ENABLING COMMUNITY RENEWABLE ENERGY DEVELOPMENT THROUGH AGGREGATION

Helping Alberta communities participate in renewable energy projects.

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Municipal Climate Change Action Centre

PEMBINA institute

BUSINESS RENEWABLES CENTRE CANADA

CONTENTS

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The Pembina Institute

About the Pembina Institute

The Pembina Institute is a national non-partisan think tank that advocates for strong, effective policies to support Canada's clean energy transition. We employ multi-faceted and highly collaborative approaches to change. Producing credible, evidence-based research and analysis, we consult directly with organizations to design and implement clean energy solutions, and convene diverse sets of stakeholders to identify and move toward common solutions.

About the Municipal Climate Change Action Centre

The Municipal Climate Change Action Centre (Action Centre) was founded in 2009 as a collaborative initiative of Alberta Municipalities, Rural Municipalities of Alberta, and the Government of Alberta.

The Action Centre delivers funding, technical assistance, and education to help Alberta municipalities and community related organizations advance actions that lower energy costs, reduce greenhouse gas emissions, and improve climate resilience.

EXECUTIVE SUMMARY

Decarbonizing the electricity sector is key in reducing emissions economy-wide and, as the cost of renewable energy declines, many are looking to wind and solar to reduce their emissions and energy costs. Alberta is no exception, having seen a surge in renewable energy deployment in the past few years. The bulk of Alberta's recent boom in wind and solar is largely attributed to corporate and institutional interest in long-term power purchase agreements.

But municipalities are no strangers to renewable energy, and their interest predates that of the private sector. Initially focused on "behind-the-meter" solar, many have since set their sights on larger-scale, community generation projects. However, as many municipalities have found, their limited size is a barrier to entry:

- As generators, community projects are too small to attract a buyer.
- As consumers, community power demand is too small to attract a seller.

Paired with the perceived complexity of the procurement process and a lack of internal support from decision-makers, municipalities are at a loss as to how to approach the problem. However, despite the challenges, many are still keen on pursuing larger-scale renewable energy procurement. Of the 29 municipalities that were surveyed for this report, 18 believe that renewable energy is one potential solution in achieving their climate goals, with nine stating that it will be very important.

Pooling the energy demand or supply of several municipalities, known as aggregation, presents a unique avenue to address the barriers brought on by scale. Stacking the power demand of several smaller municipalities could make them an attractive partner for renewable energy developers. In a similar manner, combining the generation capability of several smaller community energy projects, or pooling funds to develop a single larger project, may entice potential buyers. Our survey had 36 respondents, as some municipalities had more than one staff person respond. When presented with the concept of aggregation, half of the surveys (19) indicated interest in pursuing aggregation to achieve scale, with another 13 looking for further information before taking a stance.

The following additional measures were identified to ease the aggregation process:

- **Address the education gap.** Our surveys and interviews highlighted a myriad of outdated information among community leaders and decision makers. Changing the thinking around renewable energy costs can alleviate internal conflicts and remove the barriers that they create.
- **Build capacity and provide access to outside expertise.** Negotiating power purchase agreements is a complex process that smaller municipalities are not equipped to handle, and access to external expertise is often too costly. Community-oriented webinars and resource-and-information-sharing hubs can develop understanding among communities and facilitate engagement between municipalities and experts.
- **Advocate for deals between municipalities and anchor buyers.** Pairing several smaller municipalities with a larger "anchor" is a win-win for everyone involved.
    - **For the anchor:** aggregating the purchasing power of several off-takers will open access to greater economies of scale, lowering their own costs and sharing the risk among all participants.
    - **For the municipalities:** piggybacking on deals with larger buyers will open the door to deals that were previously unobtainable due to their limited power demand.
- **Promote a central procurement agency to facilitate aggregation.** In the absence of an anchor, smaller communities are left to aggregate among themselves to achieve the scale required to broker deals.

Streamlining this process through a dedicated aggregator could provide the much-needed stability to catalyze this process.

1. INTRODUCTION

With its nation-leading renewable energy resources, Alberta has a long history of wind energy development and a more recent surge of solar development. Both wind and solar are presently in a development boom. Particularly since 2019, renewable energy investment and construction has grown dramatically. With wind and solar energy now the lowest-cost generation options, and as stronger climate policy has been implemented in both Alberta and nationally, the prospects for further development are strong over the coming decade.

The recent surge has been driven almost entirely by corporate and institutional (C&I) procurement of renewable energy. Large businesses and public institutions have recognized the need to address both their emissions and the financial benefits of securing non-emitting power at set prices under long-term contracts. This has sparked rapid growth in the negotiation of contractual instruments — called virtual power purchase agreements (vPPAs) — whereby C&I buyers support the financing of additional solar and wind projects through contracts for difference (CfDs). A CfD is a contractual agreement between a renewable energy generator and a buyer, defining the price at which energy will be sold over the duration of the contract. Through CfD agreements, buyers and sellers are able to mitigate price uncertainty, enabling a lower cost of financing for new renewable projects. Many of these deals have proven to be not just prudent but actually economically advantageous for buyers because they save substantial energy costs against the conventional electricity market.

Organizations also face growing pressures to address operational and supply-chain emissions and their exposure to increasing carbon costs for emitting power that they consume from Alberta's carbon-intensive grid. Altogether, these factors are spurring dynamic deal-making trends. It is clear that C&I deals will continue to drive rapid solar and wind energy development in Alberta.

This rapid growth has prompted interest among municipalities and other types of communities in both producing and using renewable energy. Initially, communities focused on direct ownership of small-scale solar generation integrated with their consumption — solar arrays proliferated on town halls and hockey arenas or next to maintenance yards. But the economic development and energy security opportunities of net-to-grid solar and wind development have become more evident as sophisticated corporate actors have vigorously pursued new renewable energy through cost-effective contracts.

Our research finds that communities are interested in participating in utility-scale or community (net-to-grid distributed) renewable generation from two non-mutually-exclusive angles:

1) the opportunities to own renewable energy generation through direct equity investment and thereby to benefit from the healthy economics of wind and solar in Alberta's electricity market

2) the opportunities to purchase renewable energy, along with their environmental attributes, through forward contracts that can hedge against rising electricity costs arising from higher fuel and carbon costs.

While not all communities are necessarily interested in both sides of the supply-and-demand coin, both sides of community participation encounter scale as a barrier to deal-making because of the smaller capacities — whether investment or procurement — of municipalities and other community organizations. Aggregation of supply or demand has been identified as an opportunity to achieve scale and clear these barriers and, indeed, this has also been pioneered by C&I entities.

This report:

1) explains the drivers behind growing C&I uptake and the extent and nature of Alberta's resulting renewable energy boom, in section 2;

2) reviews the background for municipal interest in these opportunities in the Alberta electricity market, as well as the challenges of matching small community scale with large renewable energy investment, in section 3;

3) observes and assesses the desire among communities for opportunities to use aggregation to overcome barriers of scale to community participation as buyers or generators of renewable energy, along with other indicators of community interests and capacity, as discerned through comprehensive surveying and interviewing of representatives from interested communities, in section 4; and

4) analyzes examples of mechanisms for aggregating demand or generation in practice both in and outside Alberta, and assesses the suitability of these initiatives to address community concerns and challenges and facilitate community participation, in section 5.

2. ALBERTA'S RENEWABLE ENERGY PROCUREMENT BOOM

Alberta has entered a renewable energy boom time, driven by win-win dynamics between renewable energy developers and renewables-hungry corporate consumers. Corporate procurement of renewable energy is behind Alberta's national record-breaking pace of renewable energy development. The key to this market has been the proliferation of long-term virtual power purchase agreements using contracts for difference that mitigate merchant risk for developers, rendering projects financeable and much lower cost. In a virtuous cycle, the low-cost environmental attributes — renewable energy certificates (RECs) and offsets — are attractive to buyers, as is the hedge that CfDs provide against the rising costs of carbon-intensive power. These deals have become necessary for the vast majority of renewable energy development in Alberta, which has quickly become a multi-billion-dollar capital investment opportunity. The result is a rapid expansion of finance-friendly, low-cost solar and wind power in Alberta, which mops up the investment thanks to the province's unique market that enables these deals.

Understanding these commercial instruments is critical to assessing opportunities for communities to participate in Alberta's renewable energy boom.

2.1 Alberta's unique deregulated energy-only market: relevant basics

Alberta has a unique electricity market. Electric energy generation is fully deregulated, meaning independent power producers (IPPs) compete in an organized energy-only market. Consumers have market choice, so any qualified retailer can buy and sell electricity from the wholesale market, and customers are able to choose their preferred retailer or even self-retail if they are large enough to justify qualifying as a retailer.

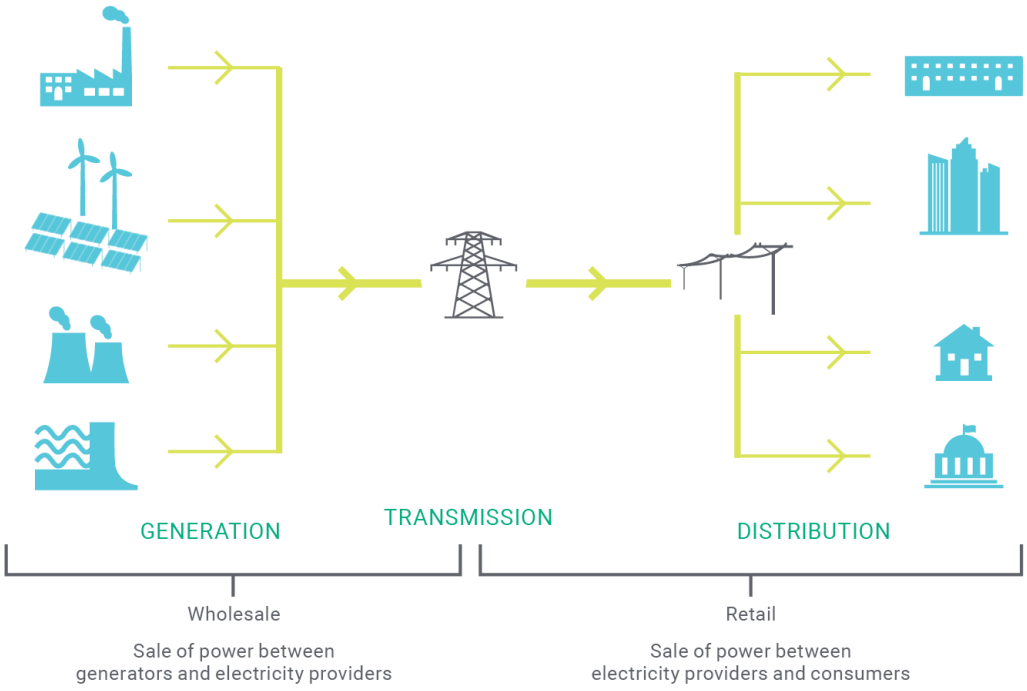

Figure 1. Structure of the Alberta electricity market

On the generation side, the Alberta Electric System Operator (AESO) manages the power pool, where IPPs submit offers every hour for each available generator, creating a merit order, or a ranking, of offers by price from lowest to highest. The AESO dispatches the supply necessary in real time, starting with the lowest-priced offers and progressively adding supply with the next lowest offers until supply meets demand across

the provincial grid (called the interconnected electric system). Only suppliers that are dispatched and generate energy are paid the hourly price for that energy, which is set for that hour by the highest-offer dispatched generator (known as the "pool price").

