature is a limited equilibrium and resources are expected to be depleting), "hierarchist" (nature is an unstable equilibrium and resources are scarce), "individualist" (nature is in equilibrium and resources are abundant), and "fatalist" (nature is an unmanageable and quantity of resources are unpredictable). Steg & Sievers (2000) find that people subscribing to different myths of nature perceived an environmental problem differently, which in turn had implications for preferences toward policy measures for managing the problem. Thus, we investigate the effect of environmental beliefs and environmental risk perceptions – as expressed in the myths of nature – on willingness to participate and invest in a REC. Accordingly, we constructed the variables "egalitarian," "hierarchist," "individualist," and "fatalist" to represent each myth of nature.

To measure environmental identity, we adapted two statements from Guetlein & Schleich (2023). Response items are recorded on a five-point scale from "strongly disagree" to "strongly agree." We use the mean of the two items (Cronbach's $\alpha = 0.701$) to create the ordinal variable "environmental identity."

We capture place identity – defined as feelings of attachment to respondents' local community – via a three-item place identity scale adapted from Kalkbrenner & Roosen (2016). Response items are assessed using a five-point scale from "strongly disagree" to "strongly agree." We use the average score for the three response items to construct the variable "place identity." Together, the three items form an internally reliable scale (Cronbach's $\alpha = 0.796$).

Following Guetlein & Schleich (2023), social norms are measured with three items. We first ask respondents if any of their family members, friends, or colleagues invest in sustainable financial investments. Next, we ask respondents how much influence their family, friends, and colleagues have on their decision to invest – or not invest – in sustainable investments. Responses are recorded on a five-point scale from "no influence" to "very important influence." Accordingly, we constructed the ordinal variable "peer influence." Finally, we ask respondents what, in general, their family's, friends', or colleagues' views would be of them investing in sustainable investments. Responses are assessed on a scale from "very unfavorable" to "very favorable."

Regarding experiences with making sustainable investments, we adapt three questions from Guetlein & Schleich (2023); we ask respondents if they ever invested in 1) green/sustainable investment assets; 2) a REC; 3) green/sustainable crowdfunding projects. The mean of the items (Cronbach's $\alpha = 0.803$) is used to create the ordinal variable "sustainable investment experience." We capture prior experience with an environmental organization with the variable "prior participation in an environmental organization." Both variables take on the value of one for respondents who reported "no, and I am not planning to," two for "no, but I am planning to," and three for "yes."

Following Gutsche & Ziegler (2019), we measure the perceived risks of sustainable investments by asking respondents to indicate their assessment of the average risk level of sustainable investments compared to conventional investments. Response options range from reporting that the average risk is "much lower for sustainable investments" to "much higher for sustainable investments." On this basis, we construct the variable "perception of sustainable investment risk."

Using the three-item financial literacy quiz designed by Lusardi & Mitchell (2008), we capture financial literacy using the variable "financial literacy." The quiz tests respondents' understanding of interest rates, inflation, and risk diversification. Respondents who answer all

three questions correctly receive a financial literacy score of three, indicating high financial literacy. Those who score two out of three questions correctly receive a score of two (moderate financial literacy). Respondents who answer one question correctly, or none, are assigned a financial literacy score of one (low financial literacy).

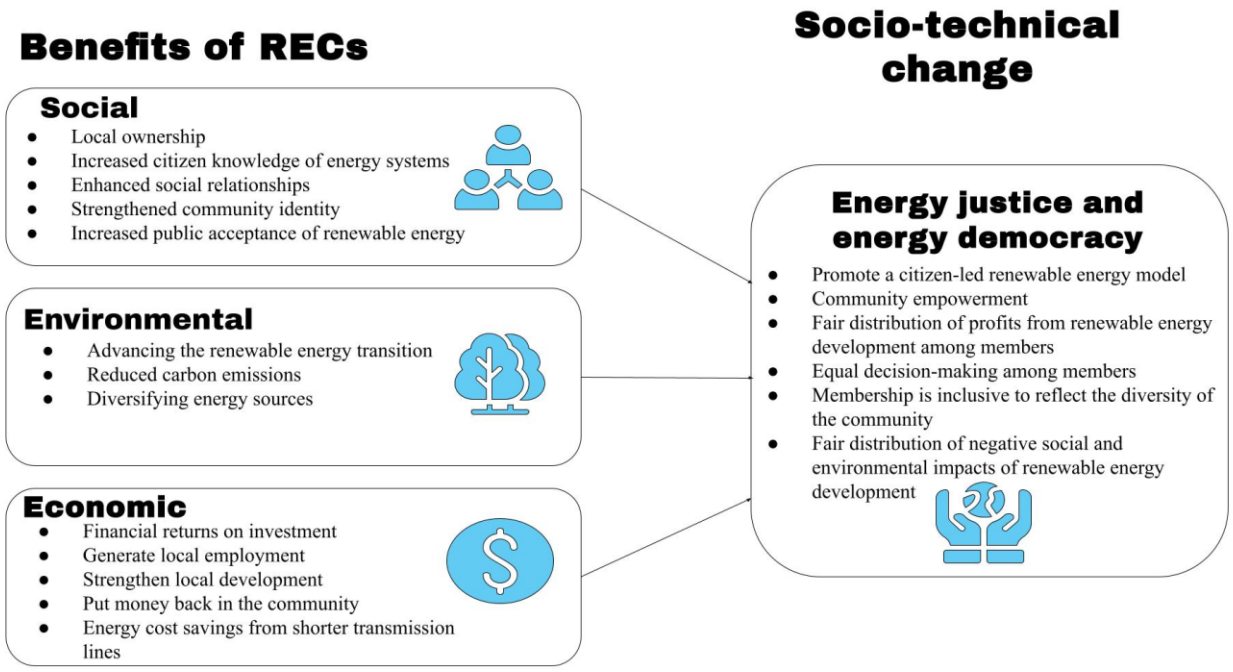
Age, gender, household income, education, and type of community (rural/urban) are selected as demographic indicators. Additionally, we measure individual political affiliation by asking respondents to select the political party that best represents their views. On this basis, we construct the variable "conservation affiliation" to take on two values: one for respondents who select "conservative" and zero for respondents who select "new democratic party/liberal," "green" or "other."

We ask respondents to indicate their familiarity with Alberta's energy market and RECs in Alberta. In both cases, responses are recorded on a five-point scale from "very unfamiliar" to "very familiar," which take the values of one and five, respectively. Beyond self-reported knowledge, we include several knowledge statements that respondents can report as "true," "false," or "don't know." The correct answers take the value of one and the incorrect answers take the value of zero. After each knowledge statement, respondents are asked to rate their confidence in their answers on a five-point scale from "very unconfident" to "very confident." Respondents who select "very unconfident" or "unconfident" are assigned the value of one, two for those who select "neither," and three for respondents who select "very confident" or "moderately unconfident."

Following each section of knowledge statements, we include descriptive paragraphs discussing Alberta's energy market and RECs, respectively. The paragraphs inform respondents about Alberta's electricity system, renewable energy sector, characteristics of RECs, and provide examples of RECs in the province. Additionally, we present a flowchart highlighting the social, environmental, and economic benefits of RECs to local communities and the environment and their potential to promote socio-technical change, as presented in Figure 1.

Figure 1

Social, environmental, and economic benefits of RECs to local communities



Data analysis

In our analysis, we use the best-worst scaling (BWS) survey method to identify the relative preferences of benefit attributes of RECs. BWS, also known as MaxDiff, is a choice modeling technique. In BWS, respondents are presented with a choice set of attributes (e.g., items, concerns, product characteristics, public policy issues) and are asked to identify the best and worst attributes from the choice set (Schuster et al., 2024). To obtain sufficient information about relative preferences, respondents are presented with several choice sets. The BWS choice experiment assumes that respondents make decisions based on several factors, which are considered conjointly; based on this subjective scale of degree of importance, researchers aim to measure the position of attributes relative to other attributes (Adamsen et al., 2013; Schuster et al., 2024). To its advantage, BWS forces respondents to make trade-offs between attributes rather than simply selecting attributes most important to them. Thus, the technique minimizes issues of response bias associated with simple rating scales (Adamsen et al., 2013). The BWS survey method is used in various fields such as public health, linguistics, environmental, transportation, marketing, and medical research.

Based on the literature explored and the theoretical expectations for REC benefits that would promote citizen participation, we identify seven key attributes of RECs to be included in the BWS questions, as shown in Table 1. Using Qualtrics' BWS experimental design to construct the questions, we provide respondents with seven choice sets; each choice set contains four different benefit attributes. Respondents are instructed to select the most and least important attribute they would consider if they were participating in a REC. The position of attributes and order of attributes in each choice set are randomly assigned by the survey platform. In addition, each respondent observes an attribute at least three times, and each attribute appears relatively the same number of times across the choice sets.

