Getting It Right: Models for Solar PV Energy Delivery in British Columbia

by

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COMMITTEE APPROVAL

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Abstract

Despite a lack of incentives, solar photovoltaic energy is gaining traction in British Columbia. Privately owned home and commercial systems are on the rise and an increasing number of community led initiatives are experimenting with various models for solar photovoltaic energy delivery. Using the business model as an analytical tool, the present study explores the range of models by which individuals and organizations have begun to harness and distribute solar PV in the province of BC, and the barriers, bridges, and critical success factors for each. A number of contextual conditions are identified that have contributed to two general categories of models that have arisen: commercially led approaches that focus on customer owned systems (i.e. individual home or building owners) and community led approaches that focus on community owned and/or financed systems. The study provides insight for others wanting to implement solar energy for themselves or their communities.

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Summary of Acronyms

COC	Cost of Capital
DPV	Distributed Photovoltaics
GW	Gigawatt
GWh	Gigawatt Hours
kW	Kilowatt
kWh	Kilowatt Hours
LCOE	Levelized Cost of Energy
MW	Megawatt
MWh	Megawatt Hours
PPA	Power Purchasing Agreement
PV	Photovoltaics
TPO	Third-Party Ownership
TW	Terawatt

Solar Glossary

Cost per Watt – Cost (or Price) per watt ($/W) is a common way to compare the capital costs of different forms of electricity generation. It refers to number of dollars spent to produce one watt of electricity. It is calculated by dividing the total project capital costs by the amount of peak power (watts-peak or Wp) it can produce

Energy Yield – The value of a PV project is driven by the amount of energy that is produced for the amount of equipment installed. The energy yield is a key metric to evaluate real-world system performance and compare the actual vs. predicted energy produced by a PV system. It is calculated as the kilowatt hours of power produced/kilowatt hours of power installed (kWh/kWp)

Grid Parity – is the point when an alternative energy source (i.e. solar PV) can generate power at a levelized cost of electricity (LCOE) that is less than or equal to the price of purchasing electricity from the grid

GWh – Gigawatt Hour is a unit of energy equivalent to one million kWh, and is often used as a measure of output of large electricity power stations

kWh – Kilowatt Hour is a unit of energy equivalent to one kilowatt of power expended for one hour of time.

LCOE – Levelized Cost of Energy is the industry standard for analyzing delivered energy costs. It is equal to the total cost of installing and operating a system expressed in dollars per kilowatt-hour of electricity generated by the system over its entire life. This is the main statistic to look at when analyzing cost effectiveness and efficiency of energy systems.

MWh – Megawatt Hour is a unit of energy equivalent to one thousand kWh, and is roughly equivalent to the energy produced from 10 automobile engines.

Net Metering – BC Hydro customers (who have smart meters installed) that generate more electricity than they use will receive a credit to their account that is applied against future electricity use. At the anniversary date, if a customer has excess generation credit remaining on their account, BC Hydro will pay them out at the rate of 9.99 cents per kWh

Performance Ratio – The Performance Ratio (PR) is another key metric to measure real-world solar PV system performance. It measures the performance of a solar panel or system by essentially normalizing the Energy Yield for a system over the irradiance measured at the location of the system. This allows for comparison between systems that may differ in design, technology and geographic location. It is calculated as the Energy Yield (kWh produced/kWp installed) divided by the Reference Yield (measured irradiance/standard reference)

Power Purchase Agreement (PPA) – A PPA (or EPA: Electricity Purchase Agreement) is an agreement between an energy producer and a utility under which the utility agrees to purchase power.

Introduction

Over the past decade, solar photovoltaic (PV) energy has experienced unprecedented growth. Driven in large part by technological improvements that have reduced costs and government policies supportive of renewable energy, global installed solar PV power capacity has increased from 5 Gigawatts (GW) in 2005 to more than 140 GW in 2014 (BCSEA, 2015). This capacity has been doubling every 2.5 years, and should reach 200 GW shortly in 2015 (Shahan, 2015). German Solar Association BSW-Solar expects global solar PV capacity to exceed 400 GW in the next 4 years (Shahan, 2015).

With numbers like this we can see that solar PV is experiencing an exponential growth rate. In fact, solar electricity has grown globally at a compound annual rate of almost 50% for the past decade (International Energy Agency, 2014). The International Energy Agency (2014) forecasts that solar electricity will account for 27% of the world's energy by 2050; making it the leading source of electricity worldwide (with solar PV contributing 16% and concentrated solar power (CSP) with storage making up the other 11%). This number may even be markedly conservative. Should solar PV continue to grow on its exponential trajectory, the new energy infrastructure could approach 100% solar by 2030 (Seba, 2014).

The countries driving this growth are Germany, China, Italy, Japan and the USA; however, solar PV is growing quickly across the world as it becomes more and more competitive against other energy sources (Shahan, 2015). In Germany, a country that receives less sunlight per year than British Columbia (BC), solar PV contributed 30 GigaWatt hours (GWh) of power in 2013, providing 5.7% of Germany's grid (BCSEA, 2015). In the US, the Department of Energy's SunShot Initiative is targeting 14% of electricity generation from solar by 2030 and 27% by 2050 (Bell, Creyts, Lacy & Sherwood, 2014). The US Congress also recently agreed to grant a 5 year extension to the 30 percent Investment Tax Credit for solar that was set to expire in 2016. This will give a huge boost to the industry and further speed up the deployment of solar PV in the US (Randall, 2015). In Canada, solar PV power has seen a surge in growth ever since Ontario introduced its feed in tariff program in 2009, and is now approaching 2 GW of solar PV power generation (CanSIA, 2014). Although Ontario is far and away the largest supplier of solar electricity in Canada, BC is starting to follow suit, recently opening the 1 MW Kimberly SunMine project in Kimberley, BC.

This explosive growth has come as the result of a variety of policies, improvements in technologies, product architectures and models for delivery. This rapid growth has also brought with it a host of challenges. The aim of the research is to explore the various models by which organizations have begun to harness and distribute solar PV in the province of BC, and the barriers, bridges, and critical success factors for each, through a comparative study of solar PV delivery models in BC.

The present study orients the focus of the research towards an in-depth analysis of several existing models for solar PV delivery in BC in order to get an idea of the possibilities available to persons or organizations interested in acquiring or developing solar PV in the province, and further, to understand the critical elements necessary for the success of these models. The attempt is made to identify the barriers and bridges to success for each of the models and to understand the critical elements and key design principles necessary for success in each of the models in light of the socio-political-economic operating context of the province.

Research Context

British Columbia already has a steady, stable and relatively inexpensive supply of renewable energy in the form of hydropower, why should we bother to pursue solar? There are many reasons for people to get into solar PV in the province, they may want to be more energy independent, hedge against rising electricity costs, be more environmentally friendly, provide jobs for their communities, or be looking for a way to make a financial investment. Whatever the case may be, solar PV represents an advancing technology whose entrance into the energy picture of the province has already begun and whose increase in the energy mix is inevitable. It is therefore important to understand how to best implement the technology and maximize or optimize its value according to the socio-political-economic context of the province.

Previous research has focused on the business model "as a framework for analyzing and operationalizing sustainable innovation in general (Boon and Ludeke-Freund, 2013) and PV deployment in particular, including business model innovation from a utility sector perspective (Frantzis, Graham, Katofsky & Sawyer, 2008; Schoettl & Lehmann-Ortega, 2011; Richter, 2012), and delivery models for rural electrification (Lemaire, 2011; Northrop, Riggs & Raymond, 1996; Rogers, 1999)" (Strupeit & Palm, 2015, p. 2). More recent research has begun to investigate how real-life models for PV delivery evolve and respond to the barriers and opportunities available within their specific region or sociopolitical context (Huijben & Verbong, 2013; Strupeit & Palm, 2015). In this vein, the current research will analyze how models for solar PV are responding to the barriers and opportunities for solar PV in BC.

The Landscape for Solar PV in British Columbia

Solar Irradiance in BC. British Columbia has a relatively good climate for solar. Though on average the solar irradiance for the province is less than its neighbours to the south (US) and east (Alberta and Saskatchewan), BC receives more hours of sunshine on average than the global PV leader Germany (See Table 1).

Table 1

Annual Sunshine Hours per year: Germany vs. British Columbia

Germany	Hours Of Sunshine	British Columbia	Hours of Sunshine
Munich	1709	Cranbrook	2191
Stuttgart	1692	Victoria	2109
Berlin	1625	Kamloops	2080
Frankfurt	1586	Kelowna	1949
Cologne	1581	Nanaimo	1940
Dresden	1581	Vancouver	1938
Hamburg	1557	Prince George	1918
Bremen	1483	Abbotsford	1887

Note: Adapted from: https://www.currentresults.com/index.php. Copyright 2016 Current Results Nexus

Solar Panel Electricity Production in BC. Though it depends on location, 1kw of solar panel(s) can be expected to generate on average between 1,100 - 1,200 kWh per year in BC (BCSEA, 2015). In general, most houses in BC use between 5,000 (very efficient) to 13,000 (not very efficient) kWh of electricity per year with the average being around 11,000 kWh (BC Hydro, 2012). For perspective, a typical single family home with a south facing roof will usually be able to support a 4kW system, generating roughly 4,400 kWh of electricity per year (BCSEA, 2015).