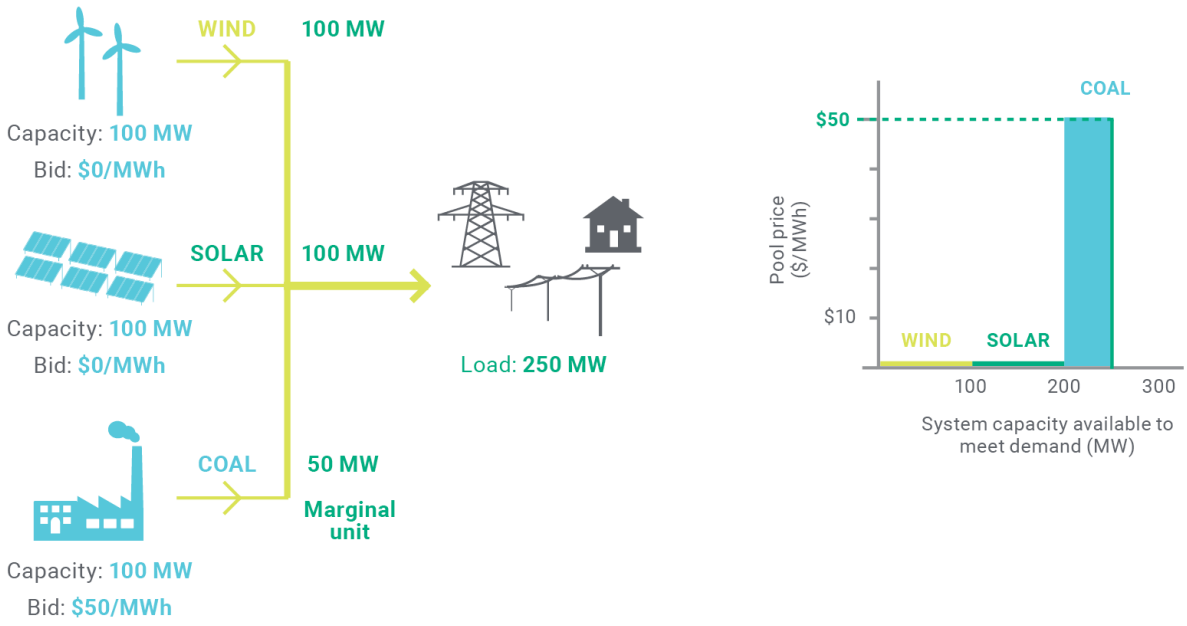

Figure 2. Simple merit order with fossil fuels setting the pool price

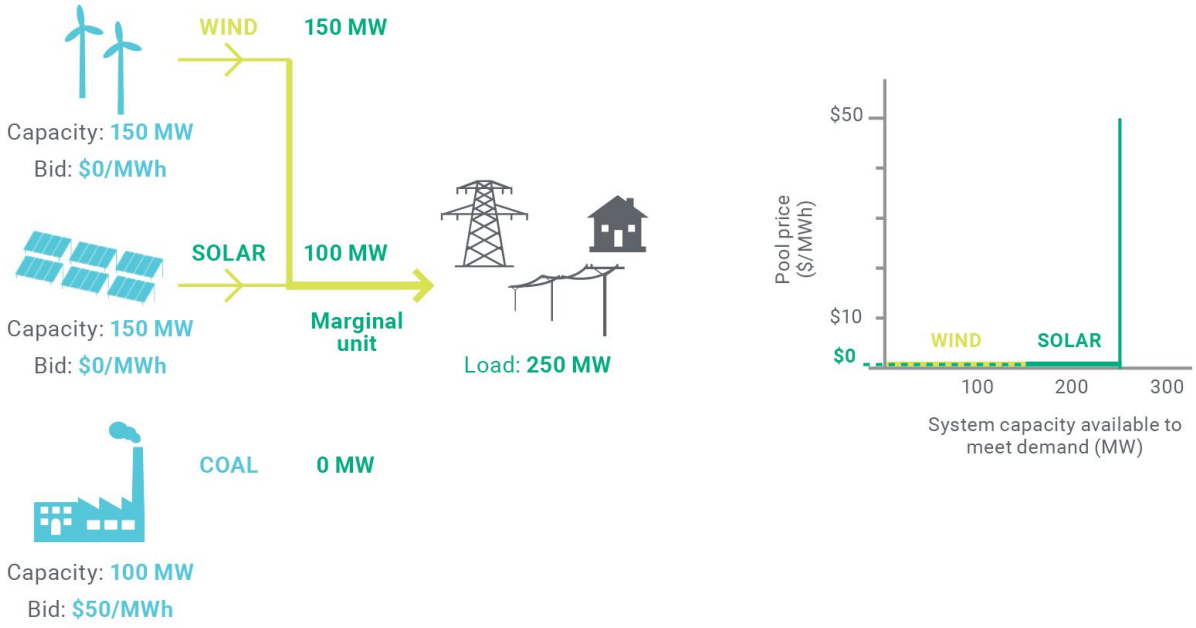

Figure 3. Simple merit order with variable renewables setting the pool price

In other words, generators only earn revenue by offering "in-merit" and producing energy. Generators, then, must recover both their upfront capital costs (plus equity return and debt servicing) and their ongoing operating and maintenance costs from their energy generation revenues. For any given hour, generators are

incented to offer at their marginal operating cost (the cost of producing another MWh, largely their fuel input cost) in order to earn revenue that covers their costs in that hour. But only by earning prices in higher-price hours do they achieve a profit margin sufficient to recover and earn a return on their capital investment.

2.2 Renewable energy within Alberta's power market: merchant risk as a barrier to investment

The deregulated energy-only market poses challenges for financing new renewable energy investments. Because renewable energy sources have virtually no marginal operating costs, (unsurprisingly, as they have no fuel input costs), renewable energy generators typically offer power at $0/MWh, looking to generate as much as possible at any price to recover their upfront investment.[1] Unlike for price-setting natural gas generators,[2] the factors that determine costs for renewable energy (upfront costs like components and construction) have no relationship to the revenue they receive from the energy market. In other words, solar and wind generators are "price takers." This is aggravated by the fact that $0 offers, like wind and solar offers, tend to reduce the pool price any time they are available to generate.[3]

Because of unpredictable supply-demand dynamics and relatively volatile and unpredictable natural gas fuel input costs, Alberta's power pool price is very difficult to forecast accurately. As such, it is difficult for any new asset to know how much revenue it will earn for the power it generates and whether it will be sufficient to cover capital costs — known as merchant risk. Merchant risk is particularly acute for wind and solar power investments because: 1) their cost profiles are almost entirely skewed to upfront capital costs, meaning more vulnerability to investment risk; and 2) they have little control over electric energy market prices, which, in turn, have almost no relationship to solar and wind input costs.

The effect is that a "merchant" renewable energy project (a project that is exposed to the market price and therefore carries merchant risk) can be difficult and costly to finance. The risk deters creditors and raises expectations for returns from investors. As capital-intensive projects, the cost of capital is the largest determinant of renewable energy costs. In this way, merchant risk damages project economics, effectively killing projects.

Accordingly, Alberta's energy-only electricity market poses a serious barrier to wind and solar investment. This is reflected in the fact that at the start of 2019, there had been no new wind energy construction started since 2015 and only 15 MW of new solar.

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[1] Wind and solar generators have little incentive to make higher offers that could end up out-of-merit, losing out on revenue for their zero-cost energy in that hour. One exception is for large IPPs with market power that can submit offers that are much higher than the assets' (including renewable assets') marginal operating costs in high-demand and tight-supply hours to further drive up the market price, benefitting their overall generation portfolio, an opportunity that can outweigh the risk of being out-of-merit.

[2] For natural gas generators, fuel supply costs make up a substantial part of their total cost of energy generation, which is reflected in their marginal operating cost and therefore their offer price. With considerable marginal operating costs to factor into their offers, their offers regularly set the pool price, making them "price makers".

[3] Because wind generators' time-of-production profiles are highly correlated with each other (particularly within large regions of the province), these generators tend to reduce the pool price in the hours that they generate, leaving them with a below-average market price capture. Solar generators' production profiles are also highly correlated (likely even more correlated), but not enough solar has been built yet to observe this dynamic; to date, solar still captures higher-than average prices because it correlates well with the high prices of summer peak. However, this is likely to change as more solar begins to operate.

2.3 Corporate offtake deals (vPPAs) to mitigate merchant risk: the commercial innovation catalyzing renewables growth

The rapid expansion of wind and solar since 2019 reveals the key to unlocking this investment barrier. It lies in the retail choices of large consumers within Alberta's deregulated market, which provides market participants (retailers, self-retailers and generators) with the flexibility to enter into agreements with one another, allowing large corporate and institutional consumers to sign energy purchase contracts with generators. Once this opportunity is combined with the growing corporate demand for environmental attributes (renewable energy's secondary product), a key commercial innovation emerged to foster new, additional renewable energy investment.

Large corporate and institutional electricity consumers face growing demands to buy renewable energy. Some, particularly industrial consumers, have climate policy obligations to meet, such as Alberta's Technology Innovation and Emissions Reduction (TIER) system and regulations, sometimes referred to as the "compliance market" for renewable energy procurement (whereby buyers typically seek offsets against emissions to comply with their TIER obligations). Others have made environmental, social and governance (ESG) commitments to address their carbon footprints, including the emissions embedded in their electricity consumption. This is regularly referred to as the "voluntary market" (whereby buyers typically seek RECs to meet their non-emitting or renewable energy power consumption claims), though this term somewhat ignores the reality that these commitments are instigated by investor, consumer and other stakeholder demands. In either case, organizations seek to address emissions by procuring renewable energy to displace emitting electricity in carbon-intensive grids, like Alberta's.

When looking to purchase renewable energy, non-utility buyers (consumers) can build their own onsite project, work with a developer to create an onsite project and purchase that energy, or develop their own offsite project and retire the environmental attributes of the renewable energy against their grid consumption.[4] But by far the largest current driver of renewable energy development in North America, including Alberta, is the use of long-term vPPAs for environmental attributes from developers of new off-site solar and wind projects. This option has emerged strongly because it creates a powerful win-win between buyers seeking low-cost environmental attributes and developers looking to mitigate merchant risk in order to finance new projects.

A vPPA is a contract structure in which a power buyer (or offtaker) agrees to purchase a new project's renewable energy for several years at a preset "strike price." With a vPPA, the buyer need not actually purchase the electric energy in a physical or even formal legal sense. The buyer typically still purchases their electric energy through whatever retail option they have chosen and still physically pulls energy from the grid. Figure 4 shows how consumers secure environmental attributes from particular renewable energy generators, even while both still exchange electric energy through the interconnected electric system and energy market.

[4] In all cases the environmental attributes must be retained and retired by the purchaser in order to claim the use of the renewable energy; they cannot be sold or used to meet other environmental obligations.

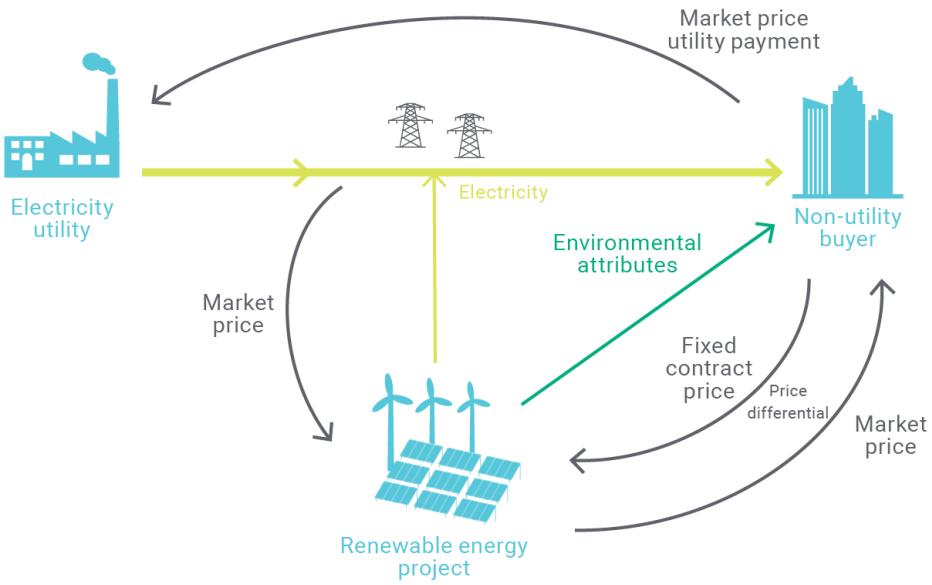

Figure 4. Structure of the VPPA transaction

However, the mechanism for calculating payments in the contract — an approach known as a "contract for difference" — mimics the financial benefits of a regular PPA for both parties. The buyer purchases the environmental attributes associated with that electric energy, but in a way that gives energy price certainty to the renewable developer/seller: the vPPA's CfD pegs the payments to cover the difference between the energy price that the generator receives from the AESO power pool and the strike price. As illustrated in Figure 5, the CfD can run both ways: if the market price is less than the vPPA strike price, the buyer makes up the difference in payments to the generator; but if the market price is greater than the vPPA strike price, the buyer actually receives the difference.

Figure 5. Contracts for difference (CfD) approach

The outcome of the CfD financial arrangement is to remove merchant risk from the developer by providing a set strike price for electric energy generated. By addressing this barrier to low-cost financing, renewable

energy developers' cost of capital is decreased and very low per-MWh renewable energy costs can be achieved. This means that the strike prices offered by solar and wind developers can be very low, allowing buyers to secure environmental attributes (and therefore helping to fulfill their emissions regulations or ESG commitments) at very low prices.

In fact, there is strong evidence that buyers can receive more than they pay. Some of the first large-scale CfDs in Alberta published the strike prices because they were public procurements, including Alberta's Renewable Energy Program (REP), which supported over 1,350 MW of new wind, and the province's procurement of solar electricity for government buildings, which procured nearly 70 MW of new solar. Analysis has shown that through contracting new renewable generation under REP, the government (as "buyer") gained over $75 million from electricity sales and an estimated additional $56 million in surrendered environmental attributes. This indicates a "negative" resulting cost (i.e., a gain) from CfDs for offsets from new wind projects in recent months and years.[5] While the government's solar procurement landed at a higher strike price ($48/MWh), solar captures a healthier market price, so these contracts also result in net payment to the government as the buyer. Of course, these contracts have so far been profitable in large part thanks to historically high electricity market prices in Alberta — they were not guaranteed to pay off in this way if prices had fallen instead. However, because the buyers are typically electricity consumers in the Alberta market, the inverse relationship of the buyer's CfD cost to the buyer's electricity market costs can serve as a valuable hedge for the buyer — like icing on the cake for the buyers' primary motivation, which is to secure environmental attributes. This hedge is even more valuable given that rising carbon costs are a component of forecasted electricity price increases in carbon-intensive grids.

2.4 The boom in corporate renewable energy procurement: State of the market

The confluence of rising climate policy and ESG obligations, along with very low-cost renewable energy facilitated through innovation in commercial agreements, has created an explosion of corporate and institutional renewable energy deals.

By the end of 2022, the total contracted capacity of renewable energy disclosed stands at 2,277 MW, spread across 30 unique C&I renewable energy deals. The Business Renewables Centre-Canada (BRC-Canada) — an initiative to accelerate the uptake of renewable energy through C&I procurement — set a goal in 2019 to reach 2 GW (2,000 MW) of announced deal volume by 2025. This goal was reached in half the time, by mid-2022. As a result, BRC-Canada has revised its ambition upward, to reach five times the original target by 2030. Reaching the new target will require expansion of the C&I market to other provinces with carbon-intensive grids, but so far Alberta has the field to itself and will continue to be the largest driver in coming years.