Table 1

Studies detailing the benefits of renewable energy co-operatives

Benefit attribute	Source
Energy cost savings	Leonhardt et al. (2022), Hoppe et al. (2019), Schwark (2017)
Return on investment	
Participating in the renewable energy transition	
Strengthened local economic development	
Democratically controlled and owned energy	
Strengthened social connections	Kalkbrenner & Roosen (2016), Bauwens and Defourney (2017)
Community empowerment	Tarhan (2015)

The outcome of Qualtrics' analysis is a rank-order list of the most preferred attributes of RECs. To create this, Qualtrics employs the hierarchical Bayes estimation technique that encompasses two models. The upper-level model predicts the average population's preferences. The lower-level model then observes how different each respondent is from that distribution to estimate the respondents' individual relative utility scores. These two models work synergistically to generate utility coefficients. The utility coefficients represent the relative preference and importance of each attribute for each respondent. To calculate individual preference utilities, Qualtrics runs the Bayesian hierarchical model written in the programming language Stan. Summary metrics include preference shares and average utility scores. The preference share measures the probability an attribute would be chosen over another if a

respondent was instructed to select the most preferred attribute from all options. Average utility scores reflect the relative preference for each attribute.

To assess willingness to invest in a REC, we use the payment card approach. The payment card approach is a method used by researchers to inquire about respondents' willingness to pay for a commodity or service (Wang & Whittington, 2005). This approach is based on the idea that individuals do not have a single fixed value they are willing to pay, but rather a range of values. This method is useful for capturing valuation uncertainty because it allows respondents to express a level of uncertainty in their preferences. Additionally, asking payment card questions can provide insights into respondents' individual valuation distributions, including mean and variance. This can enhance the understanding of individual preferences in comparison to a single dichotomous choice question (Wang & Whittington, 2005).

To determine the preferred minimum REC investment amount, we presented respondents with eight minimum investment values ranging from $100 to $2,000. The middle price point, $1000, is the most common minimum investment price currently used in RECs within Alberta. Setting $1000 as the middle price point ensures both the lower and upper minimum investment ranges are accounted for. Researchers have found respondents tend to prefer lower minimum investment requirements (Guetlein & Schleich, 2023).

Due to time constraints, we did not complete a full analysis of the payment card results. Often researchers will use the numeric likelihood values to estimate individual valuation distributions (Wang & Whittington, 2005). Alternatively, researchers have used multinomial logistic regression to analyze respondents' willingness to pay (Giannitsos, 2023). In our data analysis, we relied on descriptive statistics.

Using SPSS, weighting variables are calculated for age, gender, income, education, type of community (rural and urban), and political affiliation based on census data by Statistics Canada (2023). The variables are applied to the entire dataset to achieve a representative sample. We then analyze descriptive statistics of the variables used in the analysis. Bivariate correlations and binary logistic regressions are used to identify predictors of participating and investing in RECs. Results are presented in the section below.

Results

In this section, descriptive statistics are presented, followed by an analysis of individual determinants for willingness to participate in renewable energy co-operatives (i.e., invest time in

or volunteer, buy electricity, become a member, or invest financial resources). Next, the most and least preferred attributes of RECs are identified. Finally, we test the effects of our predictor variables on willingness to participate and willingness to invest in RECs.

Descriptive statistics

Respondents were asked to indicate their level of familiarity with Alberta's electricity system and renewable energy co-operatives before being promoted with respective knowledge questions. Roughly 21% of respondents self-identified that they were very unfamiliar (1.4%) and unfamiliar (19.7%) with Alberta's electricity system (Figure 2; n= 977). Almost 80% of respondents indicated they are somewhat familiar (44.2%), moderately familiar (27.9%), or very familiar (6.9%) with the system. However, we see inverse results from respondents who self-identified familiarity with renewable energy co-operatives. Roughly 80% of respondents indicated they are very unfamiliar (5.6%), unfamiliar (40.9%), or somewhat familiar (31.6%) with renewable energy co-operatives (Figure 3; n= 975). Only 21.9% of respondents indicated they are moderately familiar (16.9%) or very familiar (5.8%) with the business model.

Figure 2

Familiarly with Alberta's energy system (n = 977)

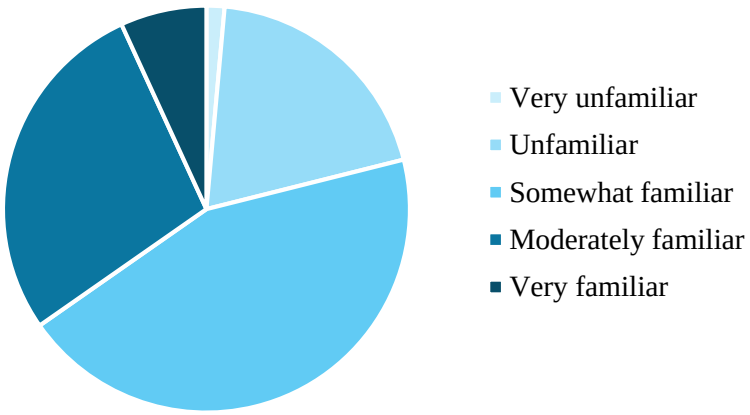
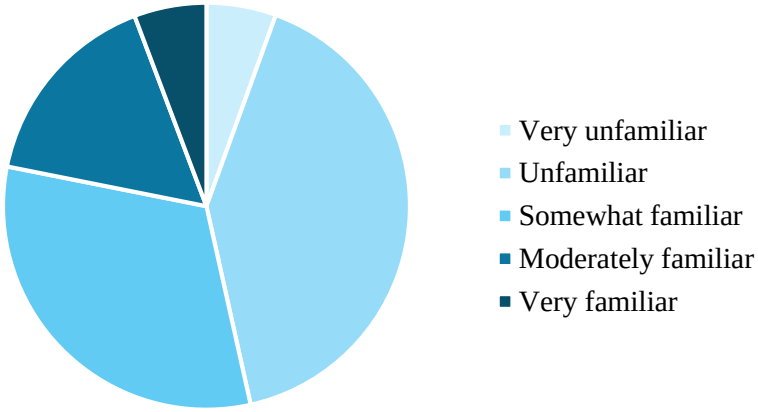


Figure 3

Familiarly with renewable energy co-operatives (n = 975)



Respondents were given a set of knowledge questions about Alberta's energy system and renewable energy co-operatives. Respondents could select "true," "false," or "don't know" and were asked to indicate their confidence level in their answers. In Table 2 the response frequencies, percent of correct responses, and confidence are displayed. Overall, respondents had relatively high confidence in their answers. Respondents were most confident the statement "Alberta has a deregulated energy market" was false. This statement had the highest percentage of correct responses. Respondents were least confident that the statement "Individuals cannot buy electricity from renewable energy co-operatives" was true. The least number of respondents correctly identified this statement, and most respondents selected "Don't know" for this question. Despite most respondents incorrectly identifying the statement "The primary focus of renewable energy co-operatives is energy generation" as false, respondents reported high confidence in their answers. This statement had the lowest percentage of correct responses. From these results, we conclude that Albertans have a good understanding of Alberta's electricity system. However, Albertans have limited knowledge about RECs. Considering the early development stages of RECs in Alberta, these results align with what was anticipated.

Table 2

Knowledge of Alberta's energy system and renewable energy co-operatives

	Frequency			Correct respondents (%)	How confident are you in your answer?		
Statements	True	False	Don't know		Low confidence (%)	Neither unconfident nor confident (%)	High confidence (%)
Alberta has a deregulated energy market.	644	75	256	66.0	9.9	24.2	65.9
The primary focus of renewable energy cooperatives is energy generation.	553	126	294	13.0	10.3	28.3	61.5
Individuals and communities can get financial returns on investments made through renewable energy cooperatives.	585	81	308	60.1	7.2	28.5	64.3
Individuals cannot buy electricity from renewable energy cooperatives.	154	427	395	43.7	8.2	33.2	58.6

The survey asked respondents to state their level of agreement across several statements to gauge their attitudes toward renewable energy and renewable energy co-operatives. The general attitudes gathered from these questions are presented in Table 3. Most respondents reported neutral attitudes towards RE and RECs. However, more respondents indicated positive attitudes compared to negative attitudes. Renewable energy had slightly more positive attitudes than renewable energy co-operatives, likely due to the lack of public awareness of RECs.