Electricity Costs in BC. BC Hydro is the main electric utility in the province. There are different rates that BC Hydro charges for electricity based on the nature of the customer (e.g. residential, commercial, industrial) and the amount of electricity used (2 step system). There are also a number of charges that can be applied to customers depending on their nature (i.e. Residential, Small, Medium or Large Business). However, compared to the main energy charge (rate per kWh) these are minor and for the sake of brevity will be left out of the present analysis.

The Residential rate for Step 1 is billed at $0.0797 per kWh for the first 1,350 kWh in an average two-month billing period (+5% rate rider[1], +5% GST) for an effective rate of $0.088/kWh or 8.8¢/kWh. For Step 2 it is billed at $0.1195 per kWh (+5% rate rider, +5% GST) for an effective rate of $0.1317 or 13.17¢/kWh for all electricity over the 1,350 Step 1 threshold (BC Hydro, 2015).

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[1] The Rate Rider covers additional and unpredictable energy costs resulting from, for example, low water inflows or higher-than-forecast market prices. The Rate Rider represents a charge of 5% applied to all charges before taxes and levies.

The Small General Service rate is for business customers with an annual peak demand of less than 35 kW, and is charged at $0.1073 or 10.73¢ per kWh (+5% Rate Rider, +5% GST) for an effective rate of 11.80¢ per kWh.

The Medium General Service Rate is for business customers with an annual peak demand between 35 and 150 kW, and that use less 550,000 kWh of electricity per year. The rate is charged at 9.89¢ per kWh for the first 14,800 kWh of their baseline[2] and 6.9¢ per kWh for remaining kWh up to baseline (+5% Rate Rider, +5% GST will give effective rates of 10.89 and 7.61¢ per kWh). There is also a Part 2 involving either a credit (9.9¢ per kWh for savings down to 20% below baseline) for using less electricity than your baseline, or a charge (9.9¢ per kWh for usage up to 20% above baseline) for using more.

The Large General Service Rate is for business customers with an annual peak demand of at least 150 kW, or that use more than 550,000 kWh of electricity per year. The rate is charged at 10.66¢ per kWh for the first 14,800 kWh of their baseline and 5.13¢ per kWh for remaining kWh up to baseline (+5% Rate Rider, +5% GST will give effective rates of 11.75 and 5.66¢ per kWh). There is also a Part 2 involving either a credit (9.9¢ per kWh for savings down to 20% below baseline) for using less electricity than your baseline, or a charge (9.9¢ per kWh for usage up to 20% above baseline) for using more.

[2] The baseline amount is equal to an account's average energy usage during the month.

Rate Hikes. While BC currently has some of the lowest electricity rates in North America, rate hikes have occurred each of the last two years with more planned to come according to BC Hydro's 10 Year Rates Plan (See Table 2).

Table 2

BC Hydro 10 Year Rates Plan

Year	2014	2015	2016	2017	2018	2019-2023
Increase	9%	6%	4%	3.5%	3%	TBD

Note: Adapted from: BC Hydro files interim rate application for year three of 10-Year Rates Plan. BC Hydro (2016a)

BC Hydro (2016a) cites a number of reasons for the rate increase: The need to invest in an aging system; replacement of aging equipment; performance of system upgrades; and a growing demand for electricity driven by a growing population, continued residential development and growth from industrial sectors.

Solar PV Costs & Grid Parity in BC. Understanding where electricity costs are currently and how they will likely increase, how do they compare with costs for solar electricity? Where does this leave the grid parity situation in the province? Dave Egles of the Victoria, BC based solar electric company HESPV gives a good comparison in a presentation that he did for the BC Sustainable Energy organization (2014).

Residential: A 4kw system now costs ~$16,000 to install and will produce ~4400 kWh per year (in Victoria). A system will last ~30 years, therefore 30-year production is (30 x 4400 = 132,000 kWh). Cost per kWh = $16,000/132,000 = 12.1 cents per kWh.

Small Commercial: A 10 kW system at $35,000 gets 11,000 kWh (Victoria). PV Solar systems last 30 years, so 30 x 11,000 = 330,000 kWh, therefore cost per kWh = $35,000/330,000 = 10.6 cents per kWh.

Larger Commercial: A 100kW system at $290,000 gets 110 MWh per year (Victoria). Over 30 years is 30 x 1100 = 3300 MWh, so cost per kWh = $290,000/3300 MWh = 8.7 cents per kWh.

If we compare the rates from BC Hydro for residential, small commercial and medium commercial to similar sized solar PV systems we can see that the rates work out to be quite similar. The argument can be made that we have reached grid parity already. Moreover, the rates from BC Hydro will increase over time while the costs for solar PV will continue to decrease. This is a sure indication that the market for solar PV will continue to expand in the province.

Customer Based Electricity Generation. In order to understand the revenue opportunities that are available to a given model, it is important to understand what the utility will pay to individuals and organizations that generate renewable electricity for the grid. BC Hydro currently offers 2 different programs (and will soon add a third) for clean or renewable customer based electricity generation. The type of program applied generally depends on the size of the system generating the electricity. Residential and commercial customers generating up to

100 kW generally fall under the currently existing Net Metering Program, projects from 100 kW to 1 MW in size will fall under the soon to be finalized Micro Standing Offer Program (micro-SOP), while projects from 1 MW to 15 MW in size will fall under the currently existing Standing Offer Program (SOP).

Net metering customers who generate more electricity than they use will receive a credit to their account that can be applied towards future electricity costs. At the anniversary date (annually), if a customer has excess generation credit on their account, BC Hydro will pay them at a rate of 9.99 cents per kWh (BC Hydro, 2016b). To determine the price of energy sold to BC Hydro under an electricity purchase agreement (EPA), the SOP uses a base price in 2010 dollars determined by the region of the point of interconnection (i.e. Vancouver Island, Lower Mainland, Central Interior, etc.) and ranges between $95 - $105 per MWh depending on the region, and with 100% of the base price escalating at CPI (Consumer Price Index) annually up to the year in which the EPA is signed (BC Hydro, 2015). See Appendix A, Draft Distributed Generation Offers, for further clarification.

Bridges and Barriers for Solar PV in BC. Any model for solar PV delivery should be designed to maximize value. The way in which any given model is designed will be determined primarily by the regulatory and commercial environment in which it operates. In understanding the landscape for solar PV in BC, we can outline the broad factors that support or inhibit its development. This will help to understand how the various models are responding to these challenges and opportunities, and will help to further understand and delineate the bridges and barriers for each of the models individually.

Bridges. As mentioned previously, the province has a relatively good solar climate. The net metering program has been described as the best in Canada in terms of ease of use and technical application (BCSEA, 2015). It offers customers a clear way to generate solar PV electricity at smaller scales and be compensated for it. The Standing Offer Program provides a channel for larger commercial projects to generate solar PV and generate revenue. Solar PV equipment is not subject to the provincial sales tax (PST) (Provincial Sales Tax Act, 2013). BC Hydro's two tiered electricity prices offer solar PV owners a good solution to offset the more expensive tier 2 electricity charges. Used in this way a consumer can maximize the value from their solar PV systems. Finally, the province is considered as the greenest province in the country with citizens concerned and interested in renewable energy, which makes it a favorable climate for developing solar PV projects and attracting investors (Corporate Knights, 2014).

Barriers. The literature identifies a number of key barriers for widespread adoption of solar PV. These include high up-front costs, long payback periods, consumer inertia, significant planning and installation effort, informational/educational gaps and customer concerns about reliability (Rosoff & Sinclair, 2009; Shih & Chou, 2011; Yang, 2010).

The Canadian Solar Industry Association (CanSIA) outlines several barriers to solar PV development in Canada (Roadmap 2020, 2014, p. 8): "Unsupportive and unstable policy and regulatory environment; confusing, slow and expensive electrical grid interconnection requirements; high non-hardware costs (i.e. soft costs) of solar electricity systems; inadequately informed public regarding solar electricity benefits and applications; and unfulfilled relationships with conventional industry participants and synergistic sectors."

In addition, there are a number of barriers that apply to solar PV in BC. The majority of the energy in the province (hydropower) is considered renewable, and so there is no clear reason to switch to solar PV from a carbon reduction/climate change perspective (Hilson, 2014). Another primary reason is the fact that BC's electricity prices and utility commercial electricity buy back rates are among the lowest in the world (Hilson, 2014). Furthermore, the province offers no feed-in tariffs, subsidies or grants for solar PV (Hilson, 2014), as does the province of Ontario.

In order to overcome these barriers solar PV needs to become low-risk, have an updated regulatory framework and rely on well-known models that offer standardized and easily implementable solutions with product offerings designed for the contextual environment (Schleicher-Tappeser, 2012; Strupeit & Palm, 2015).