[5] Sara Hastings-Simon, Andrew Leach, Blake Shaffer, Tim Weis, "Alberta's Renewable Electricity Program: Design, results, and lessons learned," *Energy Policy* 171 (2022). https://doi.org/10.1016/j.enpol.2022.113266

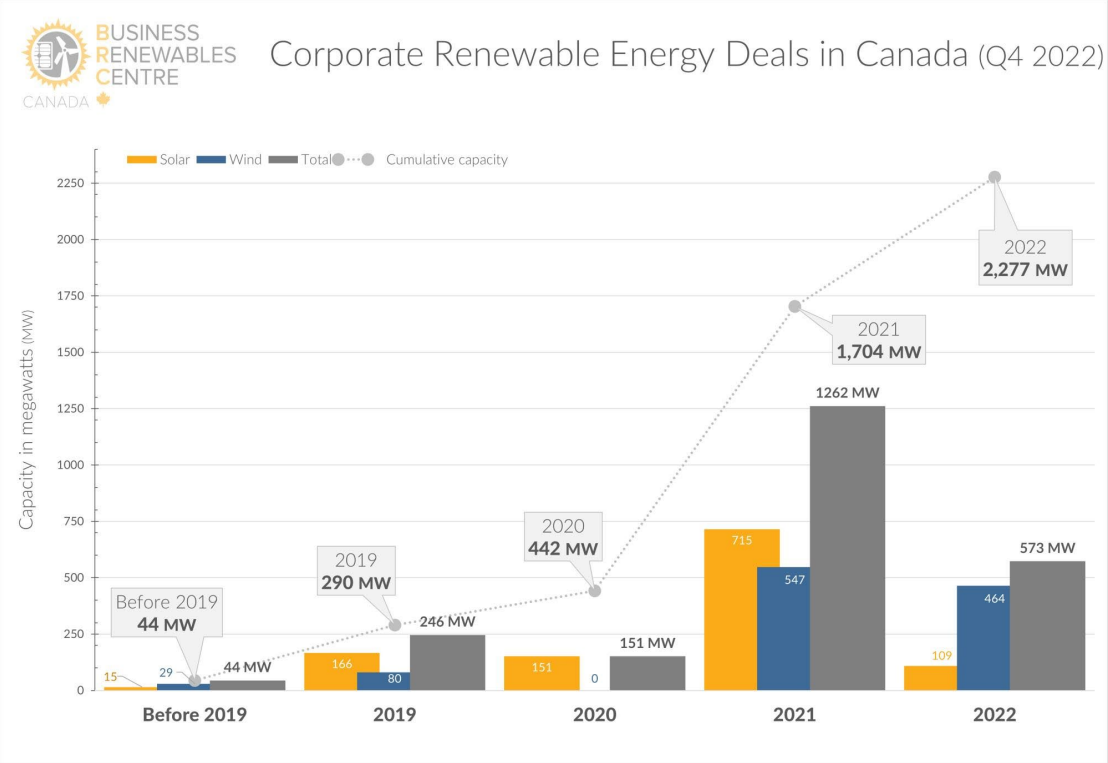

Figure 6. Business Renewables Centre Canada Deal Tracker, Q4 2022

Source: BRC Canada[6]

Because deals often back solar and wind projects that are larger than the announced deal size (an indication that some developers are able to finance projects with a mix of mostly strike price revenue and some merchant risk), these deals are leveraging even more new generation investment by supporting 2,804 MW of project capacity, 2,277 MW of which is contracted under long-term PPAs. The result is that the C&I market to-date is supporting projects worth over $4 billion in estimated capital investment and creating nearly 5,000 peak construction jobs. These projects will supply the equivalent annual energy needs of over one million homes, generating up to $1 billion per year in power pool energy value, plus hundreds of millions more in emissions offsets.

The demand for these deals is coming from a growing diversity of industrial sectors and a strong complement of both the compliance and voluntary markets, as shown in Table 1. Particularly in 2021 and 2022, bold new voluntary market entrants — particularly in technology — have helped to dilute the dominance of oil and gas and the related chemicals sectors, fostering a more dynamic and resilient C&I market.

Table 1. Sectoral distribution of Canadian renewable energy deals in 2022

Sector	Compliance or voluntary?	Deal participation	Capacity under contract (MW)	Proportion
Oil and gas	C	8	871	38.3%
Technology	V	4	622	27.3%
Public institution	V	4	208	9.1%

[6] Business Renewable Centre Canada, "Deal Tracker (Q4 2022)". https://businessrenewables.ca/deal-tracker

Telecommunications	V	4	162	7.1%
Chemicals	C	2	151	6.6%
Food & Beverage	V	2	88	3.9%
Electricity	V	4	76	3.3%
Banking & Finance	V	3	68	3.0%
Forestry	C	1	22	1.0%
Ecommerce	V	1	8	0.4%

Note: Capacity volumes in deals that involved multiple buyers were split between the buyers

Data source: BRC Canada

2.5 C&I deals are critical to renewable energy investment in Alberta

The key role of this dynamic C&I offtake market for renewable energy investment growth in Alberta is evinced empirically. We are now in the fastest phase of renewable energy construction in Alberta history and the evidence is clear that most of this would not be possible without C&I demand and the innovation of vPPA commercial arrangements.

Indeed, Alberta's entire history with utility-scale solar development has been wrapped up in the C&I market's emergence. The first utility-scale solar farm, the 15 MW Brooks Solar project that began operating in 2017, was supported by one of only two pre-2019 C&I deals that pioneered corporate offtake back when it was a niche market. Thereafter, no further projects began operating until after the provincial government pioneered a CfD arrangement and announced a $48/MWh solar procurement in early 2019. Beginning in 2020 and up to the end of 2021, 320 MW of new utility-scale solar projects began operations, an over 20-fold increase in the operating utility-scale solar in Alberta in two short years. Fully 93% of that capacity was backed by C&I offtake deals, as shown in Figure 7. By the end of 2022, the installed utility-scale solar capacity tripled again, with 828 MW added in 2022 alone. Four-fifths (79%) of those additions were backed by C&I offtake deals announced so far, including all projects over 30 MW. While there is a lot of capacity under active construction at the end of 2022 without a deal announced yet, recent history shows that deals are likely to be announced for most of this capacity in coming months.

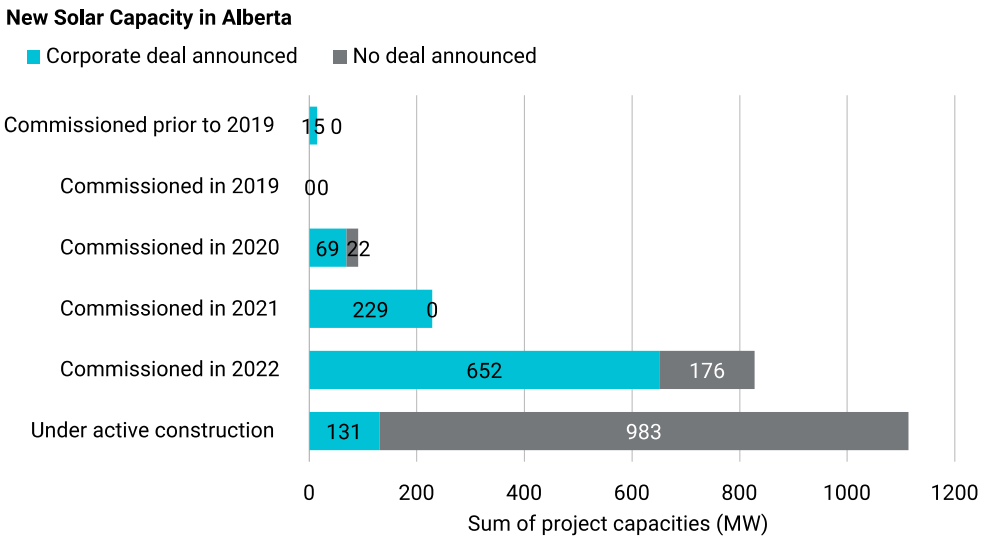

Figure 7. New solar capacity in Alberta, 2019 to 2022

Data source: BRC Canada

While the history of wind development in Alberta is longer and predates the emergence of corporate vPPAs in the province, the C&I market has become at least as crucial for new wind construction. That early history arrived at a lull in wind development after 2014, as the pitfalls of merchant risk and wind price capture set in. But the government's strike prices around $40/MWh for wind, published for three REP rounds from late 2017 to late 2018, jump-started C&I interest in wind vPPAs. REP projects continue to be built alongside C&I vPPA-backed projects, but the C&I market now predominates. No new project has been built without either a REP contract or C&I vPPA since 2014. By the end of 2022, C&I-backed construction began to outpace REP, as shown in Figure 8, with 601 MW of C&I vPPA-backed wind now operating and 1,172 MW more under active construction, more than doubling Alberta's wind generating capacity in place by 2018 without even counting the REP projects.

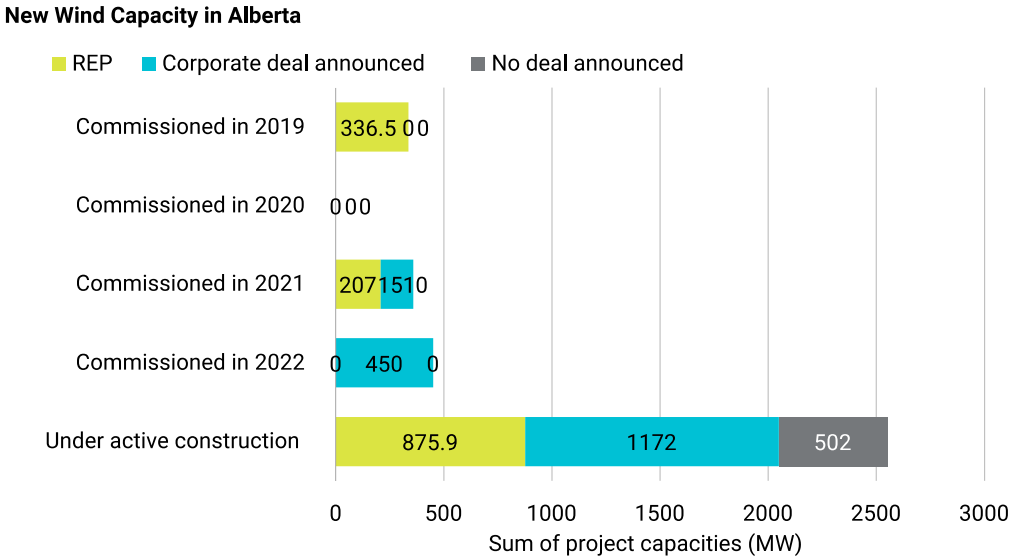

Figure 8. New wind capacity in Alberta, 2019 to 2022

Data source: BRC Canada

The solar and wind construction boom of the 2020s is mostly a product of innovations in renewable energy offtake arrangements and the growing C&I demand for renewable energy. While they were originally instigated by the public action with transparent government procurements, the pace and scale of renewable energy investment in Alberta relies, at this point, on these private-sector deals.

3. COMMUNITY INTEREST IN RENEWABLE ENERGY

Communities in Alberta have expressed considerable interest in participating in renewable energy development. This enthusiasm predates the C&I market of the last few years, demonstrating a long-standing connection between communities and solar and wind development in Alberta, initially focused on own-use building-integrated solar.

The recent deals-driven boom has heightened and expanded the interest, given the scale of economic development activity and the beneficial economics of renewable energy reviewed in section 2. In particular, the interest has broadened to offsite, net-to-grid wind and solar projects through "community generation," from both sides of the procurement coin: both as generators and consumers. However, the relatively small scale of both community power generation and consumption poses a barrier to community participation on either side of the symbiotic relationship that has catalyzed Alberta's 2020s renewables boom. The key to growing community participation in this solar and wind boom, then, is to adapt aggregation mechanisms or innovate new ones for this circumstance.

3.1 Early community energy: communities as micro-generators

Active community interest in renewable energy goes back over a decade. In 2009, Alberta Municipalities, Rural Municipalities of Alberta, and the Government of Alberta established the Municipal Climate Change Action Centre (MCCAC) with $2 million to design and deliver programs to address Alberta's changing climate. Almost from the start, this included tools and programs to raise awareness of, and then support, direct municipal participation in small-scale, own-use (micro-generation) solar production.

Early initiatives focused on education, awareness, capacity-building and unique collaboration on local pilot initiatives:

- "Lasso the Sun" and the Alberta Solar Municipal Showcase were online resources created in 2011 to showcase renewable energy demonstration projects in 20 municipal organizations across Alberta.
- MCCAC developed a solar implementation toolkit to provide guidance and tools to municipalities. It contains resources such as project investment analysis, marketing and training materials, solar permitting guidelines and sample microgeneration application and funding agreements.
- In 2013 and 2014, the MCCAC and Starland County collaborated to deliver the Starland Solar Initiative in order to support renewable energy adoption at the residential level through the installation of solar photovoltaics. Starland County residents were eligible for a solar installation grant of 50 cents per watt up to a maximum of $5,000. The initiative resulted in 12 solar systems being installed across the County, totaling 105 kilowatts in installed capacity.