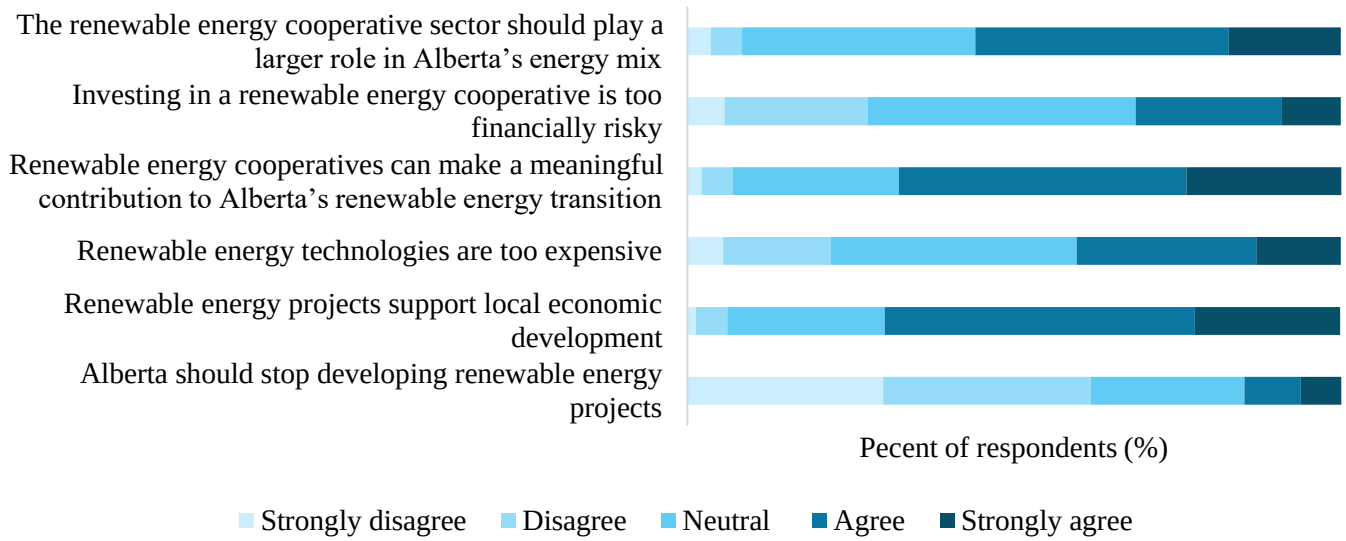
Table 3

Attitudes toward renewable energy and renewable energy co-operatives

Measures	Attitudes (%)		
	Negative	Neutral	Positive
Attitude towards renewable energy	21.2	46.7	32.1
Attitude towards renewable energy cooperatives	16.8	53.3	29.9

Figure 4

Support for statements related to renewable energy and renewable energy co-operatives



The specific results from the series of questions about respondents' attitudes towards renewable energy and renewable energy co-operatives are displayed in Figure 4. A large proportion of respondents, sixty-two percent, disagree that Alberta should stop developing renewable energy projects. Additionally, 71.8% of respondents agree that renewable energy projects support local economic development. Respondents have primarily neutral attitudes toward the financial riskiness of renewable energy co-operatives (39.7%) and renewable energy technologies being too expensive (37.5%). A majority of respondents agree that renewable energy co-operatives can make a meaningful contribution to the renewable energy transition (68.9%) and that RECs should make a larger contribution to Alberta's electricity mix (57%).

We analyze if Albertans are willing to participate in RECS in two ways. First, with respect to RECs, we ask respondents to indicate how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, or contribute financially and invest money. For each participation category, more than half of respondents report they are willing to participate. Among all forms of participation, respondents are more willing to buy electricity from a REC (Mean = 3.41; SD = 1.02; 5-point scale). Willingness to become a member of a REC (Mean = 3.05; SD = 1.13; 5-point scale) is higher than the willingness to invest time in or volunteer (Mean = 2.91; SD = 1.16; 5-point scale) and willingness to contribute financially and

invest money (Mean = 2.85; SD = 1.16; 5-point scale). As Table 4 shows, 85.5% percent of respondents report they are willing to buy electricity from a REC. The share of respondents who reported willingness to become a member or invest time in or volunteer is 69.5% and 64.3%, respectively. Among respondents, 61.7% reported willingness to contribute financially and invest money, while 38.3% are unwilling.

Table 4

Willingness to participate in a renewable energy co-operative

	Unwilling (%)		Total (%)	Willing (%)			Total (%)	Mean	SD
Measures*	Completely unwilling	Unwilling		Somewhat willing	Moderately Willing	Very willing			
Willingness to invest time in or volunteer	12.7	23	35.7	35.1	18.6	10.6	64.3	2.91	1.16
Willingness to buy electricity	4.4	10.1	14.5	42.2	26.6	16.7	85.5	3.41	1.02
Willingness to become a member	9.7	20.7	30.4	36.2	21.5	11.8	69.5	3.05	1.13
Willingness to contribute financially and invest money	14.2	24.1	38.3	33	19.7	9.0	61.7	2.85	1.16

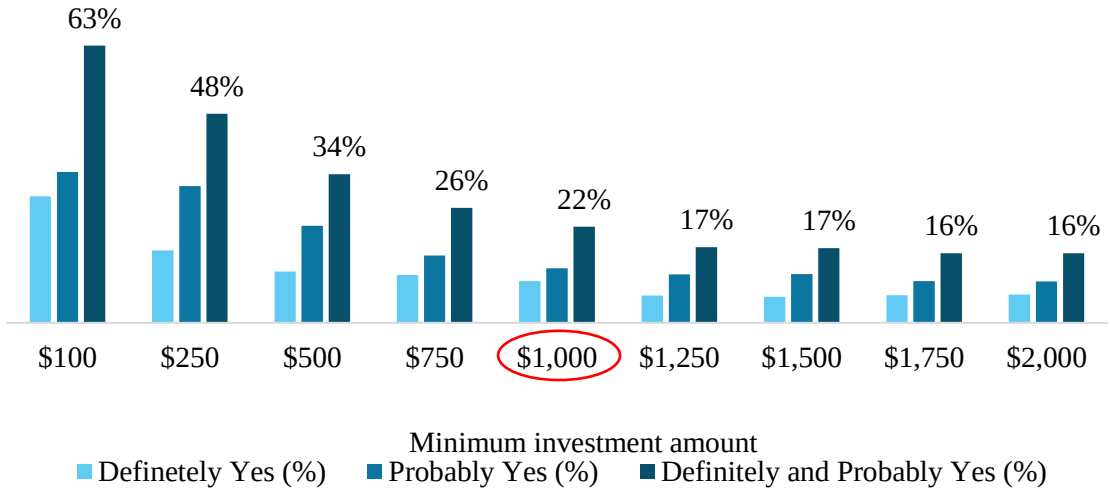
Note: *5-point scale.

The second method used to ask respondents their willingness to participate in RECs was through a payment card question. Respondents were asked to indicate their preferred minimum investment amount based on their likelihood to invest in a REC across a range of nine price options. A minimum investment amount refers to the lowest amount of money an investor can invest in a business, typically this amount is determined by the business. Figure 5 displays the percentage of respondents willing to invest in a REC at the various minimum investment prices in the payment card. These results are based on respondents who indicated they are definitely or probably likely to invest in a REC. Most respondents, sixty-three percent, indicated they would prefer to invest in a renewable energy co-operative with a minimum investment of $100. There is a steady decrease in the likelihood of respondents investing in a renewable energy co-operative as the minimum investment increases from $100 to $1250. A small proportion, twenty-two

percent, of respondents indicated they would be likely to invest a minimum of $1000 into a REC, which aligns with the average minimum investment for most RECs in Alberta. Between the minimum investment of $1250 to $2000, there is a relatively stable number of respondents who indicated they are definitely or probably likely to invest in a REC at the indicated minimum investment amounts. 16-17% of respondents are likely to invest in a REC with a minimum investment price of $1250-$2000. Overall, the results suggest respondents would be more likely to "probably" invest at each price point rather than "definitely" invest. As expected, respondents are most likely to invest in RECs with lower minimum investment amounts (Guetlein & Schleich, 2023).

Figure 5

Willingness to invest in a renewable energy co-operative based on minimum investment amounts



We conducted a correlation analysis to examine the relationships between four forms of participation in renewable energy co-operatives to understand how they interact with one another, as shown in Table 5. The analysis revealed several noteworthy correlations. Generally, we found strong positive correlations between each form of participation (Cronbach's $\alpha = 0.892$). This result justifies combining the four forms of participation into one aggregate variable for further analysis, labelled "willingness to participate."

Table 5

Correlation matrix of willingness to participate variables

Measures	Willingness to participate	Willingness to invest time in or volunteer	Willingness to buy electricity	Willingness to become a member
Willingness to invest time in or volunteer	0.842**	1		
Willingness to buy electricity	0.741**	0.566**	1	
Willingness to become a member	0.830**	0.711**	0.676**	1
Willingness to invest money	0.855**	0.697**	0.620**	0.658**

Note: *We measure willingness to participate with four items. With respect to renewable energy co-operatives, we ask respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. The mean of the four items (Cronbach's $\alpha = 0.892$) form a composite measure of willingness to participate. **$p<0.01$ (2-tailed), Spearman's rho.

Willingness to invest money in a REC showed a strong positive correlation with investing time/volunteer, indicating a significant relationship between these variables. There is a slightly weaker positive correlation between willingness to invest money and buying electricity, and investing time or volunteering. In comparison, becoming a member of a REC has slightly stronger positive correlations with investing money, investing time in or volunteering, and buying electricity.

All four individual forms of participation in the conceptual model are significantly related to willingness to participate. The strength of correlations across all four participation forms with the aggregate form of willingness to participate does not vary greatly. However, willingness to invest money in a REC is most strongly and positively correlated to the aggregate form, and buying electricity has the weakest correlation.

Table 6 shows correlations between willingness to participate, willingness to invest, and the four myths of nature variables. All myths of nature are significantly related to both willingness to participate and willingness to invest. We find a positive moderate to strong association between willingness to participate and the egalitarian myth of nature, likewise for willingness to invest and the egalitarian myth of nature. There is a weaker correlation between willingness to participate and the hierarchist, individualist, and fatalist myth of nature. Relative to their associations with willingness to participate, the correlations between willingness to

invest and the individualist and fatalist myth of nature variables are slightly stronger, respectively. For both willingness to participate and willingness to invest, the correlation with the hierarchist myth of nature is negative. Overall, the majority of respondents strongly agree or agree with the individualist myth of nature (61.5%), followed by the egalitarian myth of nature (52.3%), and the fatalist myth of nature (42.9%) (see Table A2 in Appendix A). The hierarchist myth of nature received the least support from respondents (25.8%).