Models for PV

Developing new and renewable energy technologies like solar PV is always difficult due to the start-up costs involved, limited availability of finance for frontier projects, the frequent need for public/private partnerships, and limited awareness from the public (APEC, 2009). Understanding the elements that lead to the successful implementation of new renewable energy technologies can help to develop programs and projects, minimize risk, overcome the barriers specific to a certain locale and to avoid repeating common mistakes. Of critical importance is identifying the business models that have been applied successfully in order to commercialize the technology, drive down costs and develop the market (APEC, 2009; Boon and Ludeke-Freund, 2013).

A useful way to understand models for solar PV is in terms of their evolution. For the most part, British Columbia is still in the early days of solar PV development, and as such, the majority of installations revolve around the ownership of PV systems by individuals or businesses (residential or commercial). In this early approach to solar PV development, a customer purchases and owns the PV system, and often installs it themselves or with the help of an installer. This approach is referred to as a Zero Generation PV business model (Frantzis, Graham, Katofsky & Sawyer, 2008). This model is mostly adopted by a small audience of renewable energy pioneers, who are committed to PV's environmental, energy security and self-generation benefits (Frantzis et al., 2008).

The next stage of business model development manifests with First Generation PV business models, characterized by third-party ownership and operation, and taking advantage of improved methods of financing, incentives and some degree of utility facilitation. The final stage, or Second Generation PV business models begin to manifest in an environment where the technology and emerging regulatory initiatives begin to make solar PV more viable and valuable (Frantzis et al., 2008). These generations of business model evolution are summarized in Figure 1. This framework is helpful to understand how business models for PV evolve, but it should be noted that it does not include many examples of community solar and how and where these models fit in.

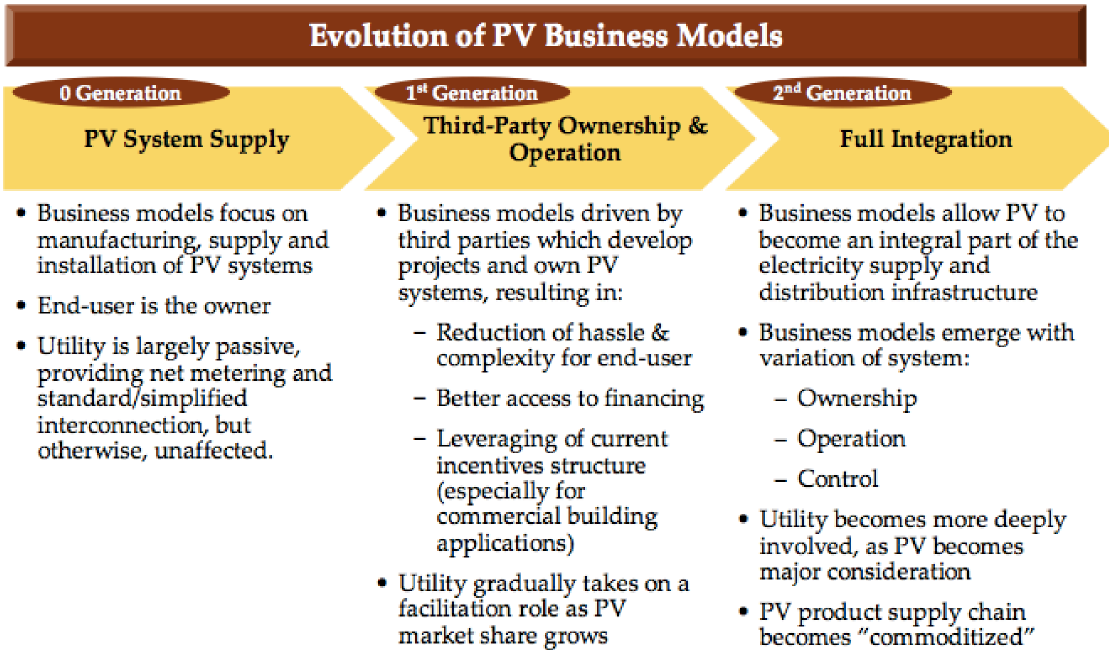

Figure 1. Evolution of PV Business Models. Frantzis et al. (2008)

The United Nations Development Program (UNDP) categorizes solar PV systems into four models based on the delivery and institutional infrastructure required (UNDP 2004).

- *Commercially led approaches*, in which suppliers and dealers develop the market, relying on cash sales of solar PV systems to consumers
- *Multi-stakeholder models*, programs managed by a project management unit or multi-stakeholder committee, and typically relying on consumer credit facilitated by an intermediary finance organization (e.g. bank, credit union)
- *Utility Model,* wherein a utility retains ownership and maintenance of the solar PV system and operates on a fee for service basis

- *Grant based models,* typically applying to institutions (schools, hospitals, etc.) where bulk procurement occurs by an authority (government) or organization (nonprofit), and is funded by grants, donations, or community contributions.

Other research focusing on different PV models has classified them according to three general deployment models: customer owned, community shares and third-party owned (Huijben & Verbong, 2013; Sauter & Watson, 2007).

These types of classifications are helpful, as they help to illustrate the varieties of organizational structures, delivery methods, financing and ownership options that are helping to develop the market and can serve as a template for others wanting to enter.

Whatever the case may be, these models are designed to create and capture value from their activities while operating within a specific regulatory framework (Shafer, Smith & Linder, 2005; APEC, 2009). Although the models analyzed in this study may be quite different from one another and may differ in the characteristics of their business models, we can use the business model template to analyze the models under the same framework and allow for cross comparison.

Critical Success Factors

Critical Success Factors (CSF) are elements that are necessary for an organization or project to achieve its goals and mission. They are understood as being the several key factors or activities vital to an organization's development, operation and future success (Boynton & Zmud, 1984).

A number of studies have been devoted to analyzing CSF in project management and enterprise planning (Bellasi, 1996; Umble, Haft & Umble, 2003; Leidecker & Bruno, 1984), including those that focus on renewable energy and solar PV in particular (Urmee & Harries, 2009; Holland, Perera, Sanchez & Wilkinson, 2001). The International Institute for Sustainable Development (IISD) undertook an extensive research project in 2008 in order to determine the key factors critical to the success of social and environmental enterprises (IISD, 2008). They identified eight critical success factors that would help to determine the likelihood of success for sustainable development projects and enterprises: Leadership, Partnerships, Proof and Clarity of concept, Business Planning & Marketing, Triple Bottom Line Planning, Short and Long term benefits management, Community Engagement, and Risk Management. As Solar PV is a fledgling industry in BC with much new growth expected, it is important to recognize the CSF for the various models under consideration, as this will limit failure of new entrants and help to expand the market for PV in the province.

Methodology

This study involves a multiple case study methodology. It examines several successful models for solar energy delivery as case studies, involving document review and interviews of key stakeholders. Case study research is an approach that has become popular in the social sciences as a valid research tool, and has been shown to be effective when doing evaluation research of projects and initiatives, documenting and analyzing implementation processes and evaluating outcomes (Yin, 2012). A particular advantage of this approach for the present study is that it will allow for cross-case comparisons and analysis (Yin, 2012).

Case Study Selection

The case studies were primarily chosen in an attempt to represent a cross section of the types of existing models for solar PV delivery in BC: For-Profit Enterprise, Non-Profit/Social Enterprise, Utility, Community, First Nations, and Strata[3]. The case studies were selected after conducting an online search for the various types of existing models for PV delivery in BC, and on the consultation of Guy Dauncey, founder and former Communications Director of the BC Sustainable Energy Organization and Michael Mehta, professor at Thompson Rivers University and co-founder and Director of GabEnergy, a community based electrical non-profit society on Gabriola Island. The models chosen are those that are considered successful (i.e. currently operating and/or growing, or whose goals and/or mission have been accomplished). One individual who had operated a now defunct solar PV installation business was consulted in order to learn about the challenges he faced with his business but was not included as a case study.

Analytical Framework

A number of studies have used Osterwalder's (2005, 2010) business model morphology to perform comparative analysis of business models for renewable energy and solar PV (APEC, 2009; Hou, 2014; Huijben & Verbong, 2013; Strupeit & Palm, 2015). The present study uses the same analytical framework.

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[3] Strata title is a form of ownership devised for multi-level apartment buildings and horizontal subdivisions with shared areas. Owners normally own a unit/apartment and have shared ownership of common property. It is common to BC and parts of Alberta.

Osterwalder's business model morphology utilizes nine building blocks organized under four core pillars as illustrated in Table 3. The advantage of the Business Model Canvas as an analytical tool is that it is a well adopted staple for business architecture world-wide, it is simple to understand and easy to use, and can be adapted for NGO and non-profit contexts (Graves, 2011).

