Enabling Community Solar Generation

The Tools, Programs and Policies Available to the City of Edmonton

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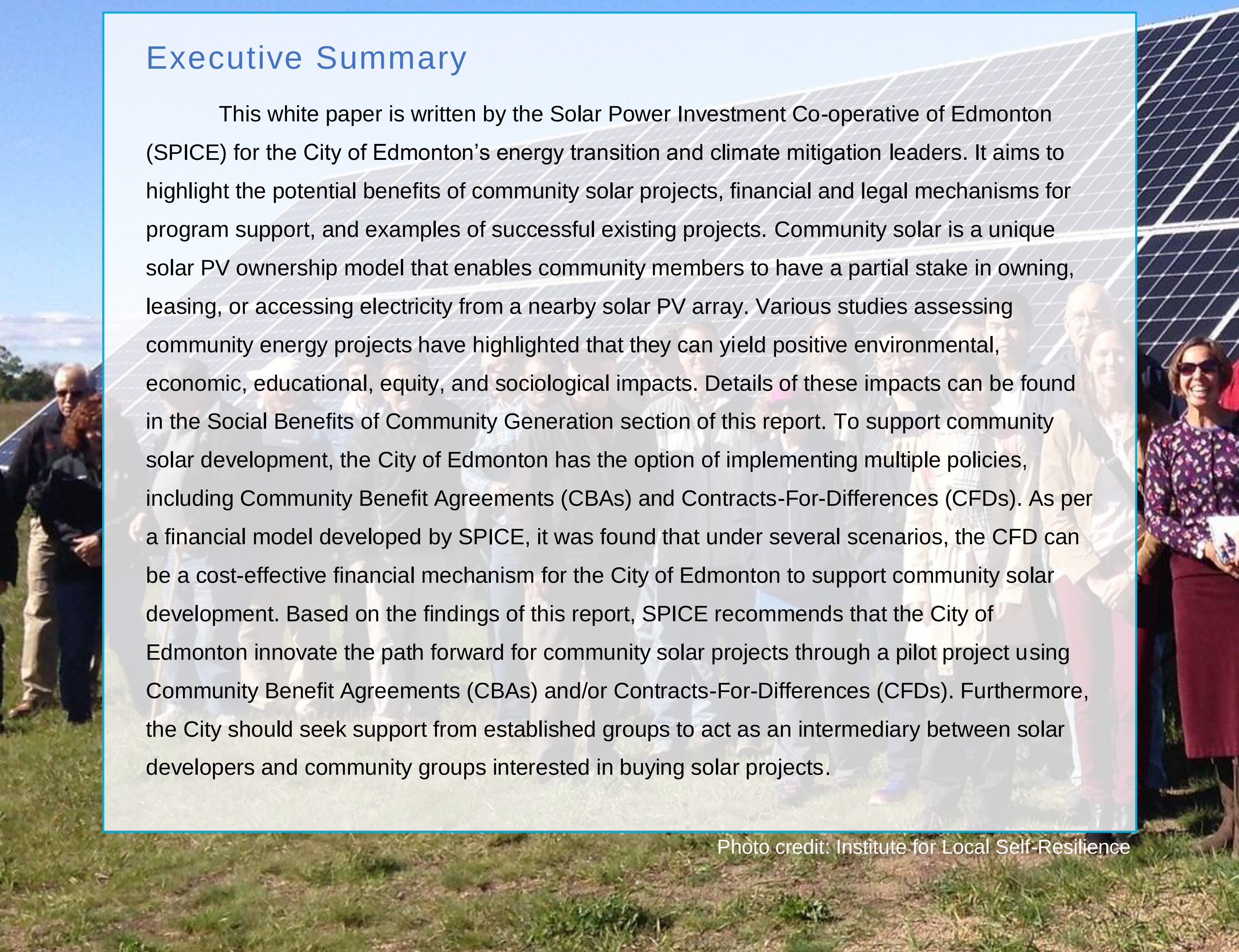
Executive Summary