Table 6

Myths of nature correlation matrix

Measures	Willingness to participate	Egalitarian	Hierarchist	Individualist	Fatalist
Egalitarian	0.530**	1			
Hierarchist	-0.268**	-0.368**	1		
Individualist	0.194**	0.246**	-0.021	1	
Fatalist	0.137**	0.235**	-0.017	-0.527**	1
Willingness to invest money	0.855**	0.457**	-0.224**	0.212**	0.149**

Note: *We measure willingness to participate with four items. With respect to renewable energy co-operatives, we ask respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. The mean of the four items (Cronbach's $\alpha = 0.892$) form a composite measure of willingness to participate. ***p*<0.01 (2-tailed), Spearman's rho.

Correlations between predictor variables, willingness to participate, and willingness to invest are shown in Table 7, Table 8, and Table 9. As Table 7 shows, we find a significant relationship between willingness to participate in a REC and environmental identity, place identity, peer influence, and financial literacy. Expectantly, these variables are also significantly related to willingness to invest in an REC. Except for financial literacy, all variables are positively related to both willingness to participate and willingness to invest. Regarding the strengths of the associations, the variables have a slightly weaker correlation to willingness to invest relative to willingness to participate. Environmental identity has the strongest correlation with both willingness to participate and willingness to invest, followed by peer influence, place identity, and financial literacy. The relationship between financial literacy and both willingness to participate and willingness to invest is very weak.

As presented in Table 8, prior participation in an environmental organization and sustainable investment experience are significantly positively related to both willingness to

participate and willingness to invest. Comparing the correlations between the variables and willingness to participate, we find slightly weaker associations with willingness to invest. We find a moderate significant negative relationship between the perception of sustainable investment risk and both willingness to participate and willingness to invest. Sustainable investment experience is strongly related to willingness to participate while moderately related to willingness to invest. As presented in Table A3 in the Appendix, we find a similar share of respondents who perceive sustainable investments as being riskier than conventional investments (28.1%) and respondents who perceive lower risk in sustainable investments compared to conventional investments (25%), while a significant portion report neither higher nor lower risk for sustainable investments (47%).

Finally, considering our sample characteristics, we find a significant negative correlation between age and both willingness to participate and willingness to invest, as shown in Table 9. Conservative affiliation is also negatively associated with the willingness to participate and invest. We also find a weak positive association between living in an urban area and willingness to participate; we find no effect of living in an urban area on willingness to invest. The remaining variables are not significant. Compared to age, there is a slightly weaker correlation between conservative affiliation and both willingness to participate and willingness to invest. Relative to willingness to participate, age and conservative affiliation have a slightly weaker relationship with willingness to invest.

Table 7

Correlation matrix of environmental identity, place identity, peer influence, and financial literacy

Measures	Willingness to participate	Environmental identity	Place identity	Peer influence	Financial literacy
Environmental identity	0.510**	1			
Place identity	0.202**	0.256**	1		
Peer influence	0.397**	0.233**	0.235**	1	
Financial literacy	-0.092**	-0.300	0.640*	-0.276**	1
Willingness to invest money	0.855**	0.428**	0.178**	0.360**	-0.086**

Note: *We measure willingness to participate with four items. With respect to renewable energy co-operatives, we ask respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. The mean of the four items (Cronbach's $\alpha = 0.892$) form a composite measure of willingness to participate. ***p*<0.01 (2-tailed), Spearman's rho.

Table 8

Correlation matrix of experience in participating in an environmental organization, sustainable investment experience, and perception of sustainable investment risk

Measures	Willingness to participate	Prior participation in an environmental organization	Sustainable investment experience	Perception of sustainable investment risk
Prior participation in an environmental organization	0.454**	1		
Sustainable investment experience	0.552**	0.521**	1	
Perception of sustainable investment risk	-0.380**	-0.346**	-0.352**	1
Willingness to invest money	0.855**	0.391**	0.488**	-0.365**

Note: *We measure willingness to participate with four items. With respect to renewable energy co-operatives, we ask respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. The mean of the four items (Cronbach's $\alpha = 0.892$) form a composite measure of willingness to participate. **$p<0.01$ (2-tailed), Spearman's rho.

Table 9

Sampe characteristics correlation matrix

Measures	Willingness to participate	Age	Gender	Education	Income	Conservative affiliation	Type of community
Age	-0.304**	1					
Gender							
Female (vs. Male)	0.025	-0.177**	1				
Education	0.043	0.41	-0.061*	1			
Income	-0.044	0.45	-0.04	0.324**	1		
Conservative affiliation							
vs. New Democratic Party/Liberal, Green, Other	-0.272**	0.100**	-0.135**	-0.015**	0.121**	1	
Type of community							
Urban (vs. Rural)	0.061*	0.03	0.018	0.02	-0.035	-0.157**	1
Willingness to invest money	0.855**	-0.299**	0.038	0.053	0.045	-0.217**	0.006

Note: *We measure willingness to participate with four items. With respect to renewable energy co-operatives, we ask respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. The mean of the four items (Cronbach's $\alpha = 0.892$) form a composite measure of willingness to participate. **$p<0.01$ (2-tailed), Spearman's rho.

Best/worst scaling analysis

We analyze the most and least preferred attribute of RECs using the best/worst scaling choice modeling technique. The preference share measures the probability an attribute would be chosen over another if a respondent was instructed to select the most preferred attribute from all options. According to Figure 4, the largest share of respondents would select energy cost saving as their most preferred attribute of REC (47%), followed by return on investment (22%), participating in the renewable energy transition (10%), strengthened local economic development (7%), and democratically controlled and owned energy (6%). Community empowerment and strengthened social connections tie for the least preferred attribute; only 4% of respondents would select community empowerment and strengthened social connections as their most preferred REC attribute.

Figure 6

Preference shares of REC attributes

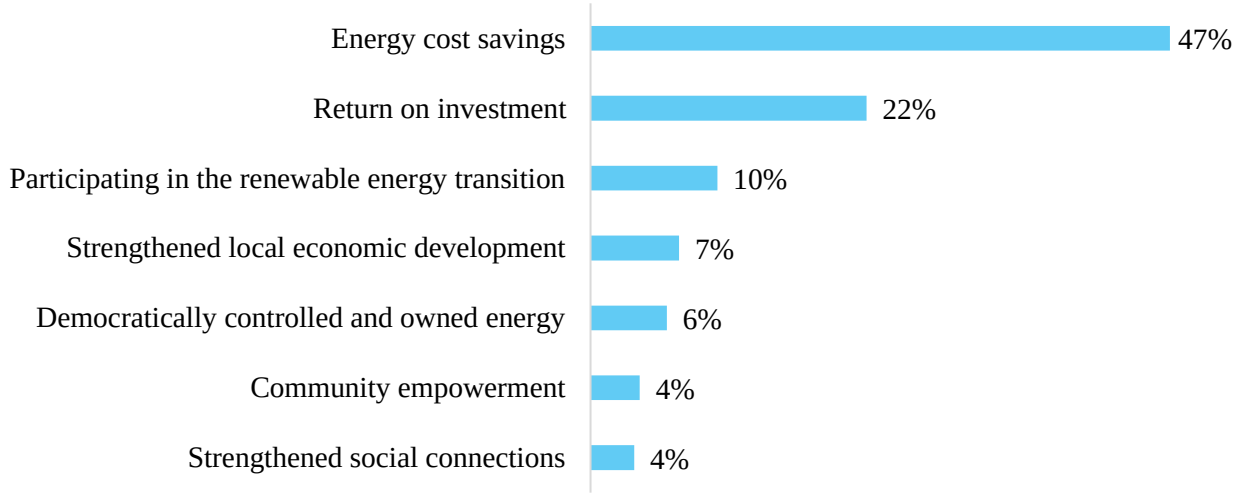
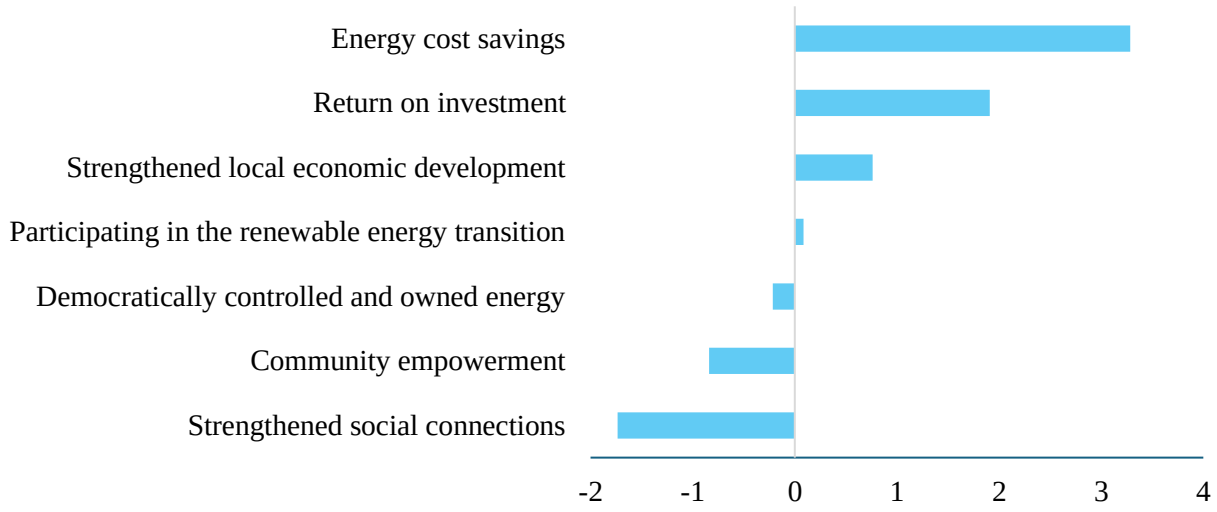