Table 3

Osterwalder's Business Model Canvas

INFRASTRUCTURE
Key Resources: The key resources (Physical, Intellectual, Human, Financial) that the model requires
Partner Network: The alliances that make up the model and/or help it to succeed
Key Activities: The most important things an organization must do (production, education, training, design, etc.) to make the model work
OFFERING
Value Proposition: The bundle of products, services and/or outcomes that create value for the customer segments
CUSTOMERS
Customer Segments: The target audiences that an organization attempts to reach and serve with its product and services and/or the group for whom the model creates value
Distribution Channels: The means whereby a company delivers products/services to customers. This includes the company's marketing and distribution strategy
Customer Relationship: Refers to the links a company establishes between itself and its different customer segments and the management thereof
FINANCES
Cost Structure: Refers to all of the costs incurred to operate the model, the class of business structure (i.e. cost-driven; value-driven) and the characteristics (i.e. fixed costs; variable costs, economies of scale)

Revenue/Returns: Is the way a company makes money through a variety of revenue flows (i.e. the company's income), and/or returns in value (i.e. non-monetary returns – success in social/environmental aims)

Note: Adapted from The Business Model Canvas by Strategyzer. Licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License.

Each of the cases also includes a summary of the barriers, bridges, critical success factors and outcomes for each of the models. The barriers are those elements that made it difficult to implement the model under consideration and/or the disadvantages of that particular model. Bridges refer to those elements that were favorable conditions, opportunities and/or advantages of the given model. Critical Success Factors are those factors that interviewees listed as being critical to the success of the model. Critical Success Factors were also labelled according to the International Institute for Sustainable Development's Critical Success Factors (2008) when appropriate, in order to place them within an established framework and so that interested parties can reference the literature to get more information. Finally, each case includes a summary of the outcomes of each model, including characteristics of performance and lessons learned when the interviewees have shared them.

Data Collection

In order to triangulate the data, the study incorporates different approaches to investigate the research question. Using more than one approach and collecting multiple sources of qualitative data enables case study research and findings to be more rigorous (Breitmayer, Ayres & Knafl, 1993). To achieve triangulation, data was collected by different methods (methodological triangulation - document review and semi-structured interviews), from different organizations, at different times and social situations, and from different people (data triangulation) (Bryman, n.d.).

Document Review. The data collection process began by reviewing print and electronic documentation on the case studies selected. Document review is an effective strategy for case study research (Yin, 2012). The review examined information from websites, organizational plans, reports, articles, and related data in order to get a sense of the characteristics and performance of each of the models. The documentary information served as the preliminary source for beginning the business model canvas for each model, and for the barriers, bridges and CSF of the models when available. This information also allowed for a more focused analysis and targeted questioning during the semi-structured interview stage.

Semi-structured interviews. To complement and triangulate the information from the document review, semi-structured open-ended interviews were conducted with key stakeholders involved with the case studies under consideration. The purpose of the interviews was to gather more detail and to better understand the characteristics and performance metrics identified in the document review (Galetta, 2012). An interview protocol was developed with the thesis supervisor ahead of time to develop questions and to make the interview method more rigorous. However, conversation was allowed to stray from the protocol if the trajectory of the conversation and the information gleaned is deemed appropriate. The interviews consisted of several parts. First, some questions related to the organizational structure were asked (e.g. what type of organizational structure was employed, why they chose this model, how decisions are made). Next, the business model was mapped against the business model canvas through a series of questions. Then interviewees were asked about the bridges, barriers, and critical success factors for their model and also the bridges, barriers and critical elements necessary to drive solar PV in BC. Finally, they were asked questions related to their model in terms of lessons learned, ways that the model could be improved upon, whether there were any issues that were missed during the interview and if there were any suggestions for additional individuals to talk to (snowballing). Interviews were conducted over the phone and ranged between 45min to 90min. Extensive notes were taken throughout.

Participants. Participants for the semi-structured interviews were made up of key stakeholders involved with the case studies under consideration, as well as those not directly involved with the case study organizations but having experience with Solar PV in general (e.g. representatives from BC Hydro, members of Bullfrog Power, etc.). A purposive sampling strategy was utilized to select individuals with key information and to incorporate a variety of viewpoints on the cases selected (Oliver, 2006). In each of the cases the primary interview targets were the organizational leaders (e.g. company president, general manager, director, etc.) and/or the project leads or champions (e.g. project managers, economic development officers, consultants, etc.). In addition, snowball sampling was used to build the interviewee pool if specific recommendations were suggested (Yin, 2012). For some of the smaller organizations or projects (e.g. Central Park Strata), only one individual was interviewed, as they were the primary or solitary lead on the project and able to provide comprehensive information. In other cases, multiple interviewees were solicited or suggested through snowball sampling to provide multiple viewpoints and sources of information for the case study.

Potential Limitations and Biases

Disadvantages of the case study approach are that it can lack rigorous control measures and it can be challenging to test hypotheses or theories within this framework (Lloyd-Jones, 2003). Case studies can also be prone to bias in the methodology or from the researcher (Corcoran, Walker & Wals, 2004). A potential bias for the study may be that it only focuses on certain elements of the cases that are deemed most relevant and therefore the results may be flawed or incomplete because the analysis did not include all of the factors that could be influencing the outcomes of these enterprises/projects. However, multiple case study comparison can compensate for most of these disadvantages.

Summary of the Cases

Two main categories of models were found that are currently operating or developing in BC (See Appendix B). These categories are similar to, or a hybrid of those found by Sauter and Watson (2007), Huijben and Verbong (2013), and UNDP (2004). The first category is Commercially Led Approaches focusing on customer owned systems, in which suppliers/installers develop the market, relying on cash sales of solar PV systems to residential and small commercial consumers that install the systems on their properties. The second category is characterized by Community Led Approaches, in which a community of stakeholders is involved in purchasing and/or ownership of the system. Within the community led approaches there is significant variation; systems can be onsite or offsite, and the energy produced can either be consumed by the system owners or sold back to the grid. It should be noted that there is a noticeable lack of third party owned models in BC, which happen to be an important driver of the market in other locales, most notably the United States (Strupeit & Palm, 2015).

There were also other examples found of models that were helping to expand the deployment of solar PV in BC. These include bulk purchasing models and “green power” purchasing plans (e.g. Bullfrog Power). Individuals from Bullfrog Power and from two bulk purchasing groups were interviewed, but these models were not included as case studies. The bulk purchasing models were somewhat informal arrangements, consisting mostly of a group of individuals coming together to reap the benefit of volume discounts from purchasing PV equipment in bulk. Bullfrog Power, though creating an opportunity for BC residents to invest in renewable energy and providing critical financial support to a number of projects in BC, was not included as a case study, since it operates across Canada with consumers not consuming energy from a distinct system. Interviewees from these models provided valuable information however, some of which helps to inform the broader results and discussion section.

Commercially Led Approaches

1. Vancouver Renewable Energy Co-op - For-Profit Workers Cooperative

Overview

Vancouver Renewable Energy Cooperative (VREC) sells, installs and provides consulting services for renewable energy systems. They’ve been operating since 2004 primarily in the Lower Mainland, and specialize in solar PV in addition to solar hot water, solar pool heating and wind energy systems (Vancouver Renewable Energy, 2015a).

They are a workers cooperative, which means that the workers are the owners of the business (employees have the option of becoming members). The idea for the co-op came about as the founders wanted to explore alternative and more sustainable business models. The co-op operates on a “democratically-flat” organizational structure, with all members working as a collective and having equal say in decision making (Vancouver Renewable Energy, 2015a). The organization has a triple bottom line approach, whereby profits are not the sole focus of the enterprise but rather meeting social, environmental and economic imperatives equally.

Model Configuration

Infrastructure.

Key Resources.

- Solar PV equipment: VREC supplies and installs equipment (for both grid-tie and off-grid systems) from a variety of manufacturers and choose the best equipment for the consumer’s needs
- Qualified and experienced staff to provide “complete turn-key solutions” for renewable energy installations (Vancouver Renewable Energy, 2015a)
- The cooperative was primarily self-financed; there was a sharing of the costs amongst the initial members in getting the cooperative started. Going forward, individuals buy shares to enter the cooperative.
- The cooperative sustains itself through ongoing revenue

Partner Network.

- As VREC is primarily a supplier/installer of renewable energy equipment and services, the main partner network consists mostly of supplier relationships
- Informal relationship with other co-ops in BC, sometimes helping each other out
- Third-Parties: VREC has started to develop partnerships with third parties through their new SolShare program. They find partners interested in installing PV systems on their properties and set up lease agreements with them. SolShare owns the equipment and does the installation and then sells the electricity generated to the third parties through a lease agreement. Investors in the SolShare program receive dividends from these lease payments (SolShare Energy, n.d.)
- VREC is a member of the BC Sustainable Energy Association, the Canadian Solar Industries Association, the Canadian Workers Coop Federation and the Canada Green Building Council

Key Activities.

- Sales and installations of solar energy systems (mostly solar PV with some thermal)
- Ongoing maintenance
- Consulting services for renewable energy installations
- Energy conservation services
- Some public education

Offering.

Value Proposition.

- The value proposition for customers is electricity cost savings, which can be considered as a green and low risk financial investment offering a competitive rate of return
- VREC offers consultation, sales and installation of renewable energy equipment to their customers
- VREC is also pioneering a cooperatively owned community shared solar model called SolShare. This model has been designed to grow community based renewable energy in the province and offer a chance for individuals who otherwise may not be able to have a solar system on their own property a way to participate in the spread of renewable energy and receive a return on their investment. Residents of BC can "purchase shares in the corporation and share in the dividends from the lease payments generated by the renewable energy equipment that SolShare owns" (SolShare Energy, n.d.)