This white paper is written by the Solar Power Investment Co-operative of Edmonton (SPICE) for the City of Edmonton's energy transition and climate mitigation leaders. It aims to highlight the potential benefits of community solar projects, financial and legal mechanisms for program support, and examples of successful existing projects. Community solar is a unique solar PV ownership model that enables community members to have a partial stake in owning, leasing, or accessing electricity from a nearby solar PV array. Various studies assessing community energy projects have highlighted that they can yield positive environmental, economic, educational, equity, and sociological impacts. Details of these impacts can be found in the Social Benefits of Community Generation section of this report. To support community solar development, the City of Edmonton has the option of implementing multiple policies, including Community Benefit Agreements (CBAs) and Contracts-For-Differences (CFDs). As per a financial model developed by SPICE, it was found that under several scenarios, the CFD can be a cost-effective financial mechanism for the City of Edmonton to support community solar development. Based on the findings of this report, SPICE recommends that the City of Edmonton innovate the path forward for community solar projects through a pilot project using Community Benefit Agreements (CBAs) and/or Contracts-For-Differences (CFDs). Furthermore, the City should seek support from established groups to act as an intermediary between solar developers and community groups interested in buying solar projects.



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Introduction

This white paper is written to inform the City of Edmonton's energy transition and climate mitigation and resilience initiatives. It is produced by the Solar Power Investment Co-operative of Edmonton (SPICE). The purpose of this paper is to: discuss the potential benefits of community solar projects, delineate examples of financial and legal mechanisms for program support, and provide examples of successful existing projects.

Solar Power Investment Cooperative of Edmonton (SPICE) is an opportunity development cooperative (ODC). Our vision is for every resident of Edmonton to participate in Edmonton's Energy Transition creating an energy-democratic city with energy literate citizens. Our mission is to provide an investment platform based on cooperative principles that will unleash local capital to build a more just energy transition. We will work by using existing urban footprints, embracing Cooperative Values, Sustainable Development Goals (SDG) goals, and acknowledging The Truth and Reconciliation Commission (TRC) call to action section 92 for businesses. By working in the urban environment on existing anthropogenic footprints we can connect people more intimately to the power they use and help build energy literacy. Being a cooperative, we are one of the many formally defined community groups that can qualify as "Community Generators" under the Small-Scale Generation Regulation (SSGR). A unique value of "Community Generation" projects is their associated Community Benefits Agreements and Statements. These agreements help document the true value of community solar in a transparent and accountable manner.

Community solar is a unique solar PV ownership model that enables community members to have a partial stake in owning, leasing, or accessing electricity from a nearby solar PV array. Unlike traditional rooftop solar PV, community solar projects are not directly connected to each owners' home or facility. They can take advantage of economies of scale to potentially compete favourably with retail electricity prices. Community solar projects make solar ownership accessible to new socioeconomic groups who cannot afford the large upfront system cost, as well as others such as renters, or owners of poorly sited properties who cannot have a solar system on their residence or business.

Social Benefits of Community Solar Generation

Various studies assessing community energy projects have highlighted that they can yield positive environmental, economic, educational, equity, and sociological impacts. Brummer et al. (2018) demonstrated that community-owned renewable energy models in the US, UK and Germany have provided an additional public education benefit thereby increasing the acceptance of renewable energy technologies. This includes unique first-hand educational experiences related to energy saving behaviour, climate change mitigation, and better social skills for participants. Berka et al. (2018) showed that there has also been enhanced support and acceptance of renewable energy projects. Particularly in Western Canada, Sherren et al. (2019) demonstrated that siting renewable energy projects within the purview of citizens - as is often done in the case of community solar - increased the support for such energy technologies by as much as 76%. In terms of societal participation, community energy projects have shown to incite financial participation of community members, along with political participation related to the energy transition. For example, through research based on 39 community energy projects, Sloot et al. (2018) showed that involvement in community energy projects is positively correlated with intentions to engage in other non-community energy related pro-environmental behaviours as well as pro-community involvement not related to sustainable energy. In terms of economic benefits, Brummer et al (2018) showed that community energy projects have given rise to new social enterprises, enhanced realization of renewable energy opportunities for marginalized groups, enhanced utilization of assets such as land or roof, and new and sustainable employment opportunities, These projects also stabilized utility costs, while providing new forms of social service revenue. A study by McNabe et al. (2018) aiming to assess economic benefits of building-integrated photovoltaics for social housing in the UK showed that community solar projects can provide a significant contribution towards the annual electrical demand and an overall reduction of the fuel burden of low-income users of social housing.