Figure 7

Average utility scores of REC attributes



The average utility scores derived from the best-worst scaling question are displayed in Figure 7. These scores indicate respondents' relative preference for each attribute. Respondents indicated that “Energy cost savings” is the most important attribute of a REC and “Strengthened social connections” is the least important attribute relative to the others. Attributes with positive utility scores (energy cost savings, return on investment, strengthened local economic development, and participating in the renewable energy transition) have relatively greater preference or importance compared to those with negative utility scores (democratically controlled and owned energy, community empowerment, strengthened social connections). Utility scores for most attributes fall within a narrow range (-2 - +2), indicating attributes are being evaluated with relatively similar levels of preference or importance. These results indicate that respondents do not strongly differentiate between the attributes. However, the energy cost savings attribute has an average utility score outside this range (3.1), indicating significantly more preference for this attribute.

Binary logistic regression analysis

We performed two binary logistic regression analyses to further investigate predictors of REC participation and investment intention. For the first regression, we examine the factors associated with "willingness to participate." The variable is a composite measure of willingness to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. We transform this ordinal variable into a binary variable where zero is equal to unwilling (completely unwilling and unwilling) and one is equal to willing (somewhat willing, moderately willing, very willing). Similarly, for the second regression, we transform the ordinal variable "willingness to invest," a five-point scale asking respondents to indicate how willing they are, in general, to contribute financially and invest money in a renewable energy cooperative, into a binary variable that takes the value of zero for unwilling and one for willing. Table 10 and Table 11 summarize the descriptive statistics of variables used in each model. We tested all independent variables for collinearity; none of the variables had a variance inflation factor greater than 3.

Table 10

Descriptive statistics of variables used in binary regression models

Measures	Mean	SD	Response options
Environmental identity**	3.24	0.98	5-point scale from strongly disagree (1) to strongly agree (5)
Place identity**	3.27	0.92	5-point scale from strongly disagree (1) to strongly agree (5)
Peer influence**	2.48	1.23	5-point scale from no influence (1) to very important influence (5)
Prior participation in an environmental organization*	1.57	0.73	No, and I am not planning to; No, but I am planning to; Yes
Perceived risk of sustainable investments*	3.03	1.02	5-point scale from the average risk is much lower for sustainable investments (1) to the average risk is much higher for sustainable investments (5)
Financial literacy*	1.16	0.84	3-point from low (0) to high (2)
Attitudes towards renewable energy**	3.12	0.84	5-point scale from strongly disagree (1) to strongly agree (5)
Attitudes towards renewable energy cooperatives**	3.13	0.79	5-point scale from strongly disagree (1) to strongly agree (5)

Table 11

Descriptive statistics of sample characteristics

Variables	N	Mean	SD
Age	977	3.56	1.746
1 = 20-29; 2 = 30-39; 3 = 40-49; 4 = 50-59; 5 = 60-69; 6 = 70-79; 7 = 80 and over			
Gender	973	1.51	0.5
Male = 1; Female = 2			
Education	977	2.8	0.935
1 = No high school diploma or equivalency certificate; 2 = High (secondary) school diploma or equivalency certificate; 3 = Postsecondary certificate, diploma or degree; 4 = Bachelor's degree of higher			
Income	977	7.97	2.773
1 = Under 5,000; 2 = 5,000 to 14,999; 3 = 15,000 to 24,999; 4 = 25,000 to 34,999; 5 = 35,000 to 44,999; 6 = 45,000 to 59,999 7 = 60,000 to 79,999; 8 = 80,000 to 99,999; 9 = 100,000 to 124,999; 10 = 125,000 to 149,999; 11 = 150,00 to 199,999; 12 = 200,000 and over			
Conservative affiliation	977	0.51	0.5
Conservative = 1; New Democratic Party/Liberal, Green, Other = 0			
Type of community			
Urban	848		
Rural	128		

According to the Nagelkerke R-square reported in Table 12, the model predicts 54% of the variance in the willingness to participate in a REC. The analysis shows that environmental identity (Exp(B) = 1.746, $p < 0.001$), peer influence (Exp(B) = 1.201, $p < 0.05$), planning to participate in an environmental organization (Exp(B) = 3.736, $p < 0.001$), positive attitudes towards renewable energy (Exp(B) = 1.501, $p < 0.05$), positive attitudes towards RECs (Exp(B) = 3.071), and education (Exp(B) = 1.244, $p < 0.05$) significantly increased the willingness of a respondent to participate in a REC. Higher age is found to decrease willingness to participate (Exp(B) = 0.651, $p < 0.001$). The statistics noted as Exp(B) represents an odds ratio, such that for

every unit increase in environmental identify (as measured in this survey) corresponds with a 74.6% increase in willingness to participate (Exp(B) = 1.746).

For every unit increase in the scale measuring the perceived risk of sustainable investment compared to conventional investments, respondents were 23% less willing to participate (Exp(B) = 0.771, $p < 0.05$). Similarly, conservative affiliation is a negative predictor of willingness to participate; having a conservative affiliation is associated with a 40% decrease in the odds of willingness to participate (Exp(B) = 0.591, $p < 0.05$).

Table 12

Binary logistic regression predicting willingness to participate in a renewable energy co-operative in Alberta

Predictor variables	B	Sig.	Exp(B)
Environmental identity*	0.557	<0.001	1.746
Place identity	0.206	0.058	1.229
Peer influence	0.183	0.046	1.201
Prior participation in an environmental organization			
No, but I am planning to (vs. No, and I am not planning to)*	1.318	<0.001	3.736
Yes (vs. No, and I am not planning to)	0.539	0.062	1.714
Perceived risk of sustainable investments**	-0.259	0.014	0.771
Financial literacy	-0.082	0.520	0.921
Attitudes towards renewable energy**	0.406	0.007	1.501
Attitudes towards renewable energy cooperatives*	1.122	<0.001	3.071
Characteristics of respondents			
Age*	-0.430	<0.001	0.651
Gender	-0.303	0.107	0.739
Female (vs. Male)			
Education**	0.218	0.045	1.244
Income	0.036	0.313	1.037
Conservative affiliation**	-0.526	0.006	0.591
Conservative (vs. New Democratic Party/Liberal, Green, Other)			
Type of community	0.470	0.066	1.600
Urban (vs. Rural)			
Constant	-6.101	<0.001	0.002
N = 979			
Nagelkerke R2 = 0.544			

Note: Dependent variable: composite measure of willingness to participate (invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money). *p<0.01; **p<0.05

Overall, planning to participate in an environmental organization was the strongest positive significant variable in the model. Respondents who did not have prior experience participating in an environmental organization – but were planning to – were 3.74 times more willing to participate in a REC compared to respondents who did not have prior experience participating in an environmental organization and were not planning to. Age was the strongest negative predictor, where a unit increase in age decreases the odds of willingness to participate by 35%. We find no effect of place identity, prior participation in an environmental organization, financial literacy, income, being female, and living in an urban community in this model.

Whereas the dependent variable in Table 12 was a composite measure of willingness to participate, the second regression focuses on which factors influence the willingness to invest in a REC. As presented in Table 13, the Nagelkerke R-square value indicates that the model predicts 45% of the total variance in the willingness to invest. Environmental identity (Exp(B) = 1.645, $p < 0.001$), planning to participate in an environmental organization (Exp(B) = 2.075, $p < 0.005$), positive attitudes towards renewable energy (Exp(B) = 1.446, $p < 0.05$), positive attitudes towards RECs (Exp(B) = 2.753, $p < 0.001$), and income (Exp(B) = 1.101, $p < 0.005$) are significantly and positively related to willingness to invest. With increasing age, respondents are 27% less willing to invest in a REC (Exp(B) = 0.733, $p < 0.001$). The strongest positive significant variable is positive attitudes towards RECs; for every unit increase in the scale measuring support for RECs, respondents were 2.75 times more willing to invest. The remaining variables had no effect on willingness to invest.