Customers.

Customer Segments.

- The primary consumer profile is individuals interested in the technology, middle class professionals/families. The majority of installs are residential with some commercial work

Distribution Channels.

- VREC serves it clients primarily through its own channels (storefront, employee service) and partner channels (suppliers/distributors)
- The website is a primary channel for directing customers to the business as well as word of mouth/referrals, and a little bit of media around their projects
- They don't do a lot of marketing but rather the focus is to make it easy for the customer to come to them

Customer Relationship.

- The customer relationship dynamic can be characterized as a personal assistance relationship through the company-customer interaction. The assistance is performed before, during and after sales/install

Finances.

Cost Structure.

- The most important costs relate to typical operating and overhead expenses for a small-medium enterprise (purchasing product, salaries, rent, etc.)

Revenue Streams.

- Revenue from products and services

Barriers

- Some misunderstanding from the public about what a co-op is, it can be confusing and sometimes consumers/clients don't realize they function just like a regular business

- Financing can be tricky because banks are used to working with traditional businesses
- Determining management processes and organizing took some time in the early days
- Collective decision making early on was a bit of a roadblock but not really an issue anymore

Bridges

- Many employees are owners which helps with the quality of service/work
- Under the co-op model they do not have to generate profit for external investors
- Team input inherent to co-op structure is often helpful
- Co-ops are often viewed positively by the public
- Principles of the co-op movement, provide a well-established framework to work from

Critical Success Factors

- Proof and Clarity of Concept: Having a good business plan and a clear vision for members were considered critical success factors for this model

Outcomes

VREC has been in business since 2004 and is the leading installer of grid-tied PV systems in Metro Vancouver. The cooperative framework seems to be working well for them and is creating economic, social and environmental value for the company and the communities in which it operates. For their purposes, they mention that it was fairly easy to set up the co-op, doing it all in-house, and was likely less complicated than setting up a corporation, and also that the model is scalable and could be replicated in another location.

2. GabEnergy - Non-Profit/Social Enterprise

Overview

GabEnergy is a legally incorporated non-profit. Their goal is to “work with communities in BC to explore, plan, develop, and operate alternative and renewable energy systems to help meet a variety of goals including sustainability, community capacity building, and cost savings” (GabEnergy, 2015).

Their mission is defined by several objectives (GabEnergy, 2015).

- To assist residents of BC in sourcing, installing, and commissioning alternative energy systems on their properties through wholesale purchasing of equipment and installation by local trades people (if needed) DIY options also exist
- To work with BC organizations to facilitate alternative energy systems
- To explore the opportunity of developing a larger-scale energy system that has a co-op structure and is member owned and operated
- To promote energy conservation as a major part of energy strategy

They have a Board of Directors that is volunteer based, and a General Manager that receives compensation based on a percentage of a 5% handling fee that they collect from consumers for services rendered. The decision to go with a non-profit was made for a few reasons; the optics of the non-profit was seen as important, as it helps to build trust with consumers; the non-profit model is relatively easy to set up in BC which allowed them to get up and running quickly; it helps them price goods and services on a very competitive basis (cost recovery + small margin to cover operating costs); and they wanted to have a community based orientation. A key focus for GabEnergy is to demonstrate and use the non-profit approach to stimulate local economies and help drive down the costs and expand the market for solar PV in the province.

Model Configuration

Infrastructure.

Key Resources.

- Some initial seed funding from Bullfrog Power was acquired
- Solar PV equipment: GabEnergy serves as a portal to connect buyers to a wholesale equipment supplier (not a reseller)
- Qualified and experienced personnel to provide consulting, coordinate ordering, shipment, delivery (and install if necessary). Recent hire of a sales associate
- Ongoing revenue (5% handling fee) to cover operating expenses and promote community initiatives

Partner Network.

- Wholesale Equipment supplier/partner in Ontario: Sentinel Solar
- Soft links with other local community organizations: Sustainable Gabriola, Gabriola Commons

- GabEnergy is a member of the BC Sustainable Energy Association

Key Activities.

- Design, planning, sales, ordering, installs, and maintenance for solar energy installations
- Community outreach
- Promoting energy conservation
- Education (including a solar PV installation course)

Offering.

Value Proposition.

- Provide highest quality solar equipment at the lowest cost possible. GabEnergy connects buyers to a wholesale equipment supplier, and charge a 5% (of equipment & shipping) handling fee. For customers off island (Gabriola Island) they charge additional fees
- GabEnergy offers consultation, sales and installation of renewable energy equipment to their customers

Customers.

Customer Segments.

- The target consumer is primarily DIY individuals/households that have good sites for PV, but also individuals/households who need help with the installation (GabEnergy provides a discounted rate on labour)
- Institutional: e.g. recycling centre, non-profits, libraries, fire halls
- Community Projects (serving as a supplier)

Distribution Channels.

- The main channel for equipment is via their wholesale equipment provider in Ontario
- The primary channel for customer acquisition is through their website and the tools it includes (solar calculator) that help customers to determine the feasibility of solar energy for themselves and/or their properties
- Customer acquisition is also helped by having high profile arrays with GabEnergy's name being visible, and through word of mouth, media stories, social and speaking events

Customer Relationship.

- The customer relationship dynamic can be characterized as a personal assistance relationship through the non-profit society-customer interaction

Finances.

Cost Structure.

- The structure is cost driven, basically trying to provide customers access to the lowest costs possible for solar equipment. The cost is primarily passed onto the customer
- There is a small cost that goes towards the General Manager who receives compensation based on a percentage of a 5% handling fee collected from consumers for services rendered

Revenue Streams.

- The main source of revenue comes by way of the 5% fee that charge customers based on the equipment and shipping (not including taxes).

Barriers

- One of the disadvantages of the non-profit model is the wear and tear on volunteers who put in a lot of time and effort. In this sense there can be a lack of stability that a company would provide
- Requires good succession planning and training new people to come in and succeed the others who move on

Bridges

- With the non-profit model, consumers view GabEnergy with a certain legitimacy and trust that may not be as easily attained in a for-profit model
- Simplicity of the model and ease of setting it up
- Small group of cohesive people with a strong vision around providing community benefit

Critical Success Factors

- Partnerships: The partnership with their equipment supplier is absolutely key for their model to work, enabling consumers to get new PV equipment at wholesale prices
- Community Engagement: Connecting with the community and having a community-oriented focus has been critical to the support and success of GabEnergy. Social events and education are a key part of this
- Free site assessments: Providing free site assessments is a key cornerstone of the business model, helping individuals to understand if solar is feasible for them and helping to bring down the total installed cost of the system
- Triple Bottom Line Planning: the conscious alignment of economic benefits with social and environmental benefits is key to the success and sustainability of the organization

Outcomes

GabEnergy only incorporated as a non-profit organization in 2014, but through the end of 2015 they've helped to provide over 1000 modules. Their focus on providing low cost solutions has been very effective, installing systems in the range of $2.40 – 2.60/Watt for roof mounted systems and getting as low as $2.00/Watt for a ground mount system where the customer helped with the installation. The LCOE for the average consumer system varies but a conservative estimate for a system lasting 25 years is ~ 8¢/kWh, and a system lasting 30 years is ~7.3¢/kWh. At these costs the Return on Investment for consumers is in the range of 4-5%, with a simple payback period in the range of 8-12 years. These are impressive numbers for customer owned systems, which makes solar PV increasingly attractive and will likely help to drive costs down across the market. Furthermore, it was noted that this model can be scalable and replicated in other communities/locations and/or GabEnergy could function as a supplier for other consumers or communities wishing to acquire equipment.

Community Led Approaches

1. Central Park Strata – Onsite Shared Solar Strata Project

Overview

Solar Strata is an interesting model for solar PV. It represents somewhat of a combination of elements from some of the other models under study. It combines the advantages of group financing to purchase/finance at a larger scale so that individuals receive the award of greater cost savings than would be possible as an individual. The Solar Strata under review here is from the Central Park Strata, a four-storey apartment building with some 100 residents in Victoria, BC, which installed a 14.7 KW solar PV array (60 panels) in the summer of 2015.

Bruce Mackenzie, the president of the Strata council, had initially been looking at installing a solar hot water system, but after learning more about solar PV and doing a cost comparison he found that solar PV was the more attractive option. At a 2011 Annual General Meeting the Strata had expressed support to explore solar PV for the building, but at the time it was too expensive. The group to decided to wait a few years for the cost of solar panels to come down. Then, with general support being there and after doing some pre-feasibility analysis, Bruce took the proposal to the Strata Council who voted in favor of developing the project.

System Characteristics

System Capacity: 14.7 kW (60 modules).

The factors that went into determining what size of system to go with were (1) how much would the owners want to spend? And (2) how much power should they generate? Bruce Mackenzie decided to limit the amount that owners would pay to be under $1000 per suite. The building has a fairly large roof and could collect more energy than would be necessary for their common area (which was the area/energy usage that they were seeking to offset), however they decided to size the system so that they would use all of the energy produced (i.e. not sending power back to the grid under normal conditions). Central Park Strata decided on a 60 panel, 14.7 kilowatt system. This system should generate approximately 16,000 kilowatt hours of electricity per year or about 1/3 of the energy used by their common areas per year (Mackenzie, 2015).