Municipal deployment of solar accelerated in 2016 when the MCCAC launched the Alberta Municipal Solar Program (AMSP). This program provided rebate incentives for the installation of solar photovoltaic systems for Alberta municipal buildings. The program reached full subscription by December 31, 2017, with 62 projects approved for funding. These projects added 8.48 MW of total solar capacity and have a calculated greenhouse gas emissions reduction of 155,631 tonnes over a 25-year timeline.

In 2018, the MCCAC launched Round 2 of the AMSP that continued to provide rebates to municipalities for installing grid-connected solar photovoltaic systems on municipal facilities or land and completing public engagement on their project. Bonus rebates were provided for first-time applicants to encourage diverse and widespread program participation. Round 2 of AMSP was fully subscribed, with an additional 67 projects, adding another 15.4 MW of solar capacity and reducing 242,832 tonnes over a 25-year timeline.

Throughout these programs, communities recognized that the economics of small-scale renewable energy were difficult to achieve because of unpredictable electricity price forecasts over the lives of the projects, making the grid cost savings of solar challenging to estimate. But as consumers, communities saw the energy resiliency benefits of self-supply and actively pursued options with provincial programming supports delivered by MCCAC.

3.2 Net-to-grid community generation: communities as generators

In the late 2010s, community renewable energy plans became more ambitious. Visionary communities recognized the growing potential for renewable energy as solar and wind costs declined and climate commitments strengthened. Those that sought opportunities recognized the same barriers to financing that private-sector developers face when encountered with merchant risk.

Alberta's Small Scale Generation Regulation sets the groundwork for community generation, defining eligible projects as those that use renewable or alternative energy sources, are appropriately sized and connected to the local distribution system to supply electricity to the grid, and confer social, environmental, and economic benefits to communities through a community benefits statement or agreement.

However, the province's direct supports for utility-scale renewable energy development through the REP program and procurement of solar for government buildings beginning in 2016 revealed prospects for public support in mitigating merchant risk. By 2018, the province even pointed to the opportunity for future REP rounds to require community participation, similar to how the second round mandated equity ownership by Indigenous communities and the solar procurement favoured bids with Indigenous participation. It also announced $200 million toward a program that would support community generation projects, as defined by new regulations that enabled distribution-connected generation and allowed for special privileges for those with community participation. However, after a change in governing parties, the province chose not to implement the proposed community REP programs and the $200 million community generation program, and reallocated those resources.

Nevertheless, smaller initiatives were implemented before the change in government in 2019. In 2019, the MCCAC launched the Community Generation Capacity Building Program for municipalities and community-related organizations to support pre-development work on community generation projects compliant to the Small-Scale Generation Regulation. The Community Generation Capacity Building Program received 42 municipally-focused applications totalling over $7.2 million.

Twelve of these projects were selected and awarded funding by MCCAC to develop technical, partnership and training activities in order to further their likelihood of success and community benefits. The average size of generation unit explored was 8.8 MW and received an average of $195,539 in project incentive funding. Of the 12 projects selected, one was research-based, while 10 of the projects were deemed to be shovel-ready once further financing is finalized. As seen in Table 2, 75% of the selected projects were solar PV, demonstrating how the economics for solar align well with the scale of community generation.

Table 2. Summary of successful community generation capacity-building program applicants

Successful Applicant	Project Description
Vulcan Solar Project	Activities including environmental studies, stakeholder engagement, engineering, technical studies, detailed electrical interconnection studies and regulatory applications to support the development and construction of a specific, utility-scale ground-based solar installation.

Banff Geothermal Exploration Program: Renewable Electricity and Heating Feasibility Study	Feasibility study to explore heat and electricity generation from one or more geothermal energy facilities. Includes: geophysical study, permitting, subsurface analysis, power station conceptual design, preliminary engineering, economic evaluation and other.
Springbrook Solar Project	To explore the environmental and engineering feasibility of a ground-mounted solar project located in Red Deer County, on Red Deer Regional Airport land.
Longview Community Solar Project	The Village has identified an experienced project developer, professional engineering contractor and sub-contractors to aid with the scoping, design, technical studies, community engagement, financial modelling and implementation requirements that are needed to conduct the feasibility study. This will be a distribution-connected project that is planned to generate power under the Alberta Community Generation Program or to private purchasers of electricity. The Longview solar site offers an ideal location on Village-owned land that is accessible by highway on the northwest side of town, with ideal south-facing exposure and adjacent to the Fortis grid distribution system running alongside the property.
Mountain View County Solar PV Study	Update the existing feasibility study, complete an interconnectivity study and a financial assessment study for either a micro-generation or distributed generation solar PV system.
Bull Pound Solar Project	Activities including environmental studies, stakeholder engagement, engineering, technical studies, detailed electrical interconnection studies and regulatory applications to support the development and construction of a specific, utility-scale ground-based solar installation.
RenuWell Solar Development Project	Re-purposing abandoned oil and gas infrastructure for small scale generation. This project proposes to create an inventory of abandoned and orphan leases throughout the MD, rank them according to their value for community solar development and explore the potential of creating co-ops to generate power for irrigation.
Town of Hanna Renewable Energy Resource Inventory	Feasibility study to develop renewable energy resource inventory for the Town of Hanna.
Renfrew Solar Garden	Evaluation for the development of a solar voltaic generation facility that can provide power and educational opportunities for the members of the Renfrew Community Association and the City of Calgary. Renfrew is a progressive neighbourhood in Calgary with a demographic that is growing due to inner-city developments. To accommodate this added capacity and progressive way of life, a source for renewable energy will be added to Renfrew's list of community services. To reach a broad audience about the benefits of solar energy, there have been discussions with TELUS Spark science centre and the City of Calgary's Living Labs group regarding the proposed facility. It has potential to be a showcase facility for visitors to the centre and any other educational resource that is needed, considering its central location.

Oyen Solar Project	Activities including stakeholder engagement, environmental assessments, technical studies, detailed electrical interconnection studies and regulatory applications to support the development and construction of a specific, utility-scale ground-based solar installation.
Stewart Siding Solar Farm	This will include land use agreements, feasibility assessments, financial analysis, stakeholder engagement, environmental assessments and wildlife studies for a solar PV project.
Municipal Leadership on Community Generation	The Pembina Institute will develop resource materials and leadership training opportunities to build the capacity of municipal leaders (mayors, chief administrative officers and interested staff or councillors) to engage in community generation.

Data source: MCCAC[7]

In 2019, MCCAC also launched the Municipal Community Generation Challenge to help bring municipally-owned community generation projects into the mix of Alberta's energy market. The MCCAC proposed an open call for municipal community generation projects in collaboration with Alberta Innovates.

The Municipal Community Generation Program has awarded two projects.

1. Town of Smoky Lake: Métis Crossing Solar Project

   The Métis Crossing Solar Project is a collaboration between two municipal communities, the Town of Smoky Lake and Smoky Lake County, and an Indigenous community, the Métis Nation of Alberta. The Métis Crossing Solar Project will be in Smoky Lake County at Métis Crossing — a signature cultural site of Métis people in Canada. The Métis Crossing Solar Project was conceptualized as a key initiative of the Métis Nation of Alberta Climate Change Action Plan after engaging with over 300 Métis citizens across 18 Alberta communities.

2. Municipal District of Taber: RenuWell Project

   Rapid technological innovation in world-wide energy systems is creating unforeseen obstacles and opportunities. In southern Alberta, production is declining in conventional oil and gas fields leaving companies and landowners burdened with massive reclamation liabilities. At the same time, renewable energy developers, attracted to the world-class wind and solar resources, are competing for access to agricultural land. The Municipal District of Taber: RenuWell Project will demonstrate how re-purposing legacy oil and gas infrastructure to community solar development can provide significant benefits to both energy industries, the environment and the economy. The widespread deployment of this concept will position Alberta as a world-wide leader in energy diversification.

Ultimately, for greater scale in community generation development, program administrators and participants alike identified the need for offtake agreements to enable project financing, beyond the small capital supports available through provincial programming. This renewable energy demand would create much needed "pull" for community generation, taking up the slack that was created when "pushing on the rope" of community generation projects through capacity-building and capital supports.

[7] Municipal Climate Change Action Centre. Community generation capacity building program (2019). https://mccac.ca/programs/community-generation-capacity-building-program/

Communities that are geographically isolated from the bulk transmission system and/or natural gas network, often referred to as rural, remote, or off-grid communities, present a unique challenge in renewable energy procurement. Relying on diesel for heat and power, many of these communities are looking to renewable energy sources and implementing energy efficiency in housing to combat rising fuel costs and the environmental and health impacts of unabated fossil fuel generation. The economic case for clean energy projects is driven by a balance of the upfront capital cost of these clean energy systems relative to the avoided cost of the diesel generation that it is displacing, including the adverse health and environmental effects that come with it.[8]

The Three Nations Energy solar farm in Fort Chipewyan, a remote community in Alberta, is jointly owned by the Athabasca Chipewyan First Nation, Mikisew Cree First Nation and the Fort Chipewyan Métis Local 125. Electricity from the project is purchased by ATCO under a PPA and distributed via the local electricity grid. The project eliminated the need for 800,000 L of diesel that is shipped up to the community by ice road every year, decreasing emissions and lowering the risk of a spill due to the lower number of shipments required. The $7.76-million solar farm was jointly funded by the Government of Alberta and Natural Resources Canada. Reduction in diesel consumption brought on by the solar farm avoids the cost for additional storage tanks, saving money for both the community and the Alberta rate payer.

3.3 Community renewable energy purchasing: communities as buyers

Municipalities have also appeared on the other side of the renewable energy investment coin, as buyers. The earliest, best-known initiative began in the early 2000s when the City of Calgary contracted ENMAX for RECs from wind farms to power the C-Train renewably. Ultimately, Calgary expanded these fixed-rate REC purchases to cover the City's corporate electricity consumption. These initiatives predated the innovation of vPPAs with CfDs in the Alberta market, but illustrate the long-standing interest of municipal leaders in renewable energy use and how municipal consumption can be used to support new, net-to-grid off-site renewable investment.

This interest recently resurfaced in the context of Alberta's C&I market boom when, in 2022, the City of Edmonton announced the first-ever vPPA for new renewable energy by a municipal buyer in Alberta. After a competitive procurement process, the City signed PPAs for energy from 32 MW of solar and 78 MW of wind capacity. Together, the contracts will allow the City of Edmonton to operate on 100% renewable electricity for the next 20 years. The City was able to achieve this due to having a large enough electricity load to secure developers, and the funds and scale to justify engaging expert consultants.

Edmonton's leadership in procuring renewable energy to meet climate commitments shows how communities can view renewable energy purchasing in somewhat the same way that ESG-driven corporations do. Other municipalities have also expressed climate-oriented motivations for procuring renewable energy, while also seeking to mitigate against the rising carbon costs embedded in carbon-intensive grid electricity. They have watched Edmonton's experience closely.

[8] This is sometimes referred to as the *true cost* of diesel, which reflects both the financial value of operating the diesel plant — fuel, transport, labour, and maintenance — as well as the burden on the community — health risks caused by air pollution, risk of spills, cost of remediation, and societal costs related to climate change. Source: Dave Lovekin, Dylan Heerema, *The True Cost of Energy in Remote Communities* (Pembina Institute, 2019). https://www.pembina.org/pub/diesel-true-cost.

3.4 Scale as a barrier to more renewable deals

The biggest barrier that communities encounter when seeking to participate in the renewable energy procurement boom is scale. This challenge appears from both sides of the procurement coin: as generators when community projects are individually too small to attract a large buyer; and as buyers when a community's electricity consumption is too small, on its own, to cost-effectively undertake procurement.

The barriers to deals with small community generators

On the generation side, economies of scale are inherent in project economics, particularly with respect to wind energy. The most economic wind projects involve multi-MW turbines and multiple turbines per project. No standalone wind project under 100 MW has been built since 2016, and all but one of the 14 projects slated to begin operations in 2023 are also over 100 MW. As shown in Figure 9, the simplest form of renewable energy procurement occurs when a buyer's load matches a utility-scale project size. In practical fact, though, wind project sizes — and the larger energy volumes they produce because of capacity factors that are typically at least twice that of solar — have trended so large that developers have now begun to stack more than one deal for proportions of the same project. Second deals were announced for three different wind projects in 2022.

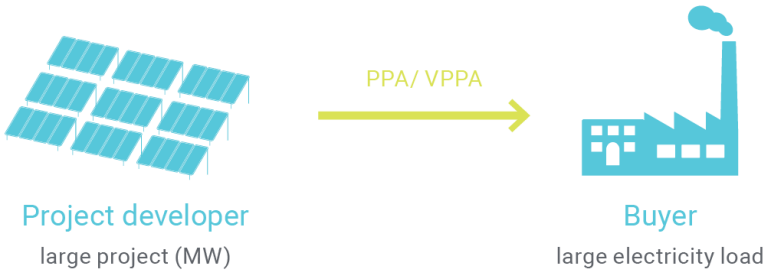

Figure 9. Power purchase agreement between a large buyer and large project developer

More modular in their design, solar projects achieve economies of scale at much smaller project sizes, which explains the proliferation of many small solar projects alongside much larger projects. So, while wind projects tend to come in the nine digits of upfront investment capital, economic solar projects can more typically fall in-range for community participation. Moreover, because of their suitability to smaller scales, they can fit into other attributes of community generation, like being near communities, integrating into the built environment, and connecting to lower-voltage distribution networks.

But smaller scale community projects encounter an additional barrier when facing the merchant risk impediment to renewable energy investment: being too small for large C&I buyers. This manifests in two ways:

1) Large C&I buyers typically seek larger deals to meet their electricity consumption and offset needs.