Alignment with Edmonton’s 2019-2028 Strategic Plan

Based on established research, it is clear that community solar projects will address a wide variety of the priorities in the City of Edmonton’s Strategic Plan for the 2019-2028 period. Table 1 overleaf lists the potential alignments:

Expected Effect	Strategic Indicator
Reduce	Percentage of Edmonton household spending 30% or more pre-tax income household income on housing
Reduce	Income growth difference between Edmonton's top and bottom 10 percent of the population
Reduce	Percentage of Edmontonians in low income status in Edmonton
Increase	Percentage of Edmontonians with access to infrastructure and amenities that improve their quality of life
Increase	Sense of community score averages for Edmonton's neighbourhoods
Increase	Percentage of Edmontonians who indicate they volunteered formally and/or informally
Increase	Edmonton's employment growth in selected areas of the city as a percentage of growth city-wide

Table 1: Potential alignments of community solar with the City of Edmonton's strategic goals

Policies for Supporting Community Solar Projects

A Financial Mechanism: Contracts-for-Differences

Contracts-for-Differences (CFDs) are a reverse auction system used to give renewable energy project investors greater financial performance certainty, which is a known barrier to entry for renewable projects in deregulated electricity markets such as Alberta (Howard et al., 2016). CFDs work by fixing the price received by the renewable energy generator on a cents per kWh basis. This fixed price can be determined based on either a predetermined price or a competitive reverse auction bid. In either case, the overall revenue per kWh is fixed, but the contract-for-difference payment is indexed to the hourly wholesale electricity price. Specifically, the project receives part of its revenue directly from the power pool based on the hourly price of electricity, with the remainder of its revenue coming from the CFD payment. The total revenue per kWh of electricity generated matches the agreed-upon fixed price. Due to the fixed price, the uncertainty of the price per kWh of electricity is lifted from the generator, who in return can secure better equity from lenders and therefore lower the cost of installation. The CFD approach to incentivizing renewable energy generation has proven vastly successful under the Renewable Electricity Program by the Government of Alberta, even though this mechanism was recently abandoned by the new party in government. While active, this CFD program helped secure utility-scale renewable energy projects for as low as 3.7 cents per kWh, which is the lowest price for renewable energy secured nationwide to date. Similar CFD programs have been used in the UK, EU, and across various states in the US. An example Contract-for-Difference payment scheme showing one year's worth of payments is shown below in Figure 1. In this case, a fixed strike price of 10 cents per kilowatt-hour and the PV-weighted average electricity wholesale prices per month between 2000 and 2018 were used.

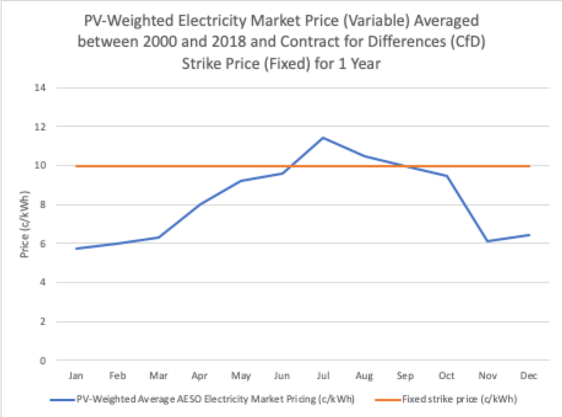

Figure 1: PV-Weighted electricity market price compared to a Contract-For-Differences (CFD) strike price. At times when the market price is below the strike price, the difference is transferred from the municipality to the solar project. At times when the market price is above the strike price, the difference is transferred from the solar project back to the municipality.

Community-owned projects suffer from the same financial uncertainty challenges that utility-scale projects do. The CFD approach can be scaled to fit the needs of community generation projects in Edmonton. Note that the Center for Climate and Energy Solutions (Leung, 2018) refer to the Contract-For-Differences (CFD) financial scheme for renewable energy generators as a "Virtual Power Purchase Agreement" (VPPA). According to Leung et al. (2018), the VPPA still sets a strike price or contract price for the electricity, which is indexed against the local market price for electricity. The different payment is paid from the customer (community group) to the generator at the time of settlement (for example, every month).