Type of system: Grid-Tied, Placed on roof of building on ballast system (no holes in roof), Silicon cell modules connected to 11.4 kW inverter

Model Configuration

Infrastructure.

Key Resources.

- Project Champion
- Experienced supplier and electrician and good relationships with both
- Suitable roof for the system

- Supportive community (Strata) and property manager
- Finances: Strata Contingency Reserve Fund used to fund the project
- PV Watts (solar calculator software) that helped project lead to put a solid proposal together
- BC Hydro Net Metering Program and support staff
- City of Victoria – permitting for the system was inexpensive and easy to facilitate

Partner Network.

- Owners of the building (Strata) – 64 owners
- Equipment Supplier: HES PV
- Electrician: Michael Geldreich of Power to the People: Photovoltaic Solar Panel Installations
- Property Manager

Key Activities.

- Pre-feasibility analysis in order to get accurate information to present to Strata Council
- Meeting with Strata Council to present idea and get support
- Securing firm quote
- Further information meetings with Strata owners
- Annual General Meeting/Vote: securing 75% vote support for proposal
- Engineering

- Installation
- Monitoring

Offering.

Value Proposition.

- Electricity Cost Savings for common use area

Customers.

Customer Segments.

- The customer segment for this model is the Strata owners themselves. The key was to present and convince the owners of the feasibility of the project

Distribution Channels.

- The communications aspect for the project was mostly in house via Strata meetings
- The delivery of product was facilitated by the supplier and electrician
- Credit for electricity comes via BC Hydro Net Metering Program

Customer Relationship.

- The relationship dynamic for this project is one of community and co-creation. Bruce Mackenzie was the project champion and developed the project but had a lot of support from the Strata, supplier and electrician

Finances.

Cost Structure.

- The total cost for the system was $47,000 and was paid for in one cheque from the Strata's contingency reserve fund (a fund used to pay for building repairs and maintenance common to all owners)
- The fund will be paid back at $9400 per year, equaling payments of $10-15 month per unit
- Cost per watt for the project worked out to $3.00/watt

Revenue Streams.

- The main source of revenue/returns for the project will be cost savings on electricity
- The cost savings were maximized by offsetting the more expensive tier 2 electricity rates used in the building's common area
- The Return on Investment was estimated to be 4.6% of the initial investment in the first year, increasing as BC Hydro electricity rates increase, but also decreasing slightly as the panels age and lose efficiency[4]
- Strata owners were confident that the investment would be recovered over time as the value of the solar panels on the building would be greater than this initial investment when it came to resale of their unit(s) in the future

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[4] The ROI will increase over time as electricity increases from BC Hydro are expected to increase at a rate greater than solar panel efficiency depreciation

Barriers

- The project was described as being quite easy once the support/vote was made. The initial challenge was making the case and convincing the owners of the opportunity
- There was some challenge in getting the ballast system on the roof. Initially they thought they might have to use a crane but with some creative thinking they were able to use carts and the building elevator to get the equipment up to the top floor and then a system of pulleys to elevate it to the roof. Although they managed to find a creative solution, this challenge should be taken into account by others wanting to replicate this model in a similar building as it could potentially represent a significant increase in installation costs
- Overall, it was a marginal financial benefit (i.e. ROI ~ 4.6%), which may not be enough to convince another Strata to pursue a similar project

Bridges

- A large roof with no shade, and an easy route for service connections down the side of the building to the electrical room
- Adequate roof strength to support the panels
- Significant use of electricity in the elevators, hallways and common areas, and a significantly high electricity rate to offset with solar electricity
- City did not require a building permit as they were not significantly altering the building
- Ballast System: The system was mounted on ballasts that were laid on top of the roof. Therefore, the system did not have to drill holes in the roof itself to mount the equipment.

This helped to get around the building permit requirement and made it easier for the owners to support, knowing that they would not be making holes in the roof which could potentially lead to water leakage problems in the future

- The supplier was willing to give them a good price for the system as this was somewhat of a pioneer project and they wanted to demonstrate to the wider community that it was possible and to create incentive for other stratas to follow suit

Critical Success Factors

- Leadership: Having a champion to lead and coordinate the project was essential
- Proof and Clarity of Concept: extensive planning, research and feasibility studies were undertaken so that a clear plan could be presented to owners with the ability to answer all of the questions/concerns posed at the meetings
- Partnerships: Strong partnerships with supplier, electrician, property manager, and building owners (Strata)
- Triple Bottom Line Planning: the alignment of economic benefits with social and environmental benefits was a deciding factor for the building owners
- Community Engagement: An extensive process of engagement and information with the stakeholders (Strata) was undertaken in order to gain support. The owners also wanted to come together to make a community decision about something they felt good about
- Risk Management: In the Strata model the cost is divided up between many people which makes it affordable for individual owners with less risk involved. Furthermore, the project was financed with funds pre-existing in the Contingency Reserve Fund

Outcomes

The project has been up and running since summer 2015. The system has been running well with electricity production exceeding expectation (See Figure 2).

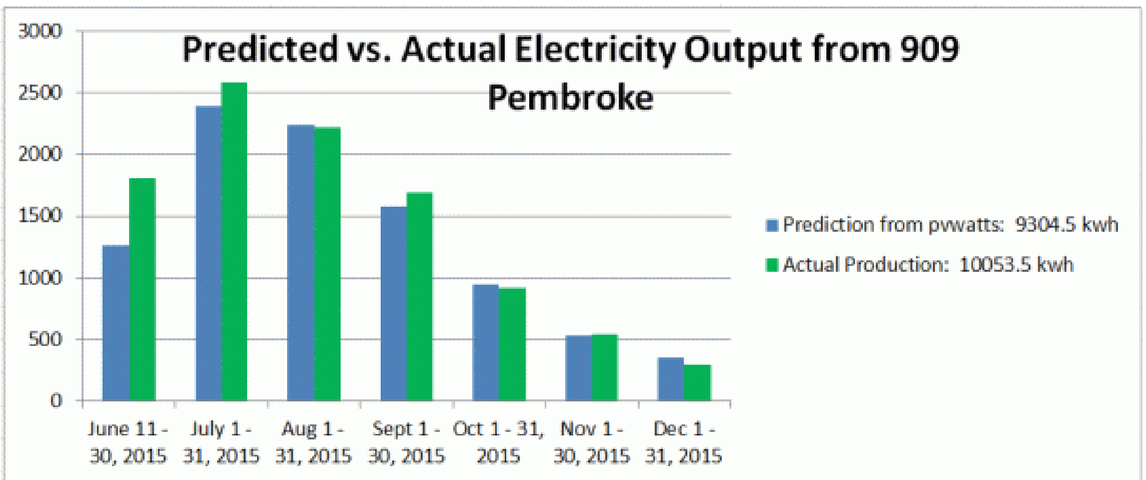

Figure 2. Predicted vs. Actual Electricity Output from 909 Pembroke: 2015. Copyright 2015 Bruce Mackenzie. Reprinted with permission.

Though the project took considerable work it is one that can be replicated and scaled up. Bruce Mackenzie mentioned that part of the reason for doing the project was to demonstrate that it was possible so that others could do the same.

The project leader also mentioned that the project seems to have made other positive effects in the building, creating a sense of pride among owners and prompting them to advertise that the building is a Solar Strata on external building signage.

One of the lessons noted was that it would be helpful to have the project champion live in the building to help with casual discussion/information sharing with residents.

2. T'Souke First Nation – First Nations Community Solar

Overview

Visioning for the T'Souke solar project first began in 2007 and coincided with the hiring of Andrew Moore as solar project director. The Nation at this time underwent a series of visioning sessions with community members, and developed a vision statement as an outcome, based on the concept of being responsible for seven generations forward. The Nation decided to take action to become as sustainably self-sufficient and autonomous as possible. A solar PV project to supply electricity to the Nation was determined to be one of the key parts of their sustainability process, along with creating self-sufficiency economically, and in the food supply, and preserving values and traditions that bring back sustainability (T'Souke Nation, 2016).

By 2009, a total of 75 kW was installed over 3 separate buildings in addition to 40 solar hot water systems in private residences and the introduction of an energy conservation program for all 96 residences (T'Souke Nation, 2016). So far the community has reduced energy consumption by 75% and plans to eventually get to net zero in order to provide for all of the community's electricity needs (A. Moore, personal communication, December 21, 2015).

System Characteristics

System Capacity: 75 kW (550 panels: 6 kW on Fisheries Office, 7 kW on the Nation Hall, and 62 kW atop the Nation's Canoe Shed)

Type of system: 2 Grid-Tied (7 kW & 62 kW), 1 Off-Grid (6kW), Roof Mounted systems

Model Configuration

Infrastructure.

Key Resources.