Table 13

Binary logistic regression predicting willingness to invest in a renewable energy co-operative in Alberta

Predictor variables	B	Sig.	Exp(B)
Environmental identity*	0.498	<0.001	1.645
Place identity	0.142	0.165	1.153
Peer influence	0.115	0.187	1.122
Prior participation in an environmental organization			
No, but I am planning to (vs. No, and I am not planning to)**	0.73	0.001	2.075
Yes (vs. No, and I am not planning to)	0.455	0.099	1.577
Perceived risk of sustainable investments**	-0.215	0.03	0.807
Financial literacy	-0.061	0.611	0.941
Attitudes towards renewable energy**	0.369	0.008	1.446
Attitudes towards renewable energy cooperatives*	1.013	<0.001	2.753
Characteristics of respondents			
Age*	-0.311	<0.001	0.733
Gender	-0.061	0.728	0.94
Female (vs. Male)			
Education	0.155	0.125	1.168
Income**	0.096	0.004	1.101
Conservative affiliation	-0.226	0.211	0.797
Conservative (vs. New Democratic Party/Liberal, Green, Other)			
Type of community	-0.115	0.646	0.891
Urban (vs. Rural)			
Constant	-5.46	<0.001	0.004
N = 977			
Nagelkerke R2 = 0.446			

Note: Dependent variable: willingness to contribute financially and invest money in a renewable energy cooperative. *p<0.01; **p<0.05.

Environmental identity, planning to participate in an environmental organization, perceived risk of sustainable investments, positive attitudes towards renewable energy, positive attitudes towards RECs, and age are significantly associated with both willingness to participate and willingness to invest. The strongest positive variable influencing willingness to participate is planning to participate in an environmental organization. Positive attitudes towards RECs are the strongest positive variable affecting willingness to invest. Conservative affiliation, peer influence, and education were significantly associated with willingness to participate, but not with willingness to invest. On the other hand, higher income was found to increase willingness to

invest but had no significant effect on willingness to participate. In both regressions, age was the strongest significant negative variable.

Discussion

Knowledge and familiarity of renewable energy and renewable energy co-operatives

Our results indicate respondents are well informed about Alberta's energy system. Alberta's deregulated energy market provides residents more control and choice over electricity suppliers, likely contributing to higher familiarity with the system (McHugh, 2024). This system allows residents to select suppliers that match their preferences and values, indicating individuals are likely aware of the values they prioritize in a supplier. However, respondents had low levels of familiarity and knowledge about RECs. This is expected because there are currently few RECs in Alberta, and the sector has not yet gained a significant presence in the province. Increasing public awareness of RECs through public engagement can address this information gap. Moreover, if energy consumers were more aware of retailer co-operatives, they would have more opportunities to select an electricity retailer that is better aligned with their values.

Participation potential

With respect to RECs, we asked respondents how willing they are, in general, to invest time in or volunteer, buy electricity, become a member, and contribute financially and invest money. Among all forms of participation, respondents are more willing to buy electricity from a REC, significantly exceeding the likelihood of becoming a member, investing time or volunteering, and investing money. Buying electricity may attract more participants because it is the most passive form of engaging with RECs. In contrast, membership requires more direct engagement, such as voting on decisions related to project development. Accordingly, respondents may opt for a less committed participation option, like switching their electricity retailer. This echoes findings from Fiander et al. (2024), who observe that Canadians prefer more passive actions in participating in local energy systems. However, over half of respondents expressed interest in all forms of participating in a REC; the willingness to volunteer, become a member, and invest money are considerably high despite low levels of familiarity with RECs. In comparison, Kalkbrenner & Roosen (2016) find much lower willingness to invest and volunteer in local renewable energy projects.

Furthermore, we find positive strong correlations among all four forms of participation, indicating Albertans who are interested in one form of participation may be interested in other

forms of participation. Thus, REC leaders should emphasize different opportunities for engaging to encourage further participation. Investing money in a REC had the strongest correlation with investing time or volunteering. This result suggests that investment co-operatives can promote further engagement by providing their investors with opportunities to participate in other ways, such as volunteering or becoming a member. These results contrast with Wu et al. (2022), who found European citizens significantly valued financial returns above open participation in RECs.

Moreover, we find considerable willingness to invest in RECs. Our findings stand in sharp contrast to Fischer et al. (2021), who observe limited participation intentions in RECs compared to participation intentions in community renewable energy identified in former studies. In our study, we find the willingness to invest in RECs comparable to, and even exceeding, investment intentions in local renewable energy projects identified by Broughel & Hampl (2018) and Salm et al. (2016). Hence, in line with these former studies, our finding indicates substantial REC participation and investment potential in Alberta.

Preferred minimum investment amount

The preferred minimum investment amount respondents would be willing to invest in a REC is $100, the lowest price point presented to respondents. This is expected as other studies have shown citizens tend to prefer lower minimum investment requirements when investing in RECs (Guetlein & Schleich, 2023; Wu et al., 2022). Therefore, our results suggest a $100 minimum investment would attract the most amount of investors in an REC. This aligns with Cohen et al. (2021), whose results indicated co-operative investment levels below €500 would generate high participation in Europe.

Unexpectedly, approximately 20% of respondents are willing to invest $1000, the most common minimum investment amount among RECs in the province. This is a substantial percentage of respondents and suggests higher minimum amounts do not significantly decrease investment in RECs, in line with Cohen et al. (2021). This information can help RECs in Alberta refine their investment strategies. For example, they could consider setting lower minimum investment amounts to boost participation or raising investment amounts to secure more substantial funding. By aligning investment thresholds with their strategic goals, RECs can better optimize their opportunities and resources.

Determinants of willingness to participate and invest in RECs

In line with earlier research, environmental identity (Fischer et al., 2021), place identity (Guetlein & Schleich, 2023), peer influence (Kalkbrenner & Roosen, 2016), prior participation in an environmental organization (Masson et al., 2015), and sustainable investment experience (Gutsche et al., 2021) are positively correlated with the willingness to participate (i.e., willingness to invest time in or volunteer, buy electricity, become a member, or invest financial resources) and the willingness to invest in a REC. The regression analysis highlights the importance of environmental identity, peer influence, planning to participate in an environmental organization, perceived risk of sustainable investments, attitudes towards renewable energy, attitudes towards RECs, education, and conservative affiliation in determining participation in RECs. However, we find no effect of place identity or financial literacy on the willingness to participate.

Concerning the willingness to invest in RECs, we find similar results; however, we find no effect of peer influence, conservative affiliation, or education on the willingness to invest. Interestingly, higher income was a positive predictor of willingness to invest but had no effect on willingness to participate. This result is intuitively convincing; the willingness to participate variables capture non-financial forms of engaging with RECs, which reduces the effect of income on willingness to participate. Furthermore, individuals with greater financial resources may have more opportunities to invest. Older respondents are associated with lower participation and investment intention, which is consistent with earlier research (Cohen et al., 2021).

Financial literacy

Highly financially literate respondents were less willing to participate or invest in a REC. In comparison, Fischer et al. (2021) report a positive relationship between financial literacy and investing in RECs in Germany. However, Gutsche et al. (2021) find that Japanese individual investors with high financial literacy were uncertain about holding sustainable investments in the future. In line with this study, our study suggests that financial decision-makers in Albertan may require more targeted information about financial returns on investments made through RECs to help them make decisions about future sustainable investments. Another explanation for our results is that, relative to Germany, the REC sector in Alberta is still in the early stages of development. Therefore, there may be greater prior awareness of sustainable investments and the financial performance of sustainable investments among investors in Germany, which may

support the positive relationship between financial literacy and investing in RECs. Notably, in the regression analysis, we find no effect of financial literacy on willingness to participate or invest, indicating there are more important predictors of participation and investment.

Perception of sustainable investment risk

We find that individuals who perceive higher risk in sustainable investments compared to conventional investments were less willing to participate or invest in a REC. This result is unsurprising since respondents who believe sustainable investments are associated with risky assets will be more skeptical toward investing in a REC. Our finding is consistent with Gutsche et al. (2019), who find a significant negative correlation between the perception of higher SRI risk and the share of SRIs among all investments. Interestingly, in contrast to previous empirical studies that find perceived risk associated with sustainable investments generally higher than the average risk level, we find a similar share of respondents who perceive higher sustainable investment risk and respondents who perceive lower sustainable investment risk. Furthermore, almost half of respondents are undecided about the risk of sustainable investments. To address this uncertainty, campaign efforts to attract REC investors and investments in sustainable energy projects should emphasize the financial performance of sustainable investments.

Type of community

While representing one of the weakest correlations in our study, living in an urban community increased the willingness of participation and investment. This contrasts with Germany, where living in a rural community increases the likelihood of participation in local renewable energy initiatives (Kalkbrenner & Roosen, 2016). Our result is unexpected because most renewable energy projects are located in rural regions. However, in the regression analysis, the type of community does not appear to predict participation or investment in RECs.

Peer influence and place identity

Our findings confirm the influence of perceived expectations of peers on the willingness to participate and invest in RECs, as identified by earlier research on social norms (Guetlein & Schleich, 2023; Kalkbrenner & Roosen, 2016). As expected, respondents whose social environment expects them to engage in sustainable behaviours are more willing to participate. Further, the result emphasizes the importance of non-financial utility gained from sustainable behaviours. In the regression model, peer influence does not appear to predict the willingness to

invest in a REC. This indicates that the influence of peer expectations is relevant to sustainable behaviours but not sustainable investment decision-making.

Relatedly, we find positive correlations between place identity and both willingness to participate and invest in RECs. Because RECs are rooted within a local community and may reflect local uniqueness and specificity, an individual with strong place attachment may feel more compelled to engage. Our finding is consistent with Cohen et al. (2021) who observe that years spent living in an area increased the likelihood of investing in an REC. However, the regression analysis indicates no effect of place identity on willingness to participate nor invest in RECs, indicating there are more important predictors at play.