2) Deals themselves can be complex and time-intensive commercial arrangements and need to be a minimum size to overcome transaction costs such as legal fees, intermediary and expert fees, and staff time.

Indeed, only two of the 28 C&I deals announced since the start of 2019 were for less than 25 MW of capacity, and all 28 have been over 20 MW. The average of all deals announced to-date is 76 MW, with most of the solar deals falling between 25 and 75 MW and most of the wind deal volumes above 75 MW, as shown in Figure 10. There is more appetite in the voluntary market for smaller deal sizes (which partially explains why the

voluntary market is also disproportionately keen on deals with solar energy), with commercial entities seeking less volume for building electricity consumption than industrial facilities typically seek to offset their on-site emissions.

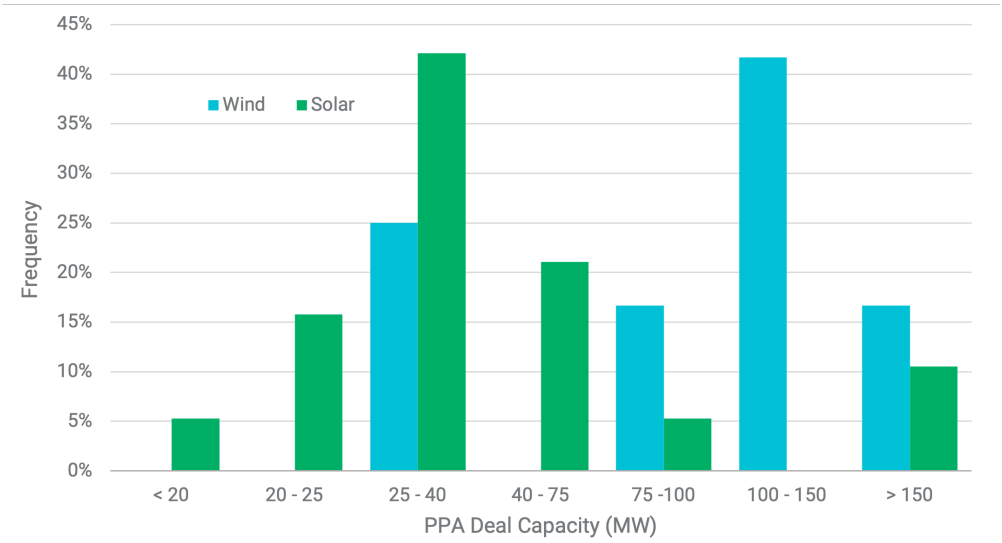

Figure 10. Frequency of corporate power purchase deals by volume, 2019 to 2022

Data source: BRC Canada (not public)

Community generation is typically small enough to connect to the distribution system — indeed, this is part of the definition supplied in Alberta's Small Scale Generation Regulation. That limits community generation to a maximum of around 20 or 25 MW, but even these sizes would require several tens of millions of dollars of upfront capital investment, a stretch for most community entities. As such, there is very little overlap between the minimum size of deals in the C&I market and the maximum size of community generation projects.

The barriers to deals with small community buyers

Smaller buyers face similar challenges in their incongruity with the size of economic renewable energy projects and the transaction costs of complex commercial negotiations and agreements like vPPAs. However, some innovative mechanisms have been developed to mitigate these impediments.

If the most economic project is a much larger wind project, for example, a smaller buyer will not subscribe enough of the energy production to enable a developer to finance the project. A developer will not be able to commit to the completion of the project unless it reaches the threshold of offtake necessary to mitigate merchant risk and secure financing. The buyer, then, would be investing effort and resources in negotiating and designing an agreement for a project that might not come to fruition, a risk that many small buyers cannot afford to take.

In part, this explains why the voluntary C&I market buyers, with their commonly smaller demand for environmental attributes, have been more attracted to smaller-scale solar projects. But we have also now seen examples of smaller buyers piggybacking on larger buyers through deal stacking (described in s. 2.3.1) or buyer aggregation within a single deal. There are now two examples of the latter, both involving RBC and Bullfrog, with one of the deals also adding Shopify on the buyer's side of the ledger. This has the benefit of buyers bringing enough offtake demand together to meet the threshold necessary to make a new project financeable. Buyer aggregation to pool demand and achieve sufficient scale is illustrated in Figure 11.

Figure 11. Power purchase agreement between a large developer and several small buyers

The Alberta C&I market has also seen an example of project aggregation within a single deal, whereby a single developer brought one wind project and one solar project into a deal with a single buyer. The fact that it was only one developer would have mitigated the transaction costs inherent in aggregation, enabling this option. Nevertheless, these examples of aggregation of both buyers and generation projects demonstrate the real-world potential for a key solution to the community renewables scale barrier to financing projects through vPPA deals: aggregation.

4. IN THEIR OWN WORDS: COMMUNITIES' VIEWS ON RENEWABLE ENERGY PARTICIPATION

Every community is in a different position when they consider using and developing community generation. While some have participated directly in community generation development or renewable energy procurement, others have hardly looked at these options. But in a province with an emissions-intensive grid like Alberta's, electricity consumption is too significant a part of emissions profiles and carbon pricing risk to ignore. Participation in community generation can offer meaningful opportunities to advance climate action, community resilience and local economic development.

So, in an era of increasing awareness and attention to climate change, as well as rising costs of relying on emissions-intensive electricity, many communities have considered renewable energy participation as part of developing climate action plans or building resilience against rising carbon prices. However, overall participation has been relatively small to-date, particularly by comparison to the active renewable energy development boom underway. It is important to understand what barriers interested communities — and particularly, local champions pursuing climate action — meet when considering participation in community generation. It is essential to seek input from and speak directly to interested and motivated communities when developing solutions to common barriers.

4.1 Survey and interview methodology

Municipalities and community organizations across Alberta participated in a voluntary survey related to their experience with and views on renewable community generation. Several respondents were also interviewed, providing further insight into the barriers that communities face in endeavouring to meet climate goals, and the support that they need to achieve them.

Initial surveys were distributed to key stakeholders to gauge interest and level of understanding in the different approaches of renewable energy development and procurement. Key stakeholders were identified as participants in the MCCAC's Community Generation Capacity Building program, Municipal Community Generation Challenge, Alberta Municipal Solar Program, and Municipal Energy Manager program.

Survey questions were mostly multiple choice, with some opportunities for respondents to clarify or expand on responses with short, free-form answers. The survey received 34 responses from 29 unique municipalities and two from community organizations cross Alberta, illustrated in Figure 12.

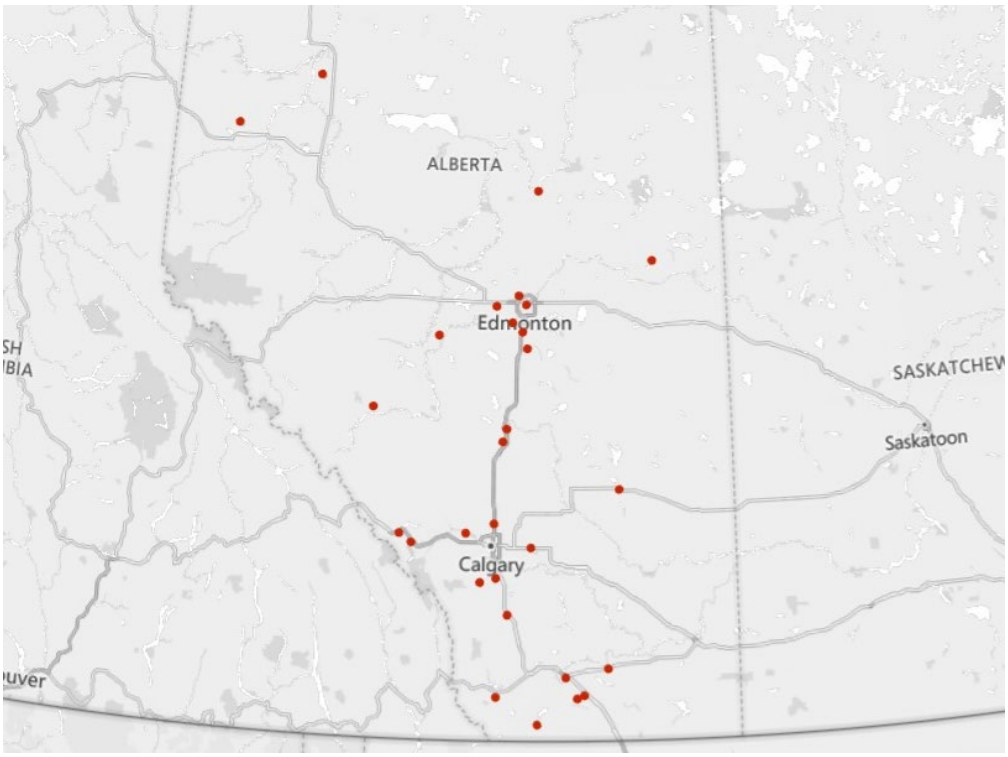

Figure 12. Geographic dispersion of survey respondents

Among the municipalities that responded, the majority were towns with fewer than 10,000 residents, but particularly larger towns with over 1,000 residents, as shown in Figure 13. The second most common category were large towns and small cities.

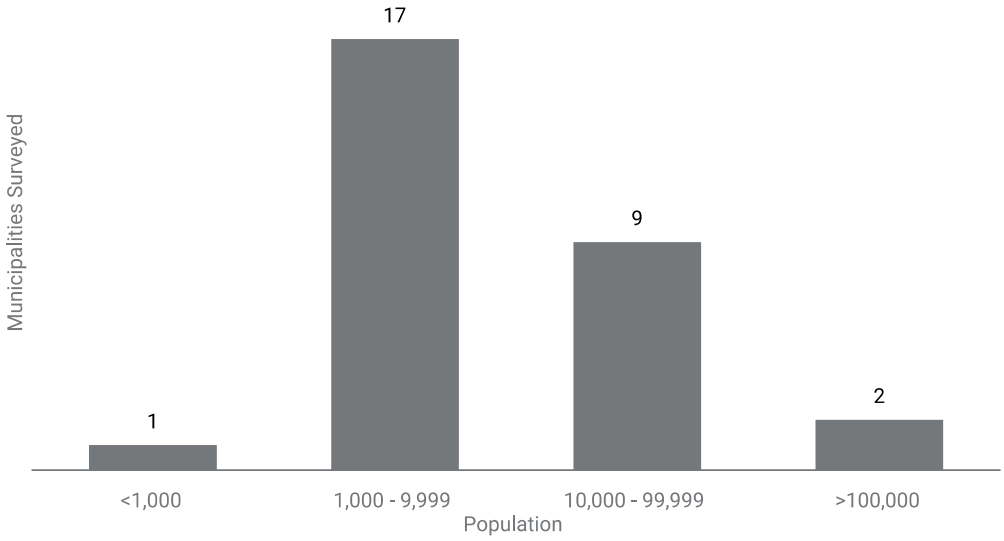

Figure 13. Population distribution of municipalities surveyed

Data source: Wikipedia

Of the 36 survey respondents from both municipalities and community organizations, 11 agreed to be interviewed for a deeper dive into their experiences with renewable energy procurement. The interviews

were more semi-structured, enabling interactive and iterative discussion and deeper perspective-sharing on topics that were particular priorities for communities. Interview questions focused on:

- challenges and barriers the municipalities face in achieving their carbon reduction targets
- types of renewable energy procurement and emissions-free power they are interested in
- methods or mechanisms of support that would help achieve their goals
- past experience with grants and other funding sources: what has worked, and what caused issues.

4.2 Interest in and barriers to renewable energy participation

Through the survey responses and interviews, community representatives expressed strong understanding of and motivation toward the intersectional economic, resiliency and climate opportunities of renewable energy, as reflected in the word cloud image of the survey responses, in Figure 14. In particular, they are attracted to the local benefits of community generation. However, direct participation in renewable energy through community generation development or renewable energy purchasing faces daunting barriers, particularly for smaller and resource-constrained communities.

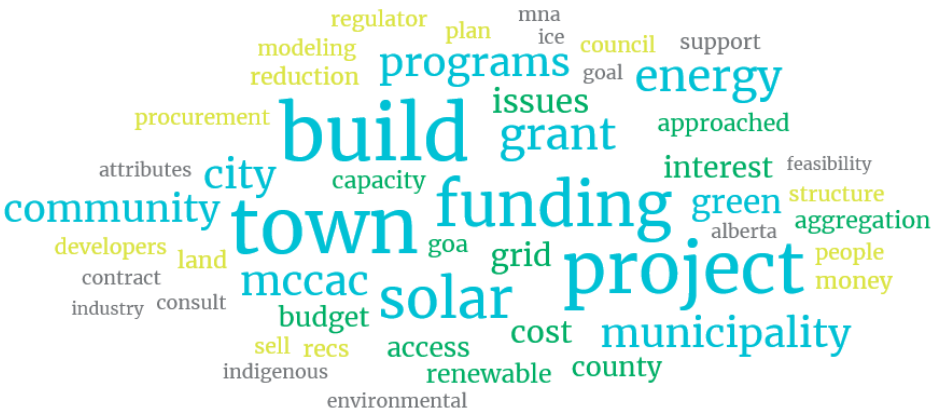

Figure 14. Word cloud of survey responses

Municipal emissions reduction targets have become more common in Alberta, particularly since programming administered by the MCCAC has built municipal capacity for climate action. However, many municipalities have still not made emissions reduction targets. Among those that have, some municipalities recognize that they are now outdated and not compatible with international commitments like net-zero 2050 (e.g., 80% renewable energy by 2050). Others have not yet published their commitments in writing. Fewer still have made net-zero commitments or targets.