- Forward thinking leadership
- Community Vision/Supportive Community
- Suitable roof sites for system
- Network of partners
- Funding: Innovative Clean Energy (ICE) Fund administered by the Ministry of Energy and Mines; Solar BC ecoEnergy funding; Western Economic Diversification funding, Indigenous and Northern Affairs Canada
- Experienced installer combined with community labor to help with install
- Net metering

Partner Network.

- BC ICE Fund
- Solar BC/ecoEnergy program
- Western Economic Diversification program
- Indigenous and Northern Affairs Canada
- HES PV: Supplier and Installer
- BC Hydro

Key Activities.

- Visioning/Planning
- Community Approval
- Feasibility Studies
- Finding and securing funds
- Installation
- Kick-Off event – celebration and gathering
- Monitoring

Offering.

Value Proposition.

- Electricity Cost Savings/Payback through net metering program
- Fulfilling community vision for energy autonomy
- Pioneer project: Demonstration and Education for other communities
- Training in solar PV installation for members of the Nation

Customers.

Customer Segments.

- The model primarily creates value for the Band, but also creates value for other communities wanting to move in the same direction (demonstration/education), and for the utility (BC Hydro) in learning how to facilitate community solar (this project was in many ways a first for BC Hydro as well)
- BC Hydro purchases excess electricity through its net metering program

Distribution Channels.

- The initial channel to present and communicate the idea was through the vision and planning sessions
- The solar product and installation channel was through HES PV
- Communication about the project to reach external audiences has taken place via news stories, a kick-off event, website and tours of the site
- Credit for electricity comes via BC Hydro Net Metering Program

Customer Relationship.

- The relationship dynamic for this project is one of community and co-creation with the Nation, it’s partners, and now spreading to other interested parties who come to visit the site and learn

Finances.

Cost Structure.

- The total costs for the total installed PV system was $900,000

Revenue Streams.

- The main source of revenue for the project is cost savings on electricity and selling energy back to the grid in times of excess production

- The high level of interest in the project has begun to evolve into a potential eco-tourism industry that may be able to produce revenue through site visits and educational sessions

Barriers

- Finance Barrier: Securing funding for a project of this nature was a challenge; little incentive for solar PV in BC. They had to rely on funding from 15 different governmental and non-profit sources to fund the project (T'Souke Nation, 2016)
- Cost Barrier: cost of the project and the technology at the time of development was a barrier (but has since improved)
- Pioneer project: At the time they developed the project there were no other examples to base project on, therefore, there was a lot of learning involved (for example, the interconnection process took 9 months)
- Institutional Barrier: Experienced some initial resistance from the utility
- Governance: Although the leadership of T'Souke Nation has been a driving force behind the project, there is the potential for future leaders to not be in support of current sustainability initiatives, and this could be problematic in the future. The leadership at T'Souke Nation changes in a 2 year cycle which makes the community vulnerable to any changes in governance with different motivations (Newell & King, 2013)

Bridges

- History of sustainable living and values around sustainability

- Recognized need to respond to loss of industry (i.e. fishing, logging) and effects of climate change
- Autonomy and suitable site to proceed with project

Critical Success Factors

- Leadership: Strong leadership initiative from the whole community, in addition to the Chief and other senior Band members, and Andrew Moore (solar Project Manager)
- Partnerships: Good partnerships, including those that are project funders
- Triple Bottom Line Planning: Meeting economic, social and environmental imperatives were an important part of project and critical to community support
- Short and Long Term Benefits Management: The project has clear long term benefits for stakeholders, as the array will continue to produce years into the future, and also short term benefits (training, education, tourism) that keep the community engaged and committed
- Community Engagement: This was the most critical piece of all. The project was an outgrowth of community visioning. Getting the collective vision together was essential: “a picture that everybody can see themselves in” (A. Moore, personal communication, December 21, 2015)
- Risk Management: “Taking the time on creating a collective vision is the biggest risk mitigation strategy” (A. Moore, personal communication, December 21, 2015)
- Philosophy: The T’Souke First Nation ascribes to the philosophy detailed in the Great Laws of the Iroquois Confederacy whereby they must consider the impact on the next

seven generations of their people when making decisions in the present. Adhering to this philosophy has been a critical success factor in their developing as a sustainable community (Newell & King, 2013)

Outcomes

So far the project has been a great success; the solar array is working well, and in combination with the solar hot water and energy conservation programs, has been making great headway towards total energy autonomy for the community. The community has also become much more conscious of their own habits and has inspired community members to lead more sustainable lifestyles. The project has had other positive outgrowths, including the organic development of an eco-tourism program that sees dozens of schools, municipalities, government groups and tourists from all over the world visit the site to learn more about the project and how to bring the innovations from T'Souke to their own communities. The Band has also recently installed electric vehicle charging infrastructure. Perhaps the most important outcome from this project is the example that it has set and the path it has paved for similar projects to follow in its footsteps.

There were some key lessons learned, as this pioneer project employed somewhat of a learning-by-doing approach. The first is that the energy conservation program should have been enacted first. They did the solar PV project first and realized afterwards that had they reduced demand first, they would not have needed as many solar panels. Second, after doing some analysis, they found that the effect on energy consumption for each of the three programs (energy conservation, solar hot water, solar PV) was fairly similar and yet they spent about

$900,000 for solar PV, $250,000 for solar hot water and only $150,000 for the conservation program. This tied in to the key realization that individual changes in habits, rather than focusing on new technology can achieve the biggest benefits.

3. City of Nelson/Nelson Hydro – Utility Driven Offsite Shared Solar (Solar Garden)

Overview

The City of Nelson is currently developing a community solar garden project that will give residents the ability to purchase solar energy and to receive credit on their electricity bill. A community solar garden is a shared community solar array with grid connected members who can subscribe to purchase a portion of the solar generation (Solar Gardens, n.d.). The advantage to the solar garden is that homeowners and businesses can access solar energy in their community without having to install and maintain panels on their own property.

The idea started from similar projects in the US, and because Nelson owns its own municipal utility, they thought they'd be a good location to try something similar. The solar energy is generated from a shared offsite PV array and is credited to the subscriber's Nelson Hydro bill in proportion to their investment (Community Solar Garden, 2015). In this way, solar is available to those who otherwise would not be able to access it, for example, renters, or those whose space is not ideal for solar PV.

Participation in the program is available to Nelson Hydro customers on a voluntary basis. "A contract agreement between the City of Nelson and Nelson Hydro customers will include terms and conditions that specify financing amounts, amortization periods, transfer options and rates. The project is being developed, marketed and managed through Nelson Hydro's EcoSave Program" (Community Solar Garden, 2015, p. 1)

System Characteristics

System Capacity: The Nelson Solar Garden will be in the range of 50kW-100kW (200 – 450 panels) in size, but could be larger depending on community interest

Type of system: Grid-Tied, ground mounted on land near existing Bonnington generation station. Equipment TBD.

Model Configuration

Infrastructure.

Key Resources.

- Project Lead: Carmen Proctor
- Suitable site (Bonnington Plant) to accommodate size of system and close to electrical infrastructure
- Network of committed partners
- Financing: Funding & Electrical customers
- Supportive community

Partner Network.

- Bullfrog Power: Funding partner, provided $15,000 for research and development and a later $20,000 for capital costs
- West Kootenay Eco-Society: helped out in a general way, they were a partner for the prior energy efficiency program and they hosted a communications event for the project

Key Activities.

- Started with community engagement via a community conversation event. Put out an opinion poll to those people that attended the community café – interest was high.
- Solar monitoring and feasibility studies
- Presentation of plan to City Council (July 2015)
- Site analysis and selection
- Prepared a budget
- Funding application
- Consultation with city council for bylaw amendments as necessary
- Public information sessions
- Presale phase: 75% of 50kW array (~ 150 panels) must be pre-sold to proceed with project (achieved)
- Kick Off Event: Coincides with pre-phase and including presentation about project including location, energy production estimates, buy in model, solar credit rates and costs

- Construction (2016)

Offering.

Value Proposition.

- The consumer, community and utility all benefit from the addition of renewable energy to the community
- The utility benefits by gaining experience in solar PV
- Provides access to solar PV for customers who may otherwise not be able to afford it or access it
- Consumers who invest in the project will be entitled to receive an annual credit proportional to their investment over a 25 year term contract and which will calculated based on the kWh generated by the solar array.
- Return on Investment: The customer pays for the solar panel(s) up front, and recoups the cost through solar panel production and subsequent credit to their electricity bill. Any credit received after recouping initial investment cost is profit to the consumer
- Efficiency: Compared to an individual roof installation, the community project could be 30-40% less expensive (Community Solar Garden, 2015).
- The project helps to demonstrate and communicate the value of renewable energy

Customers.

Customer Segments.

- Nelson Hydro customers (It should be noted that as long as the solar credit is allocated to a Nelson Hydro account anyone can participate)
- Local schools and churches have expressed interest in program
- Business community has expressed interest in program

Distribution Channels.