Environmental identity and myths of nature

Environmental identity and planning to participate in an environmental organization strongly impacted willingness to participate and invest. This confirms findings from earlier studies that identify environmental values, environmental identity, and environmental awareness as important predictors of participating or investing in RECs and local renewable energy projects (Fischer et al., 2021; Gutsche & Ziegler, 2019; Koirala et al., 2018). Our findings indicate that individuals with a pro-environmental orientation consider participating and investing in RECs as a suitable direction for sustainable behaviour. Furthermore, it emphasizes the importance of non-financial motivations for citizen investment in community renewable energy projects, in line with Wu et al. (2022). Therefore, methods to mobilize citizen participation in RECs should include highlighting the environmental benefits of RECs and REC investments.

The importance of environmental considerations in motivating participation and investment in RECs is further emphasized by our finding that, among the four myths of nature, the egalitarian position has the strongest association with willingness to participate and invest in a REC. The egalitarian's myth of nature, nature ephemeral, believes in the statement "Environmental problems can only be controlled by enforcing radical changes in human behaviour and in society as a whole." As Steg & Sievers (2000) note, the egalitarian is highly concerned with environmental issues and believe they have a responsibility to contribute solutions to environmental problems. With a large share of respondents expressing affinity with the egalitarian myth of nature, this result connects nicely to our finding that environmental values influence sustainable investment decision-making. This further suggests that efforts to increase citizen participation and investment in RECs should emphasize opportunities for

citizens to actively participate in the renewable energy transition and thereby reduce emissions and energy consumption.

Attitudes

In addition to environmental identity, positive attitudes towards renewable energy and RECs are a significant predictor of willingness to participate and invest in a REC. This result is expected, given that prior research established an association between attitudes and beliefs related to renewable energy and sustainable investments (Musall & Kuik, 2011). In our study, most respondents expressed neutral attitudes towards renewable energy. These neutral attitudes may be attributed in part to uncertainties around renewable energy technologies in the context of Alberta's oil and gas industry. However, these attitudes differ from previous opinion polls on renewable energy in Alberta, which have been overwhelmingly positive. In comparison, Abacus (2019) finds most Albertans support government investment in new green infrastructure, such as renewable energy. Similarly, Calgary Climate Hub (2023) find most Albertans opposed the moratorium on renewable energy projects initiated in 2023. Additionally, DeCillia (2020) notes that 79% of Albertans think the province should transition towards renewable energy. Our results may differ from these opinion polls because these polls capture the general Alberta population, whereas our survey focuses on financial decision-makers.

Similarly, a considerable share of respondents reported neutral attitudes towards RECs. This can be potentially explained by the relatively low level of familiarity with RECs in Alberta. In comparison, Patel et al. (2020), find that a large share of rural farmers in Alberta believe co-operatives are efficient business models for renewable energy and expressed interest in becoming a member. However, rural farmers may express more positive attitudes towards the co-operative model due to Alberta's long history with agricultural co-operatives.

Our results suggest there is a need for greater support and acceptance of renewable energy in Alberta, which are essential prerequisites for managing the ongoing renewable energy transition (Kalkbrenner & Roosen, 2016) and mobilizing citizen participation in RECs. Moreover, among all predictors, positive attitudes towards REC have the strongest impact on willingness to invest. In our study, respondents appear undecided about renewable energy and RECs. Therefore, a shift in public opinion and attitude is possible, indicating potential for increased investment in RECs.

Conservation political identification

Respondents with a conservative political identification are less willing to participate or invest in RECs than respondents with a left-wing political orientation, i.e. an affinity with the New Democratic Party (NDP), the Green Party, or Liberal. Since political conservatism is intimately linked with the promotion of fossil fuel use in Alberta, conservatives may be more critical of the expansion of renewable energy transition and are, therefore, less likely to participate in RECs. Our findings are consistent with prior research that identify the relationship between political orientation and support for the energy transition (Groh & Möllendorff, 2020).

Interestingly, the regression analysis shows that conservative affiliation is a predictor of willingness to participate, but not a significant predictor of willingness to invest. The first result echoes observations from Fischer et al. (2021), who observe that conservatives in Germany were less likely to indicate a high willingness to participate in RECs. The story changes when considering willingness to invest. Conservative affiliation may be a significant negative predictor of willingness to participate – but not willingness to invest – because the willingness to participate variables involve more direct forms of engaging with RECs, and conservatives generally do not place emphasis on citizen participation in the renewable energy transition. Furthermore, political orientation may lose its influence on willingness to invest because financial motivations (e.g., cost savings and investment returns) may be more important to conservatives than non-financial motivations. Because political orientation is not a predictor of investing, this finding indicates positive implications for investments in RECs in the province.

Most preferred attributes

The relevance of financial motivation is further emphasized in our BWS results. We find that Albertans generally prefer REC attributes related to economic and environmental benefits. The three most preferred attributes are energy cost savings, return on investment, and participating in the renewable energy transition. Social benefits (e.g., democratically controlled and owned energy, community empowerment, strengthened social connections) are considerably less preferred.

Our results aligned with Fiander et al. (2024), who found that personal financial gain was the strongest motivator for participating in community renewable energy projects among residents of Canada's Prairie provinces (Alberta, Saskatchewan, and Manitoba). Non-financial benefits of participating, like enhanced community capacity, were deemed less important. This

suggests that financial incentives are a stronger motivator for Prairie residents compared to social benefits. Similarly, Patel et al. (2020), identify perceptions of economic benefits as the strongest predictor for supporting further development of wind energy in Alberta and Canada. Economic benefits were a stronger predictor than environmental benefits. In comparison, Klingeren & De Moor (2024), identify ecological motives as the most significant predictor of participating in a REC in Belgium, followed by financial motives and social benefits. These differences may suggest that Albertan financial decision-makers consider environmental values less important in participating in local energy systems compared to renewable energy investors in Europe.

Overall, our findings on REC attributes highlight the relevance of financial and environmental criteria for individual investment decisions. To unlock participation potential, campaigns should reflect the values and preferences of Albertans by highlighting the economic and environmental benefits of participating and investing in RECs.

Conclusion

RECs can support the shift from fossil-fuel dependent energy systems towards decentralized low-carbon systems. Moreover, RECs provide citizens opportunities to reconfigure their roles within the energy system as not only energy consumers, but as partial owners of energy production, distribution, and active participants in local energy initiatives. Against the background of rapidly growing renewable energies and the historical presence of the co-operative model in Alberta, the REC sector in Alberta has the potential to grow.

Importantly, the ongoing renewable energy transition is sustained by public acceptance of renewables and citizen participation. Likewise, citizen participation in the energy system is essential to sustain and expand RECs. Considering this background and the limited literature about motivating factors for participating in RECs in Alberta, our study explores the factors driving citizen participation and investment in RECs among financial decision-makers in Alberta. Best/worst scaling provides novel insights on which attributes of RECs Albertans value the most, offering campaigning and advocacy direction for policymakers and co-operative leaders.

This study reveals considerable participation and investment potential in Alberta; despite the low level of familiarity with RECs, financial decision-makers in Alberta expressed interest in volunteering, buying electricity, becoming a member, and investing money. These findings have positive implications for the future of the REC sector in Alberta. Energy cost saving, investment

returns, and environmental considerations are important factors influencing participation and investment in RECs, demonstrating the relevance of both financial and non-financial motivations for citizen participation and investment in community energy systems. To further activate the participation and investment potential of Albertans identified in this study, advocates can emphasize that RECs provide citizens with a chance to address climate change and emissions trends through actively participating in the renewable energy transition. In addition, efforts to promote investment in RECs and community energy systems can highlight the financial performance and environmental benefits of investing in RECs and sustainable investments.

Investment co-operatives can evaluate their organization's goals when determining minimum investment amounts. Those focused on obtaining substantial funding, rather than a high number of investors, can select minimum investment amounts around $1000. Co-operatives who want to attract a higher number of investors can select an investment level closer to $500.

Limitations of our study are related to our survey design and sampling procedures. Due to limitations with our survey platform, Qualtrics, our BWS experimental design was not a balanced incomplete block design (BIBD). This means that each respondent received different choice sets containing attributes. There is a risk that certain attributes appeared more frequently to some respondents than others. However, Qualtrics' experimental design aims to present each attribute relatively the same number of times across the choice sets, which minimizes bias. Additionally, while the application of weighting factors was necessary to achieve a representative sample, weighting may affect the variance of estimates. Furthermore, our survey respondents were online panelists registered with Dynata, the third-party polling firm. Although we established quotas on socio-demographic characteristics and political positions, these respondents may differ from the general population by nature of being a panelist.

It is important to note that we assessed the willingness of respondents rather than actual behaviour. Analyzing motivating factors for participation in RECs among people who have previously engaged with RECs or similar community energy projects would enhance our analysis. Furthermore, future research may involve further analyzing the upper and lower bound of Albertans' willingness to invest or exploring a smaller range of minimum investments to better understand the range of most preferred investment amounts. Additionally, while our study only focused on four forms of participation within RECs, future researchers could consider other

forms of engagement such as participating in educational activities, voting, and attending meetings and seminars.