SPICE developed a financial model including a total of 36 scenarios for calculating the CFD costs, wholesale electricity market revenues and payoff periods for a 100kW community solar project. Assumptions across all scenarios include PV-weighted market electricity prices averaged per month between 2000 and 2018, a 2.5% annual inflation rate, a 0.5% decrease in electricity production per year due to PV panel deterioration, and a CFD strike price that increases with the same 2.5% inflation rate. Note that it is important for the strike price to reflect inflation in order for it to compare fairly to inflating power pool prices. The first variable that was changed across scenarios was the capital cost of installation of the project, which was varied from $2.7/W to $1.5/W. Note that recent rooftop solar projects in Alberta have been shown to cost roughly $2.7/W installed (Natural Resources Canada, 2019), whereas a utility-scale solar projects in Alberta has recently been built for roughly $1.7/W installed (Stephenson, 2019). By these standards, expected future installation costs between $2.7/W and $1.5/W installed is not unrealistic. Another variable that was changed is the strike price of the CFD, which was varied between 15 c/kWh and 10 c/kWh starting in 2020 (always inflating at 2.5% annually). As well, another variable was the value of Renewable Energy Credit (REC), which was either not acquired or acquired at a rate of 2c/kWh (and also inflated at 2.5% annually). Finally, the scenarios were also differentiated by the contract term, where the CFD either has a fixed term of 20 years (meaning that CFD payments are made for a total of 20 years since the start of the project) or a variable term ending when the project breaks even (meaning that the total earnings of the project from the CFD plus the wholesale electricity market compensates the total installation cost of the project). Table 2 summarizes the settings for the 36 scenarios.

SCENARIO 1: $2.7/W installed 15c/kWh strike price Breakeven term No RECs	**SCENARIO 2:** $2.7/W installed 12.5c/kWh strike price Breakeven term No RECs	**SCENARIO 3:** $2.7/W installed 10c/kWh strike price Breakeven term No RECs	**SCENARIO 10:** $2.7/W installed 15c/kWh strike price 20-year term No RECs	**SCENARIO 11:** $2.7/W installed 12.5c/kWh strike price 20-year term No RECs	**SCENARIO 12:** $2.7/W installed 10c/kWh strike price 20-year term No RECs
SCENARIO 4: $2.0/W installed 15c/kWh strike price Breakeven term No RECs	**SCENARIO 5:** $2.0/W installed 12.5c/kWh strike price Breakeven term No RECs	**SCENARIO 6:** $2.0/W installed 10c/kWh strike price Breakeven term No RECs	**SCENARIO 13:** $2.0/W installed 15c/kWh strike price 20-year term No RECs	**SCENARIO 14:** $2.0/W installed 12.5c/kWh strike price 20-year term No RECs	**SCENARIO 15:** $2.0/W installed 10c/kWh strike price 20-year term No RECs
SCENARIO 7: $1.5/W installed 15c/kWh strike price Breakeven term No RECs	**SCENARIO 8:** $1.5/W installed 12.5c/kWh strike price Breakeven term No RECs	**SCENARIO 9:** $1.5/W installed 10c/kWh strike price Breakeven term No RECs	**SCENARIO 16:** $1.5/W installed 15c/kWh strike price 20-year term No RECs	**SCENARIO 17:** $1.5/W installed 12.5c/kWh strike price 20-year term No RECs	**SCENARIO 18:** $1.5/W installed 10c/kWh strike price 20-year term No RECs
SCENARIO 19: $2.7/W installed 15c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 20:** $2.7/W installed 12.5c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 21:** $2.7/W installed 10c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 28:** $2.7/W installed 15c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 29:** $2.7/W installed 12.5c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 30:** $2.7/W installed 10c/kWh strike price 20-year term 2c/kWh REC
SCENARIO 22: $2.0/W installed 15c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 23:** $2.0/W installed 12.5c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 24:** $2.0/W installed 10c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 31:** $2.0/W installed 15c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 32:** $2.0/W installed 12.5c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 33:** $2.0/W installed 10c/kWh strike price 20-year term 2c/kWh REC
SCENARIO 25: $1.5/W installed 15c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 26:** $1.5/W installed 12.5c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 27:** $1.5/W installed 10c/kWh strike price Breakeven term 2c/kWh REC	**SCENARIO 34:** $1.5/W installed 15c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 35:** $1.5/W installed 12.5c/kWh strike price 20-year term 2c/kWh REC	**SCENARIO 36:** $1.5/W installed 10c/kWh strike price 20-year term 2c/kWh REC

Table 2: Summary of input variables for the 36 scenarios

Results from the 36 scenarios of the CFD financial model are shown in Table 3. Results that were calculated by the model include: The year that the project breaks even (meaning that the total earnings of the project from the CFD plus the wholesale electricity market compensates the total installation cost of the project), and the total CFD cost to the municipality (meaning the total payment that the municipality pays the solar project over the CFD contract life). Out of these scenarios, the favourable ones (coloured in green in Table 3) are where the total CFD cost to the municipality is below $40,000 (the current upfront incentive for the 100kW available from the Edmonton Solar Power Rebate) and the breakeven for the project occurs within 15 years from 2020 (the acceptable payback period of a solar project for solar PV developers). Scenarios that come close to these favourable criteria are coloured in orange, whereas scenarios that do not come close to these criteria are coloured in red.