Despite this, non-emitting power is widely recognized as an opportunity — typically an important one — for municipal emissions reductions. Of the 18 municipalities surveyed that have an existing emission reduction target or climate action commitment, half believe that emissions-free power is very important in meeting those targets. The other half believe that it is at least slightly important in achieving their climate action goals.

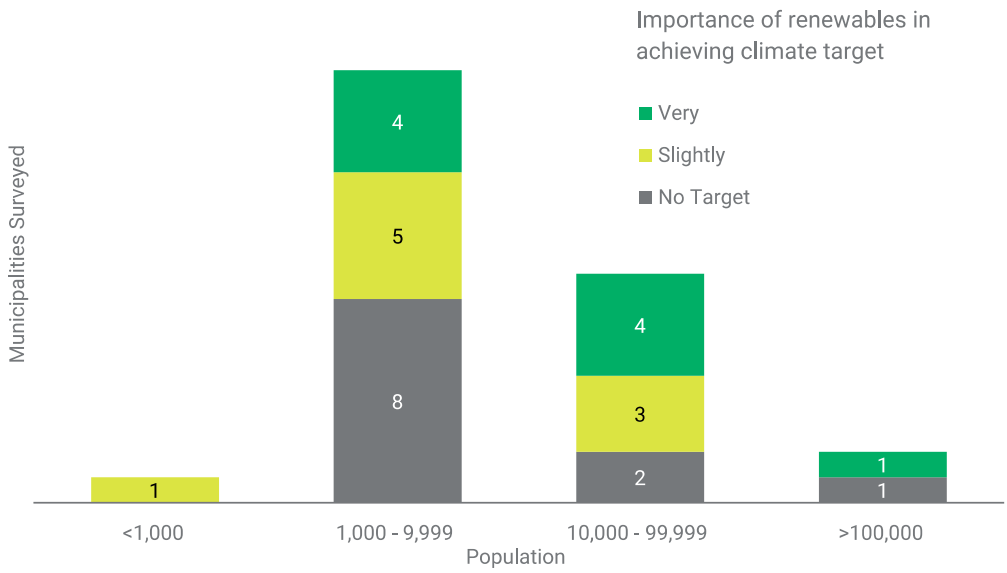

Figure 15. Municipal views on the importance of renewables by population

Moreover, the interactive interviews made clear that renewable energy — particularly local and community generation — bring additional community benefits and opportunities of interest to municipalities.

However, municipalities in all three categories (those who believe emissions-free power is very important to meeting their emissions reduction targets or climate action commitments; those who believe it is only slightly important; and those who do not have such targets or commitments) have encountered barriers to participating in renewable energy.

When asked about barriers to procuring renewable energy for municipal consumption, the most common barriers cited across all three groups were the cost and the complexity of the procurement process, as shown in Figure 16. In interviews, it was revealed specifically that municipalities lack the resources to tackle those cost and complexity barriers.

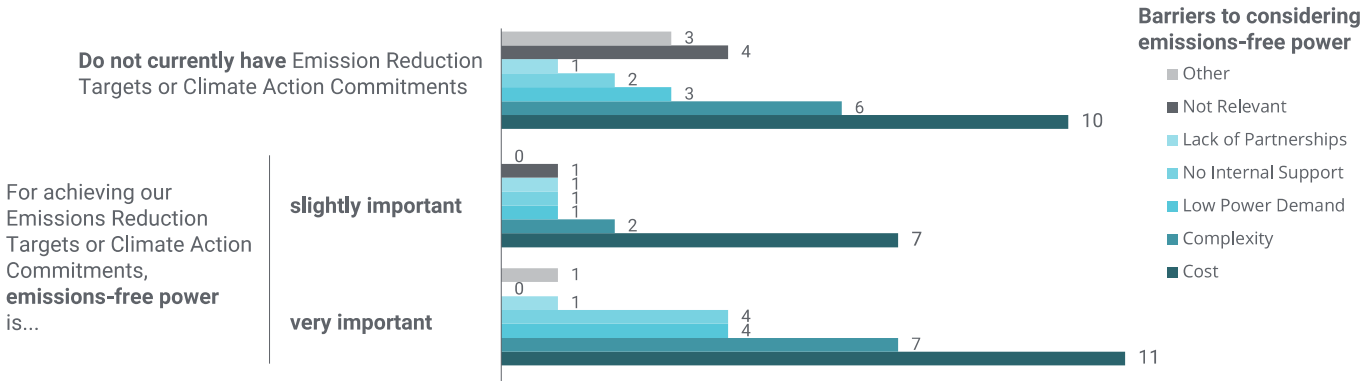

Figure 16. Survey results: Barriers to municipal renewable energy procurement

The common reference to "cost," specifically, is notable and worth probing further. The private-sector C&I market for renewable energy procurement, reviewed in section 2, has demonstrated the cost-effectiveness of this approach to emissions reductions. Indeed, there is evidence that buyers are presently earning substantial revenue from their CfDs with renewable developers. This finding, then, suggests either an education gap in understanding the economics of vPPA-type contracts for renewables or out-dated

perspectives on renewable costs. Or, it could speak to cost barriers that do not relate to the costs in the vPPA contract (the CfD payment obligations), but rather the costs of designing, developing, negotiating and executing vPPA contracts (transaction costs).

The latter interpretation corresponds well with the second most cited barrier, complexity. If the cost barrier municipalities encounter are transaction costs, this relates directly to the complexity of renewable energy procurement. The type of vPPA contracts with CfDs that are particularly cost-effective (because they mitigate cost of capital for projects, as reviewed in section 2.3) are, indeed, complex commercial arrangements. The resource (financial, staffing, expertise) constraints of smaller municipalities are difficult to match against the complexity of running procurement processes to choose lowest-cost providers and of designing and negotiating resulting agreements.

This barrier relates directly to the third most cited barrier — low power demand. Only where the amount of power to be purchased rises to the scale to justify a vPPA for an economic solar or wind project might the overall effort (including transaction costs) prove cost-effective as an emissions reduction option for communities.

Municipalities also had the costs of direct development expenditure (not only procurement) in mind, recognizing that it is difficult for them to access capital for upfront investment of projects. And they also noted other barriers to directly participating in development, such as the need for ministerial approval of municipally-owned projects under Alberta's Electric Utilities Act, which creates red tape, challenges and delays. Other red tape issues relating to regulatory processes and approvals were referenced, noting that any project over 5 MW is treated the same as a 500 MW project, posing unnecessary burdens for projects at the "community" scale.

Interviewees noted the complexity of any renewable energy effort, whether procurement or development, trying to navigate and coordinate timing around community engagement, environmental approvals, project supply chains and construction, and offtake agreement, all of which have to come together in harmony. Linking this to aggregation, they noted that aggregation could actually increase the complexity, because it would require all actors to be on the same page, adding to the transaction costs of the initiative.

With respect to vPPAs, specifically, interviewees noted that municipal budgets are often balanced very marginally, so they are unable to cushion unforeseen costs. As such, because the variable costs of vPPAs make them difficult to forecast, they are tough to bring into municipal budgeting. This feedback assumes that municipalities are already hedged against the costs of future electricity consumption, because electric energy costs are themselves very unpredictable and vPPAs vary inversely to market electricity costs. In this way, a vPPA can help to hedge the uncertainty of floating electricity costs over years.

One interviewee expressed an interest in having another entity assume the market risk and supply consistent energy costs to the municipality, for which the other entity could receive the potential upside profit of the vPPA. This idea suggests an interest in incorporating energy from renewable energy into their overall, fixed-rate electric energy supply package, rather than procure renewable energy separately.

4.3 Municipal perspectives on aggregation to facilitate community generation development and procurement

Naturally, then, the concept of aggregation to support the development or procurement of cost-effective renewable energy was an opportunity of interest to many municipalities. However, it is evident that more education and information-sharing around the opportunities of renewable energy offtake agreements would support further municipal consideration of these opportunities.

A small minority of survey respondents (four) indicated a total lack of interest in aggregation to facilitate renewable energy development or purchasing by municipalities. A plurality (13) indicated they required more information before being able to assert a perspective on their level of interest.

The remaining half of all communities (19) expressed an interest in aggregation either to achieve the scale to develop renewable energy projects and to purchase renewable power, or to develop renewable power alone. The interest in developing renewable energy locally (and not just participating in renewable energy purchasing) was strong across the board for those interested in aggregation, as shown in Figure 17, with every such respondent including on-site solar and/or wind energy in the list of renewable energy options they would consider.

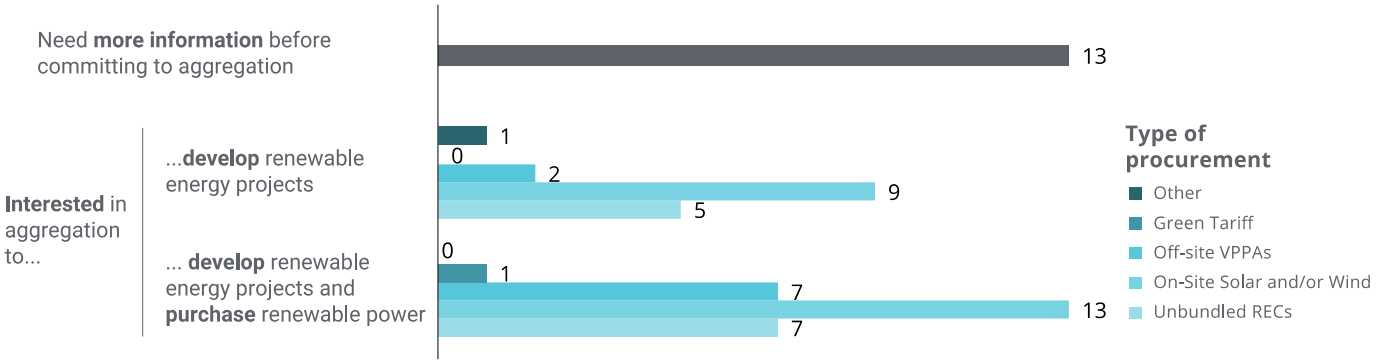

Figure 17. Survey results: Municipalities' views on aggregation for development and purchase of renewable power

The interest in local development also emerged clearly in the interviews. Various economic development gains of local investment were frequently cited as additional benefits that made on-site development most attractive. Because on-site projects tend to be relatively small, it is also not a surprise that community interest would be linked to aggregation, to achieve the scales necessary to facilitate corporate or institutional offtake deals.

Municipalities that were interested in aggregation to purchase renewable power were equally interested in off-site vPPAs and unbundled RECs (a form of REC purchasing that does not involve a long-term CfD through a vPPA). Among those that do not look to aggregation to aid renewable power purchasing, unbundled RECs were preferred over off-site vPPAs. This makes sense because scale is not typically a barrier to unbundled REC purchases: REC suppliers already exist to enable even small consumers to purchase their electricity "renewably."

However, larger corporate and institutional investors have demonstrated the clear financial benefits for electricity consumers to engage in off-site vPPAs over unbundled RECs, as detailed in section 2. The environmental attributes have come at lower cost through vPPAs, the contracts provide a valuable hedge against electricity and carbon price increases, and the vPPA more clearly supports the additionality of the directly linked renewable energy project, bolstering the claim of emissions reductions and environmental benefits.

This gap reveals the need for better information and education for municipal administration and leadership around vPPAs and aggregation and the opportunities they offer. While most respondents were at least somewhat familiar with the concept of vPPAs, the majority expressed an interest in learning more, as shown in Figure 18, with over 60% of respondents indicating they were not, or only somewhat familiar with, vPPAs or PPAs. Many also expressed an interest in learning about aggregation. Fewer expressed an interest in learning more about unbundled RECs, which are already a commonly commercially-available product.

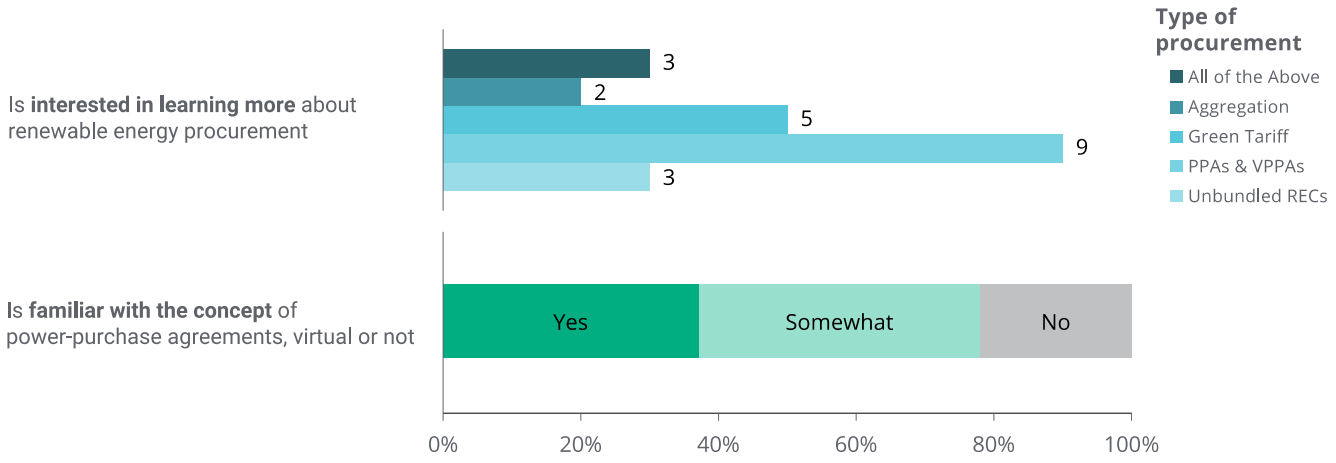

Figure 18. Survey results: Familiarity with and interest in power procurement mechanisms

The desire for education and information sharing extended beyond the technical expertise that administration needs to pursue renewable energy initiatives. Interviewees pointed to the need for greater understanding and myth-busting for community leaders, such as municipal council members, who may be hesitant toward clean energy initiatives due to outdated information or data related to the cost of renewable energy. The fact is that renewable energy is now cost-competitive with new thermal generation, even without carbon pricing.[9]

4.4 Ideas for solutions

The desire and need for further information and education should not come as a surprise. Particularly in smaller municipalities — those whose smaller scale makes them most in need of aggregation — the relevant municipal staff responsible for energy management and climate action can have very wide-ranging responsibilities, including pressing day-to-day operational tasks like ensuring facility energy needs. Many interviewees spoke to the long timelines, complexity and need for expertise in pursuing renewable energy purchasing or development. There was a commonly repeated request for assistance in the form of roadmaps and access to expertise (consultants, contract managers, technical and legal experts) and stable sources of funding to pursue options over the full life cycle of purchasing or development processes.