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Appendix A

Table A1

Sample characteristics

Variables		Sample (n = 994) Frequency Count	Sample (n = 994) Frequency Frequency (%)	Alberta average Frequency (%)	Weight variable
Gender					
	Female	507	51.1	50.08	0.980039139
	Male	483	48.7	49.92	1.025051335
Age					
	20-29	148	14.9	16.36	1.097986577
	30-39	175	17.6	20.67	1.174431818
	40-49	193	19.4	18.28	0.942268041
	50-59	191	19.2	16.76	0.872916667
	60-69	168	16.9	15.06	0.89112426
	70-79	96	9.7	8.411	0.867113402
	80 and over	23	2.3	4.45	1.934782609
Education					
	No high school diploma or equivalency certificate	24	2.4	13.97	5.820833333
	High (secondary) school diploma or equivalency certificate	306	30.8	22.81	0.740584416
	Postsecondary certificate, diploma or degree	432	43.5	42.91	0.986436782
	Bachelor's degree of higher	232	23.3	20.3	0.871244635
Household income (in CAD)					
	Under 5,000	15	1.5	1.03	0.686666667
	5,000 to 14,999	24	2.4	1.28	0.533333333
	15,000 to 24,999	54	5.4	4.09	0.757407407
	25,000 to 34,999	86	8.7	5.73	0.65862069
	35,000 to 44,999	62	6.2	6.18	0.996774194
	45,000 to 59,999	148	14.9	9.51	0.638255034
	60,000 to 79,999	146	14.7	12.89	0.876870748
	80,000 to 99,999	142	14.3	11.81	0.825874126
	100,000 to 124,999	115	11.6	12.55	1.081896552
	125,000 to 149,999	88	8.9	9.61	1.079775281
	150,00 to 199,999	72	7.2	12.29	1.706944444
	200,000 and over	42	4.2	13.05	3.107142857

[a] Percentage of the Albertan average was provided by Statistics Canada based on the 2021 Census of Population.

Table A1 (continued)

Variables	Sample (n = 994) Frequency		Alberta average Frequency (%)	Weight variable
	Count	Frequency (%)		
Political affiliation				
New Democratic Party/Liberal	316	34.7	44.2	0.139873418
Conservative	500	54.9	52.6	0.1052
Green	32	3.5	0.8	0.025
Other	62	6.8	2.2	0.035483871
Type of community				
Rural	83	8.4	15.2	0.18313253
Urban	911	91.6	84.9	0.093194292

[a] Percentage of the Albertan average was provided by Statistics Canada based on the 2021 Census of Population. Political affiliation frequencies were provided by the 2023 provincial election data (percentage of votes received in each party).

Table A2

Support for each myth of nature

Myths of nature	Strongly agree or agree (%)
Environmental problems can only be controlled by enforcing radical changes in human behavior and in society as a whole (egalitarian)	52.3
Environmental problems are not running out of control, but the government should dictate clear rules about what is and what is not allowed (hierarchist)	25.8
We do not need to worry about environmental problems because in the end, these problems will always be resolved by technological solutions (individualist)	61.5
We do not know whether environmental problems will worsen (fatalist)	42.9

Table A3

Assessment of the average risk level of sustainable investments compared to conventional investments

Statement	Percent of respondents (%)
The average risk is much lower or rather lower for sustainable investments	25
The average risk is neither higher nor lower for sustainable investments	47
The average risk is rather higher or much higher for sustainable investments	28.1

Appendix B

Table B1

Survey questions

Characteristics	Question/items	Response options
Age	*Please select your age group.*	20-29; 30-39; 40-49; 50-59; 60-69; 70-79; 80 and over
Type of community	*Please enter the first three digits of your postal code.*	
Gender	*Please indicate your gender.*	Male; Female; Other; Prefer not to say
Household income	*What is your before-tax household income?*	Under 5,000; 5,000 to 14,999; 15,000 to 24,999; 25,000 to 34,999; 35,000 to 44,999; 45,000 to 59,999; 60,000 to 79,999; 80,000 to 99,999; 100,000 to 124,999; 125,000 to 149,999; 150,00 to 199,999; 200,000 and over
Education	*What is the highest level of education you have completed?*	No high school diploma or equivalency certificate; High (secondary) school diploma or equivalency certificate; Postsecondary certificate, diploma or degree; Bachelor's degree of higher
Political affiliation	*Please indicate the political party that best represents your views, whether or not you voted in the last provincial election.*	New Democratic Party/Liberal; Conservative; Green; Other; Prefer not to say
Myth of nature	• *Environmental problems can only be controlled by enforcing radical changes in human behavior and in society as a whole.* • *Environmental problems are not running out of control, but the government should dictate clear rules about what is and what is not allowed.* • *We do not need to worry about environmental problems because in the end, these problems will always be resolved by technological solutions.* • *We do not know whether environmental problems will worsen*	Five-point scale from strongly disagree (1) to strongly agree (5)
Environmental identity	• *Minimizing energy use is an important part of who I am.* • *I see myself as someone who is very concerned with environmental issues.*	Five-point scale from strongly disagree (1) to strongly agree (5)

Table B1 (continued)

Characteristics	Question/items	Response options
Place identity	• *I feel strongly attached to the city, community, and region in which I live.* • *There are many people in my community whom I think of as good friends.* • *I often talk about my community as being a great place to live.*	Five-point scale from strongly disagree (1) to strongly agree (5)
Social norms	• *Do any of your family members, friends, or colleagues invest in sustainable investments?*	• Yes; No; Don't know
	• *How much influence do your family, friends and colleagues have on your decision to invest – or not invest – in sustainable investments?*	• Five-point scale from no influence (1) to very important influence (5)
	• *In general, what do you think your family's, friends' or colleagues' views would be of you investing in sustainable investments?*	• Five-point scale from very unfavorable (1) to very favorable (5)
Experience with participating in an environmental organization	*Do you have experience participating in an environmental organization?*	Yes; No, but I am planning to; No, and I am not planning to
Experience with sustainable investments	*Have you ever…* • *Invested in green/sustainable investment assets?* • *Invested in a renewable energy cooperative?* • *Invested in green/sustainable crowdfunding projects?*	
Perceived risk of sustainable investments	*Please indicate your assessment of the average risk level of sustainable investments compared to conventional investments.*	Five-point scale from the average risk is much lower for sustainable investments (1) to the average risk is much higher for sustainable investments (5)
Financial literacy	• *Suppose you had $100 in a savings account and the interest rate was 2 percent per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, less than $102?*	• Less than 102$; Exactly 102$; More than 102$ (correct response); Don't know
	• *Imagine that the interest rate on your savings account was 1 percent per year and inflation was 2 percent per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?*	• Less than today (correct response); Exactly the same as today; More than today; Don't know
	• *Do you think that the following statement is true or false? Buying a single company stock usually provides a safer return than a single mutual fund stock.*	• True; False (Correct response); Don't know

Table B1 (continued)

Characteristics	Question/items	Response options
Self-reported knowledge about Alberta's energy system	*How familiar are you with Alberta's energy system?*	Five-point scale from very unfamiliar (1) to very familiar (5)
Knowledge statements about Alberta's energy system	• *Alberta has a deregulated energy market.*	• True (Correct response); False; Don't know
	• *How confident are you in your answer?*	• Five-point scale from very unconfident (1) to very confident (5)
Self-reported knowledge about renewable energy cooperatives	*How familiar are you with renewable energy cooperatives?*	Five-point scale from very unfamiliar (1) to very familiar (5)
Knowledge statements about renewable energy cooperatives	• *The primary focus of renewable energy cooperatives is energy generation.*	• True; False (Correct response); Don't know
	• *How confident are you in your answer?*	• Five-point scale from very unconfident (1) to very confident (5)
	• *Individuals and communities can get financial returns on investments made through renewable energy cooperatives.*	• True (Correct response); False; Don't know
	• *How confident are you in your answer?*	• Five-point scale from very unconfident (1) to very confident (5)
	• *Individuals cannot buy electricity from renewable energy cooperatives.*	• True; False (Correct response); Don't know
	• *How confident are you in your answer?*	• Five-point scale from very unfamiliar (1) to very familiar (5)
Attitudes towards renewable energy	• *Alberta should stop developing renewable energy projects.* • *Renewable energy projects support local economic development.* • *Renewable energy technologies are too expensive.*	Five-point scale from strongly disagree (1) to strongly agree (5)

Table B1 (continued)

Characteristics	Question/items	Response options
Attitudes towards renewable energy cooperatives	• *Renewable energy cooperatives can make a meaningful contribution to Alberta's renewable energy transition.* • *Investing in a renewable energy cooperative is too financially risky.* • *The renewable energy cooperative sector should play a larger role in Alberta's energy mix.*	Five-point scale from strongly disagree (1) to strongly agree (5)
Willingness to participate in a renewable energy cooperative	• *In general, how willing are you to invest time in or volunteer for a renewable energy cooperative?* • *In general, how willing are you to buy electricity from a renewable energy cooperative?* • *In general, how willing are you to become a member of a renewable energy cooperative?* • *In general, how willing are you to contribute financially and invest money in a renewable energy cooperative?*	Five-point scale from completely unwilling (1) to very willing (5)