SCENARIO 1: Breakeven: 2034 CFD cost: $109,023	**SCENARIO 2:** Breakeven: 2036 CFD cost: $75,265	**SCENARIO 3:** Breakeven: 2040 CFD cost: $27,308	**SCENARIO 10:** Breakeven: 2034 CFD cost: $168,919	**SCENARIO 11:** Breakeven: 2036 CFD cost: $98,237	**SCENARIO 12:** Breakeven: 2040 CFD cost: $27,554
SCENARIO 4: Breakeven: 2030 CFD cost: $79,777	**SCENARIO 5:** Breakeven: 2032 CFD cost: $55,490	**SCENARIO 6:** Breakeven: 2035 CFD cost: $19,573	**SCENARIO 13:** Breakeven: 2030 CFD cost: $168,919	**SCENARIO 14:** Breakeven: 2032 CFD cost: $98,237	**SCENARIO 15:** Breakeven: 2035 CFD cost: $27,554
SCENARIO 7: Breakeven: 2028 CFD cost: $61,039	**SCENARIO 8:** Breakeven: 2029 CFD cost: $41,750	**SCENARIO 9:** Breakeven: 2032 CFD cost: $15,487	**SCENARIO 16:** Breakeven: 2028 CFD cost: $168,919	**SCENARIO 17:** Breakeven: 2029 CFD cost: $98,237	**SCENARIO 18:** Breakeven: 2032 CFD cost: $27,554
SCENARIO 19: Breakeven: 2032 CFD cost: $95,137	**SCENARIO 20:** Breakeven: 2033 CFD cost: $109,023	**SCENARIO 21:** Breakeven: 2035 CFD cost: $19,703	**SCENARIO 28:** Breakeven: 2032 CFD cost: $168,919	**SCENARIO 29:** Breakeven: 2033 CFD cost: 98,237	**SCENARIO 30:** Breakeven: 2035 CFD cost: $27,554
SCENARIO 22: Breakeven: 2028 CFD cost: $62,948	**SCENARIO 23:** Breakeven: 2030 CFD cost: $42,343	**SCENARIO 24:** Breakeven: 2031 CFD cost: $14,015	**SCENARIO 31:** Breakeven: 2028 CFD cost: $168,919	**SCENARIO 32:** Breakeven: 2030 CFD cost: $98,237	**SCENARIO 33:** Breakeven: 2031 CFD cost: $27,554
SCENARIO 25: Breakeven: 2026 CFD cost: $53,417	**SCENARIO 26:** Breakeven: 2027 CFD cost: $36,253	**SCENARIO 27:** Breakeven: 2029 CFD cost: $10,575	**SCENARIO 34:** Breakeven: 2026 CFD cost: $168,919	**SCENARIO 35:** Breakeven: 2027 CFD cost: $98,237	**SCENARIO 36:** Breakeven: 2029 CFD cost: $27,554

Table 2: Summary of results for the 36 scenarios tested for the CFD model

The above scenario-based analysis of the CFD financial model offer several key insights into making a CFD program feasible. Almost all scenarios which were able to secure a strike price of 10c/kWh were feasible, apart from those which were built at the steep cost of $2.7/W installed, which took longer than 15 years to break even. For higher strike prices such as 12.5c/kWh, additional measures such as a 2c/kWh REC value and a breakeven contract period helped bring the project to a point feasibility. Furthermore, in all cases, a CFD contract period which terminated after the project achieved breakeven helped significantly reduce the cost of the CFD program for the municipality.

A Regulatory Mechanism: Community Benefit Agreements

Community Benefit Agreements (CBAs) are agreements signed by developers of renewable energy projects which ensure that the host community of the project supports the project in return for a list of benefits the develop agrees to deliver. Communities could include neighbourhood associations, faith-based organizations, unions, environmental groups, or municipalities. These agreements have historically been used to ensure that measurable benefits from the project are delivered to the local community. Such agreements are enforceable, legally binding, and involve substantial community consultation. Local benefits could include local sourcing, job creation, revenue sharing, equity share in the project, environmental protection, educational partnerships, etc. Agreements can furthermore include requirements based on targeting specific low-income groups or enforcing proactive hiring or social procurement practices. Furthermore, as a result of signing such agreements, developers benefit from gaining the trust of the community, reducing project risks, and having access to local subsidies or municipal approvals.