Alberta already has good experience in supporting and building capacity for community climate action. Interviewees gave consistent praise for MCCAC's history of program administration in terms of its broad eligibility, accessibility and easy application processes. Similar praise was heard for the Indigenous Clean Energy Network's efforts in providing expertise and capacity-building, including connecting applicants with experts to help navigate the complicated regulatory processes in developing renewable energy projects. Interviewees recommended publicly funded consultants to remove barriers for municipalities that lack capacity.

Conversely, communities have had experiences with other funding sources that have had cumbersome application processes and steep requirements. They have also seen where applications for project capital funding required sophisticated and expensive modelling to prove project financial viability — there is often a lack of capacity to meet these requirements, and outside consultation is too expensive. Communities have also had challenges with capital funding programs that require environmental attributes to be waived or

[9] Clean Energy Canada, *A renewables powerhouse* (2023). https://cleanenergycanada.org/report/a-renewables-powerhouse/

forfeited to the funder, making applicants legally unable to say they reduced their emissions or to improve the finance-worthiness of their project through offtake agreement.

> *"There are currently 110 programs available on Climate Action through the federal government. There isn't a lack of funding, but rather the lack of the right funding: a mismatch between funding and project."*
>
> — Metis Nation of Alberta

Interviewees expressed strong support for a web page, online forum or some other space to connect municipalities, developers and other collaborators, in particular to learn and forge partnerships around community renewable energy procurement and development. Many felt that a slate of recurring meetings would be helpful, as well as a clearinghouse of information such as a repository of studies, RFP templates and other documents, such as step-by-step processes for development and regulatory processes (one interviewee recommended something like the Here Comes the Sun report,[10] but geared toward municipal or community generation).

[10] Rebecca Kauffman, *Here Comes the Sun: Solar Law in Alberta* (Environmental Law Centre (Alberta) Society, 2021) https://elc.ab.ca/wp-content/uploads/2021/08/Here-Comes-the-Sun-Solar-Law-in-Alberta-August-2021.pdf

5. MECHANISMS FOR ENABLING COMMUNITY RENEWABLES

As noted above, renewable energy procurement agreements are complex and there is a mismatch between their transaction costs and the scale of both community generation and community electricity demand. To help uncover solutions, a scan of successful mechanisms to overcome these barriers was conducted, including many foreign and domestic jurisdictions, detailed further in Appendix A. Precise, on-point examples are few and far between. Nonetheless, there are examples that illustrate analogous concepts in different settings, including:

1) A municipality that procured a project developer for a solar site on local municipal land and purchased all of the energy under long-term contract
2) A number of examples of buyer aggregation, including one that involves multiple municipalities as buyers alongside corporations and institutions, all pooling their demand
3) A mechanism for aggregating buyers through a central authority, utility or procurement agency
4) An Alberta example of municipal buyer aggregation mediated through a central agency for the purchase of conventional (not necessarily renewable) electric energy

Notably, no example was found that aggregates community generation for vPPA offtake.

5.1 Acquiring renewable energy through integration with local land use

Municipalities often have access to land, a crucial resource for renewable energy development. One Alberta example is the Innisfail Solar project, which was developed on land owned by the Town of Innisfail. The Town acquired the land with plans for future development, but updates to the growth plan during the economic downturn of the late 2010s meant that the land would not be developed for many years. To make profitable use of the land in the meantime, the Town leased the land to Elemental Energy for a 22 MW solar project, which began operations in 2020. The Town earns lease revenue and property tax from the project, and because of a community benefits agreement between the developer and the Town, the project qualifies as a "community generation" project under Alberta's Small Scale Generation Regulation.

Holliston, a large town of around 15,000 people in Massachusetts, took the concept of municipal land for renewable energy development a step further. Using an exhausted landfill space that would not have other productive uses, the Town ran a request for proposals for a solar project developer on the site, resulting in a 3.2 MW solar project along with a 1.25 MW battery, by Sol Systems. As part of the contract, the Town entered a long-term PPA to purchase the energy from the project, providing an offtaker for the project, which facilitated its financing.[11] The project's annual generation nearly fulfills the Town's annual electricity consumption, while earning around $373,500 in annual lease revenue and $57,700 in property tax revenue from the project.

Although their regulations with respect to utilities is different, Alberta municipalities would also be able to act as an offtaker for a renewable energy project on municipal land, by entering a vPPA to secure RECs for the municipality. Such an agreement would support renewable energy project development on underused municipal land, creating a win-win where the municipality earns land lease and property tax revenue while supporting local economic development and using renewable energy for its electricity needs.

[11] Chris Cain, "Let The Sun Shine and the Electricity Flow," *Holliston Reporter*, January 23, 2021. https://hollistonreporter.com/2021/01/let-the-sun-shine-and-the-electricity-flow/

5.2 Municipal buyer aggregation

A jurisdictional scan of aggregation of buyer demand for renewable energy found 15 interesting initiatives to review, undertaken since 2017, as detailed in Appendix A. Most (eight) were examples of corporate aggregation, but nearly half were led by or included at least one municipality (two), university (two), regional utility (two) or non-profit (one). Most initiatives were located in the United States, where there is an active, dynamic and voluminous C&I market for renewable energy offtake, though two were in Australia and one in the Netherlands.

The size of the renewable energy projects enabled through these buyer aggregation initiatives ranged very widely from very small local projects (0.9 MW) — more commonly involving smaller municipal and institutional buyers — to very large utility-scale projects (500 MW) — more commonly involving aggregates of corporations. Whereas global corporations that are active in renewable energy procurement (like Microsoft and Amazon) are able to act as offtakers on large projects of their own accord, small- and mid-sized corporations, as well as municipalities and institutional buyers, tend to form partnerships with similarly-sized and goal-oriented peers in order to distribute risk and reduce costs. Typically, small buyers must either finance smaller-scale projects and miss out on shared knowledge and economies of scale, or they must find larger and more experienced partners.

One initiative in the scan deserves particular attention for its applicability, given the municipal participation involved: the Melbourne Renewable Energy Projects (MREP). The first initiative was formed in 2017 with the City of Melbourne's goal of leading a partnership group to purchase renewable energy from — and thereby support financing for — 110 GWh/yr of wind power within Australia's competitive energy market, not entirely dissimilar from Alberta's. The group included several municipalities and institutions and ultimately secured 88 GWh/yr of wind energy from nearby regions through a competitive procurement, enough to run all municipal operations with 100% renewable electricity.

The initiative was so successful that champions and organizers undertook MREP II with the same wind energy goal, but broadening the buyer aggregation to bring in other large local energy users like shopping centres, offices and manufacturing facilities. By bringing in more diverse buyers and undertaking information dissemination activities, MREP II heightened the educational ambitions, including by documenting the learnings of the effort with a guide of findings for purchasing "large scale, off-site, grid-connected renewable energy."[12] The guide serves as a useful how-to on municipal, institutional and corporate renewable energy purchasing agreements.

The MREP initiative provides an interesting model for buyer aggregation that enables smaller municipalities to participate in purchasing renewable energy in a competitive deregulated power market not unlike Alberta's. It also points to a key factor for success that has not emerged yet in Alberta: an anchor buyer that can champion the initiative and undertake the organizational and transactional effort. Melbourne, a city of over 5 million people, has the resources and electricity consumption to carry out the initiative alone. But in bringing more consumers into the fold, Melbourne amplified the impact of its purchase and perhaps also accessed further economies of scale by adding to the procurement. For Melbourne, the aggregation aspects of the MREP would surely have added to the upfront effort for organizing, negotiating, and designing the initiative. But aggregation contributed further to the initiative's goals by adding to the environmental benefit, broadening the participation, and possibly even securing lower-cost renewable energy.

[12] Melbourne Renewable Energy Project, Renewable Energy Procurement: A guide to buying off-site renewable electricity (2017). https://www.melbourne.vic.gov.au/sitecollectiondocuments/mrep-guide-renewable-energy-procurement.pdf

5.3 Subscription green tariffs' role as buyer aggregators

Another important example of renewable energy buyer aggregation results from programs designed to enable corporate procurement in electricity systems with conventional, regulated, vertically-integrated utilities. Green tariff programs have proliferated across these types of jurisdictions in the United States (including at least 17 states with subscription-model green tariffs) and are now being pursued in Nova Scotia (Green Choice Program) and actively being developed in Saskatchewan (Renewable Partnership Option). They involve long-term PPAs between utilities and renewable energy project developers with the costs (set price for power, plus system access charges) and benefits (environmental attributes and hedge against rising costs of emitting power) passed to interested consumers via the utility.

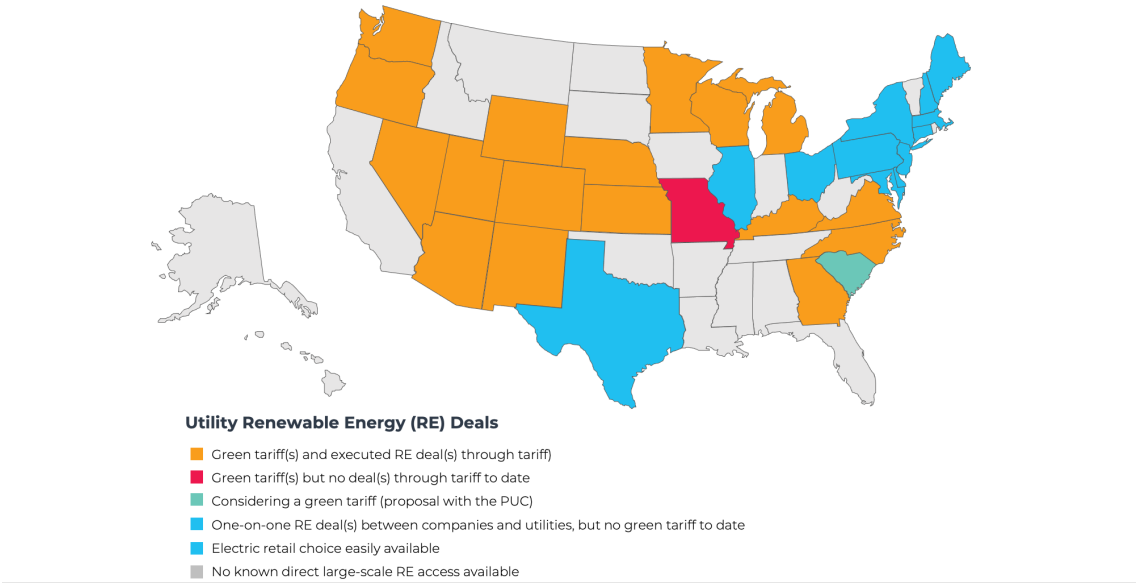

Figure 19. Green tariff programs, active and under consideration, in the United States

Source: Clean Energy Buyers Association[13]

As such, the central objective of these programs is to foster C&I offtake in regulated markets, to replicate the opportunity in deregulated markets like Alberta's. However, a corollary benefit of one type of green tariff — the subscription green tariff — is aggregation of buyers. Subscription green tariffs use a central procurement authority to contract for new renewable energy. This can be the monopoly utility, but it can also be a purpose-built or purpose-contracted organization, like with Nova Scotia's use of a procurement authority. With a single central authority running the procurement, the program is made available to any qualifying buyers. The number of subscribers and their volume of consumption then drives the procurement volume. The environmental attributes, along with the costs of the procurement and system access for the renewable energy project, are then passed to subscribers, displacing their default electricity costs.

Though the main purpose is to enable C&I offtake agreements in regulated systems, the outcome is buyer aggregation. For this reason, subscription green tariffs are particularly adept at serving renewable energy demand from customers that are individually relatively small. Though the Alberta market does not need green tariffs to enable renewable energy procurement per se, the subscription green tariff offers a model for a central organizing authority to facilitate buyer aggregation.

[13] Clean Energy Buyers Association, "Green Tariffs." https://cebuyers.org/programs/education-engagement/green-tariffs/

5.4 Institutional buyer aggregation: Alberta Schools Commodities Purchasing Consortium

The Alberta Schools Commodities Purchasing Consortium formed in 2005 to help member school boards reduce their exposure to electricity price volatility.[14] They did this by fixing electric energy costs through long-term power purchase contracting (PPAs), helping school boards to hedge against rising energy costs. The energy price stability is crucial for school boards to budget without suddenly responding to energy costs through cuts to core services.

After nearly a decade of conventional power purchase contracting for school boards, the consortium ran a competitive process to select a wind development partner, ultimately selecting BluEarth Renewables' Bull Creek Wind Facility.[15] Bull Creek's 29 MW became operational in 2015, supported by the PPA offtake with the consortium, which mitigated merchant risk for the project and enabled financing.

This is a relevant example of aggregation of small buyer demand to attain the size of renewable power needs to enable a utility-scale renewable energy project.

5.5 Conventional (null) electricity buyer aggregation in Alberta

A relevant example of municipal electricity buyer aggregation occurring in the Alberta electricity market is Power+ created by Alberta Municipalities.[16] The combined purchasing power of the 120+ municipalities has enabled the group to negotiate prices well below those any individual municipality could access on the open market.[17]

The primary goal of Alberta Municipalities Power+ is to create value for members by achieving long-term budget certainty at a low total cost. They facilitate the process of connecting energy supply to the aggregated buyer group via public procurement. Aggregation has always been a foundational principle. By working together, the group's participants access bidders that range from renewable project developers, financial institutions, and global conglomerates, in addition to local generators and energy retailers. This competitive pricing environment results in lower electricity prices for Power+ participants.

Power+ manages to further reduce costs in many ways. PPA pricing is unlocked though long-term contracts. Alberta Municipalities centralizes expenses, paying for the resources and expertise needed to plan, design, and negotiate these complex commercial transactions. It then recovers the investment via fees while ensuring that the total cost is still lower than what members can achieve through traditional independent procurement approaches.

Large volume buyers and aggregators typically purchase wholesale electricity. Alberta Municipalities, however, is continually improving its approach and is in the process of purchasing electricity further upstream. By purchasing directly from generators and project developers, it can reduce prices below wholesale rates by avoiding markups along the supply chain.

While Power+ has not focused on renewable energy, the procurement approach has been open to competitive bids from any generation source.

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[14] BluEarth Renewables, "Bull Creek Wind Facility." https://blueearthrenewables.com/projects/bull-creek-wind-facility-2/

[15] "Bull Creek Wind Facility."

[16] Alberta Municipalities, *Power+ fact sheet* (2022). https://www.abmunis.ca/system/files/2022-03/ABmunis%20Fact%20Sheet_Power%2B_0.pdf

[17] Information in this section was provided by Alvin Law, Alberta Municipalities, personal communication, September 14, 2022 and March 22, 2023.

Based on direction from participants, Power+ continues to evolve and is considering opportunities to support community generation. It will achieve this through aggregated purchasing, enabling members to buy from each other's community generation projects, including from renewable sources.

Alberta Municipalities works hard to enable member innovation and participation in the energy industry. The idea of forming buyers' groups and sellers' groups and simplifying collaborations between industry and municipalities, and between municipalities and municipalities, is fundamental to that work. To date, Alberta Municipalities has achieved numerous milestones through Power+:

- Established a buying group (over 120 participants currently) who have authorized Alberta Municipalities to act on their behalf in a trade compliant procurement process
- Attracted 15 bids from a range of local and international project developers, generators, financial institutions, and other market participants
- Answered municipalities who called for lower-cost electricity by aggregating demand and accessing stable, long-term pricing at levels below the wholesale market

Although not strictly focused on renewables, Power+ has demonstrated the interest of municipalities in working together to obtain lower energy prices. Just as importantly, it has shown that with expertise, aligned visions, and coordination of resources, a framework for long-term solutions can be created, enhancing value for municipalities and industry.

6. RECOMMENDATIONS AND NEXT STEPS

Thanks to the importation of innovations in commercial transactions of private sector electricity offtake agreements, Alberta's electricity system is quickly decarbonizing through the rapid deployment of new renewable energy investments. Many Alberta communities have shown clear interest in participating in both the local economic development benefits of building renewable energy and the climate action benefits of using renewable energy.

However, communities encounter serious obstacles to participating in the rapid and dynamic growth in corporate and institutional renewable energy procurement that is unfolding in Alberta. These obstacles require tailored interventions to enable communities to participate, including:

- education, information dissemination and myth-busting
- capacity-building and access to expertise
- champion anchor buyers
- central procurement authorities to facilitate aggregation by subscription

6.1 Education

Recommendation: The reality of cost-effective renewable energy procurement, as demonstrated by active private sector procurement, makes clear that the outdated thinking of costly renewable energy needs to be updated to reflect current renewable energy economics. Section 2 of this report provides a summary of the C&I market in Alberta that could be used to build accessible materials for education and for providing up-to-date power contract costs with community leaders and decision-makers.

Context: The surveys and interviews revealed considerable gaps in information, awareness and understanding among key decision-makers about the realities of the C&I market and the benefits of the vPPA with a CfD instrument. The reality of cost-effective renewable energy through sharing merchant risk and of win-win relationships between developers and buyers stands in direct contradiction with outdated examples of costly or subsidized renewable energy. This creates an obstacle to communities undertaking any initiatives related to renewable energy development or procurement s.

6.2 Capacity-building and access to expertise

Recommendation: Resources such as webinars and information clearing houses to build internal familiarity and comfort with vPPAs and CfDs could facilitate project management of community participation in the renewable energy development boom. However, ultimately, communities need cost-effective access to legal, development, procurement and other expertise to pursue these initiatives. Resources and information-sharing collaboration that can facilitate these engagements would reduce the entry barriers for communities. For instance, a fund for a "centre" that can retain this expertise for accessibility to communities at below-market rates would foster community capacity and appetite for participation.

Context: Among interested communities that are relatively small, there are limited resources and capacity for technical experts to pursue community participation in renewable energy development and procurement. vPPAs with CfDs are complex commercial arrangements and the processes for procuring them competitively can also be complex and time- and resource-intensive while requiring deep expertise, which can be costly to acquire.

6.3 Champion anchor buyers

Recommendation: Larger corporations, institutions, governments, and municipalities have the scale, resources, capacity and interest to undertake procurement and can invite smaller interested participants. Acting as "champion anchor buyers" in this way offers them the opportunity to amplify the impact of their initiatives while accessing greater economies-of-scale and receiving a contribution from other participants toward the initiative costs, thereby reducing their own costs. This is most comprehensively illustrated by the Melbourne MREP initiative summarized in section 5.2. Unfortunately, despite rounds of renewable energy procurement from all levels of government in Alberta (the federal government, the provincial government, and the City of Edmonton), no entity or municipality has chosen to pursue this approach.

As described in section 2, there have been a couple of instances of buyer aggregation by corporations in the Alberta market, but these have not yet included smaller institutions or municipalities.

Context: Smaller communities are unable to cost-effectively pursue renewable energy procurement on their own because of the small scale of their demand, which is insufficient to justify transaction costs in securing competitive renewable energy.

6.4 Central procurement authorities to facilitate aggregation

Recommendation: Creating a central procurement authority to facilitate or even organize a program for small buyers and small generators could catalyze the aggregation necessary to achieve win-win deals for community generation development and procurement. This could be accomplished with a new entity with startup seed funding or providing seed funding for a new initiative organized by an existing entity. The Power+ program is an example of such an initiative undertaken by an existing entity, Alberta Municipalities. Green tariffs can be launched by existing utilities or outsourced to purpose-built consultants with expertise in procurement.

There would be a useful role for a central authority in Alberta to act as an aggregation facilitator that could see small community buyers securing renewable energy under long-term contract from small community generators, as shown in Figure 20. Seed funding would be essential to cover upfront costs for initial programs, with the goal of a self-sustaining model whereby buyers could cover administrative costs of the entity in subsequent rounds. This cost recovery could be facilitated through collaboration with, and eligibility for, small private-sector buyers.

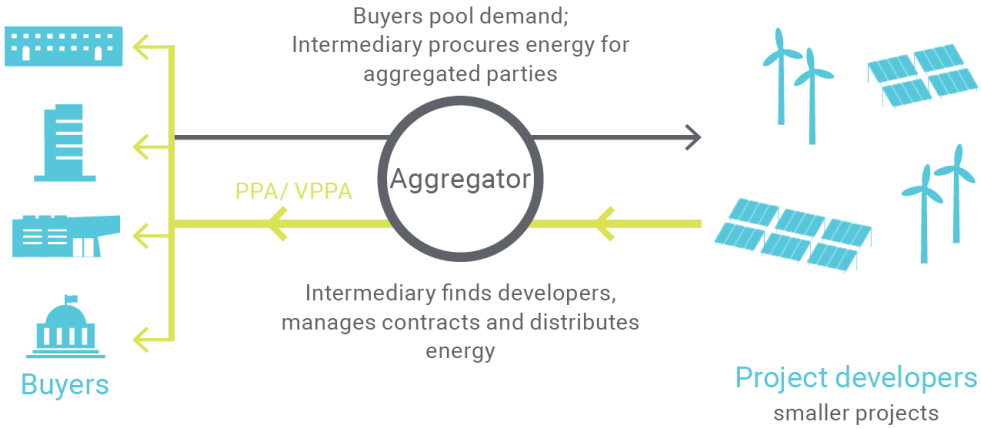

Figure 20. Power purchase agreements between several small developers and small buyers, facilitated by an aggregator

If aggregation isn't deemed possible, there was also a significant interest from municipalities to have an online community hub that they could access. As the municipal energy managers tend to work independently and come from a variety of backgrounds, there could be huge value in bringing them together through webinars, forums with experts and other initiatives that allow them to learn from one another. All communities are different, but many of their identified struggles and desires were similar, including:

- dependable financing options
- access to the market
- expertise when applying for projects.

Context: In the absence of willing champion anchor buyers, small prospective buyers are left to their own devices to achieve the scale necessary for cost-effective, competitive renewable energy procurement. On the other side of the coin, community generators are also left to resolve the same obstacle, but from the supply side of the contract. The two sides of this coin are described in Section 3.4 and visualized in Figure 21. Aggregation offers a path to achieve the requisite scale for both groups; however, it does not occur spontaneously. Aggregation involves effort, a unified vision and transaction costs (such as negotiating responsibilities and costs of procurement or negotiations), which are upfront and therefore especially difficult given the risk that no successful procurement might result.

Figure 21. Barriers faced by municipalities in procuring renewable energy deals

APPENDIX A. RESULTS OF JURISDICTIONAL SCAN

Project Name	Developer	Off-takers	Deal Size	Project Detail
Municipal Renewable Energy Project 1	Pacific Hydro	Fourteen partners, including cities, banks, universities and corporations	88 GWh per year	Off-takers combined their purchasing power to finance a new 80 MW windfarm.
Municipal Renewable Energy Project 2	Tango Energy	Seven partners, as facilitated by the City of Melbourne	110 GWh per year for ten years	Off-takers purchase energy from existing wind farms in Australia.
A Better City	Dominion Energy	MIT, Boston Medical Center, and Post Office Square Redevelopment Corporation	60 MW PPA	Off-takers combined purchasing power to finance a new solar farm.
AkzoNobel Consortium	E-Connection, Deltawind, Zeeuwind, and Kallista Energy	AkzoNobel, DSM, Google, and Philips	140 MW PPA	Off-takers combined purchasing power to finance a new wind farm, and purchase power from an existing one.
Amazon-Arlington Solar Farm	Dominion Energy	Amazon and Arlington County, Virginia	120 MW shared vPPA	Off-takers combined purchasing power to finance a new solar farm.
Monroe County Water Authority (MCWA) Solar Farm	Sol Systems	MCWA, Rochester Gas and Electric	6 MW	The solar farm is located on MCWA property, but was financed by a third party. A percentage of the energy is credited to MCWA on its utility bills.
Eckington Place	Sol Systems	FedEx, SOME	0.9 MW	FedEx is donating a portion of the electricity bill credits to local non-profit SOME.
Sol Systems-Microsoft	Sol Systems	Microsoft	500 MW	Microsoft to purchase electricity from portfolio of several Sol Systems solar farms.

The Nature Conservancy	Sol Systems and Sun Tribe	The Nature Conservancy, Cumberland Forest LP	75 MW	Sol Systems to construct several solar farms on former surface mine sites within Cumberland Forest property.
Bowdoin College	Sol Systems	Bowdoin College	5 MW PPA	Construction of the new solar farm, financed through a long-term PPA, will push the college past its 100% renewable energy goal.
City of Norfolk	N Solar	Nebraska Public Power District	8.5 MW solar + 1 MW/2 MWh battery	The project will be constructed on the city's well field, through a 30-year agreement with N Solar.
Town of Holliston	Sol Systems	Town of Holliston	3.2 MW solar + 2.5 MWh battery	The project will be constructed on an unused landfill and will provide benefits through tax revenue and energy cost savings.
Capitol Heights	Sol Systems and Greenbacker Renewable Energy Company	WGL Energy Services and Under Armour	3 MW PPA	Electricity generated by the solar farm will be sold to WGL, who will then provide it to Under Armour under a 12-year deal.
Fern Solar Project	BayWa r.e.	Bloomberg, Cox Enterprises, Gap Inc., Salesforce, and Workday	42.5 MW PPA	Off-takers combined purchasing power to each receive between five and 10 MW of capacity to comply with their ESG commitments.
Champaign's Solar Farm 2.0	Sol Systems	University of Illinois	12 MW PPA	The new solar farm, financed through a long-term PPA, will triple the university's on-site renewable energy capacity and provide flat-rate electricity for 20 years.

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