CBA's history of delivering successful outcomes for numerous energy infrastructure projects, can serve to inspire future community solar project CBAs. As a non-solar example, in the Town of Robbinson, Maine, a CBA was developed with Downeast LNG Inc. to derive benefits in return for the permitting, construction, development and operation of a liquified natural gas (LNG) import terminal. Some clauses in the agreements included the establishment of an annual County Economic Trust Fund, a 5% local supplier goal for contractors, a 60% obligation for recruiting workforce from the local county, and even road repair/transportation (United States Department of Energy, 2017). Similarly, within Alberta's community solar sector, as part of the provincial Small Scale Generation Regulation introduced in January 2019, the Government of Alberta defined a CBA as a "legally binding written contract between a small scale producer and a community group in respect of a small scale generating unit that confers social, environmental or economic benefits to that community group" (Kauffman, 2019). Accordingly, small scale generators can access provincial government supports once they have established a CBA with a relevant community group. The list of qualifying community groups includes: societies, condominium corporations, co-operatives, educational institutions, First Nations, Metis Settlements, municipalities, and non-profit organizations.

Case Studies of Municipal Community Solar Leadership

Municipalities have started to capitalize on the advantages of community solar business models and have started playing unique roles in expanding such projects.

Minnesota: An example of a government legislating a utility program

In Minnesota, the state government required XCel Energy (a large electric utility) to offer community energy options to its customers. As of 2019, the community solar program has grown to a record of 635-MW. All utility customers (not just the community solar subscribers) are seeing financial benefits from community solar compared to volatile gas prices and from the shift of wealth from the previously private monopoly. Subscribers include commercial customers as well as public entities such as schools, colleges, hospitals, and local governments (Farrell, 2020).

D.C.: An example of a program on state department facilities

In the District of Columbia, the Department of General Services (DGS) has entered three separate physical power purchase agreements with wind and solar project developers in order to move the state agencies towards cleaner power. This includes a 20-year contract with Iberdrola Renewables to supply 30 percent of the District's government electricity demand from a 46-MW wind farm in southwestern Pennsylvania. Additionally, DGS also signed a 20-year power purchase agreement with multiple solar developers to install solar PV arrays on 50 district government buildings including schools, recreation centres, and municipal buildings. Projects have been coming online since 2016 (Leung et al., 2018).

Ashland: An example of a municipally led community energy project

In Oregon, the City of Ashland launched a 63-kW solar array on a city-owned parking lot in 2008. The project was developed by the municipality itself, and once completed, the city opened access to purchasing or leasing parts of the array to all members of the community as long as they were ratepayers to the municipal utility. Project members were able to either make upfront payments or monthly zero interest loans for a full, half or quarter panel. In return, they would receive credits from the municipal utility on their monthly electricity bill for the next 20 years. In addition, project-qualifying tax credits were passed down to the participants by the municipality (City of Ashland, 2020).

Recommendations

Based on the findings of this report, the Solar Power Investment Co-operative of Edmonton believes there are numerous ways in which the City of Edmonton can support community solar projects. Some methods include:

1. Consider initiating a small-scale Contract-For-Differences (CFD) pilot program. This can be piloted through a limited capacity procurement (e.g. under 1MW installed). To make the budget for this possible, the City can consider launching this program in partnership with other levels of government or non-profit institutions and organizations. A pilot project can develop and demonstrate best practices. The City's example can also inspire private businesses to become community energy off-takers as well.
2. Consider how community generation support programming can be made compatible with potentially complementary policies. This includes:
   a. Property-Assessed Clean Energy (PACE) financing
   b. Local Access Fees (LAFs) and/or utility franchise contracts (Farrell, 2014)
   c. Renewable Energy Credits (RECs)
3. Consider ways of leveraging private capital. Some examples are:
   a. As PACE originators, co-operatives such as SPICE can help leverage PACE financing for its community generation partners.
   b. Incentives for private businesses to become solar energy off-takers.
   c. Lower fees for community groups and local developers to participate in the Business Renewables Centre.
4. Create a web portal for connecting solar developers and interested communities seeking solar power. For example, see the Illinois Power Agency's Adjustable Block Program (ABP) online dashboard (Illinois Power Agency, 2020).
5. Expand the City's portal to include specific resources relevant to community generation, like Community Benefit Agreements templates.
6. Educate Edmonton-based community organizations about the potential of community solar projects.

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