- The City held information sessions, did news stories, a kick-off event involving pre-sales, and gave information via their website
- The distribution channel for the products/services is the pre-existing Nelson Hydro framework
- Nelson Hydro is requesting proposals for equipment from suppliers

Customer Relationship. There are several levels to the customer relationship in the Community Solar Gardens model:

- Personal Assistance: in the form of utility-customer interaction (i.e. prior to sales (information session), during sales and after sales)
- Self Service: the organization (utility) provides the option and tools needed for the customers to serve themselves easily and effectively
- Community: the utility and customer have a community relationship allowing for direct interaction and where knowledge can be shared and problems solved

- Co-creation: the final characteristic of the customer relationship in this model is one of co-creation. The customer has a direct impact in the development and final outcome of the program

Finances.

Cost Structure.

- Nelson Hydro performed a cost analysis for a 50kW array (which can be expanded to a 100kW array with demand) and is outlined in Table 4

Table 4: Nelson Community Solar Garden Cost Estimate

Project Costs	**50 kW Array**
Site Preparation/Foundations	$19,650
Panels (245w) (200 panels)	$42,262
Micro Inverters	$33,629
Metering System	$540
Racking (Made in Nelson) and clips	$26,398
Shipping	$3,000
Installation	$20,000
System Grid Connection Single Phase 240V, 400A	$7,210
Electrical (Installation labor, balancing, design/management)	$25,000
Contingency	$15,000

Subtotal (Capital Cost)	$192,689
Land Rights (* Nelson Hydro owns the land)	$0
Program Development	$10,000
Structural, Civil & Geotechnical Engineering	$12,000
Electrical Engineering & Design, Solar Analysis	$10,000
Subtotal (Owner's Cost)	$32,000
Total Estimate	**$224,689**

Note. Retrieved from City of Nelson Community Solar Garden Project Plan. Copyright 2015 City of Nelson

- The estimated cost per watt (not including grants) is in the range of $3-4/watt. For the cost passed on to the customer, the estimated cost per watt is closer to $3.00/watt

Revenue Streams.

- The revenue structure is set up so that customer/subscriber investment covers most of the project costs. Subscribers must invest in at least one panel but no more than ten, at a cost of no more than $924/panel[5] (See Table 5)

Table 5: Nelson Community Solar Garden Funding Sources

Funding Sources

[5] Cost may be lower dependent on size of project and additional grant funding

Customer Buy In ($923.45 per panel) (200 panels)	$184,689
Nelson Hydro Contribution	$25,000
Bullfrog Power Contribution	$15,000
Estimated Contributions	**$224,689**

Note. Retrieved from City of Nelson Community Solar Garden Project Plan. Copyright 2015 City of Nelson

Barriers

- Pioneer project: complex project, new model for electricity production, combined with the fact that Nelson Hydro and project lead were not experienced with solar installations at this scale
- Length of contract (25 years) and subsequent payback period may not be attractive for certain customer segments
- A tiny minority of vocal critics (2 individuals noted), who either don't believe in the value of project or don't fully understand the entire value proposition

Bridges

- Previous Eco-Save energy retrofits program (which helps homeowners make their houses more energy efficient) had lofty targets that the city met quite quickly, therefore, they knew the community was receptive to further related projects/developments
- By law in BC only certain entities are allowed to be a utility. Nelson is able to move forward with this project because the City of Nelson has their own utility (Nelson Hydro) and electrical grid that generates and distributes its own power

- 25 year contract – if people move they would be offered a transfer (able to transfer their account if they stay within the Nelson Hydro territory). If people move out of territory, they'd buy it back or facilitate the transfer of their credit to another account (or charity) in the Nelson territory
- Base of consumers who want to get into solar PV but do not have a suitable site or cannot afford individual system

Critical Success Factors

- Leadership: Project champion who had idea and saw it through to development
- Partnerships: Good partnerships, including one that has become a project funder
- Proof and clarity of concept: Extensive work undertaken to determine feasibility of project, define the scope and communicate it out
- Triple Bottom Line Planning: Meeting economic, social and environmental imperatives were an important part of project and critical to community support. As a City department, Nelson Hydro is guided by the city's environmental policies, including those related to sustainable development
- Short and Long Term Benefits Management: The project clearly demonstrates how it will deliver longer term benefits to stakeholders (including how the benefits will be shared) but also short term benefits (i.e. local design, employment, etc.) that keep stakeholders engaged and committed

- Community Engagement: This was the most critical piece of all. Without the support of the community the project would not be going ahead. Great care and extensive work was done on community engagement, outreach and communication

Outcomes

So far, community interest and buy-in for the project has been great. As of January 2016 the pre-sale for the project has exceeded its target, which means the project will likely scale up to a 60kW capacity. The next step involves analyzing bids for equipment supply.

This model may be somewhat limited due to the fact that it is utility driven, and unless a utility chooses to develop something similar it may be out of reach. However, the opportunity exists for municipally-owned and private and/or investor owned utilities to exist in the province (and elsewhere), so this may prove to be a feasible model for other municipalities and businesses.

Regardless, the main innovative feature of this model can be borrowed and used in other contexts, and this is the innovative mechanism of virtual net metering. Virtual net metering goes a step beyond net metering by allowing multiple homeowners to participate in the same metering system and share the benefit/output from a single facility, that is not connected to their physical property (or meter) (Gottlieb, 2014). Under virtual net metering customers will receive credit on their bills just as they would under regular net metering.

The Nelson Hydro community solar garden project offers easy access to an enthusiastic population, a majority of which have been previously barred from entry due to economic factors or lack of a site. It also offers the further benefit of having the consumer cover the majority of the capital cost up front (through a distributed initial investment), and then, through the same framework, offer a channel for value and revenue for the consumer as they earn credit back. An additional feature of Nelson Hydro's model is that they've added the additional pre-sale feature, which helps to gauge genuine interest in the project and minimize risks in developing it. (I.e. if the interest is not there, we do not build).

4. Kimberley SunMine - Community Owned Solar Project

Overview

The Kimberly SunMine is a community owned and operated solar PV plant built on the reclaimed brownfield site of the former Teck Sullivan Mine Concentrator in Kimberley, BC. With 4,032 modules mounted on 96 solar trackers following the sun's movement, it is BC's largest solar project, Canada's largest solar tracking facility, and the first solar project in BC to sell power to the BC Hydro grid (SunMine, 2014).

The project was initiated by the EcoSmart Foundation; a Vancouver based non-profit specializing in technical innovations and solutions for a sustainable economy. After analyzing weather and solar irradiance data across Canada, EcoSmart discovered that Kimberley was an ideal spot for solar PV. The idea was bolstered by the fact that there was a decommissioned mine site in the area with a BC Hydro substation near the property that could transfer electricity to the grid. EcoSmart approached the City of Kimberley to introduce the idea in 2008 and helped to bring Teck into the discussion. The City put the idea to the community through a 2011 referendum and saw a strong majority of the community support the idea and support the City in borrowing the necessary funds to finance the project. They spent the next three years working with partners to develop funding, negotiating agreements and conducting feasibility studies. Construction began in 2014 and SunMine began commercial operation in June 2015.

System Characteristics

System Capacity: 1.05 MW

Type of system: Grid-Tied, Ground Mounted with solar tracking, Conergy PV modules, ABB Power One Distributed Inverters, and DEGER dual-axis trackers

Model Configuration

Infrastructure.

Key Resources.

- Large and suitable site for the size of system
- High degree of solar insolation
- Supportive community
- Partners to provide design, construction and funding assistance
- City council/employees – administration, decision making
- Financing and Funding for the project was acquired as follows:

Table 6: SunMine Project Funding

SunMine Project Financing/Funding	Revenue
City of Kimberley (Loan)	$2,000,000
Teck Resources Contribution	$2,0000,000
Innovative Clean Energy, BC Govt.	$1,000,000
Columbia Basin Trust Funding	$300,000
Southern Interior Development Initiative Trust	$50,000
Total Project Funding	$5,350,000

Note: Adapted from http://www.sunmine.ca/uploads/3/1/6/3/31637493/sunmine_business_plan_complete.pdf.

Partner Network.

- EcoSmart, helped to develop the concept, bringing technical expertise and experience with publicly supported technological innovation
- Teck, contributed land for the site and $2 million
- BC Ministry of Energy and Mines, contributed $1 million of funding through the Innovative Clean Energy Fund program
- BC Hydro, negotiated a 25 year electricity purchase agreement
- Columbia Basin Trust, contributed $300,000 in funding
- Southern Interior Development Initiative Trust, contributed $50,000 in funding
- Contractors: Conergy, SkyFire Energy, Hebditch Contracting, Jetson Consulting Engineers

Key Activities.

- EcoSmart approaches City and Teck to introduce and develop concept
- Application for funding
- Feasibility studies and on-site solar PV energy testing
- Public presentation of concept and referendum
- Secure funding, confirm public support
- Negotiate roles, responsibilities, ownership, initiate preliminary design, energy verification, engineering review
- Request for Qualifications Proposals issued and evaluated
- Develop and issue agreements and contracts with partners
- Communications with stakeholders and public
- Proceed with construction and undertake monitoring and maintenance

Offering.

Value Proposition.

- Selling electricity to BC Hydro and generating a return on investment for the citizens of Kimberley
- Creating a community asset to draw people and business to Kimberley
- Providing economic development and local jobs
- Pioneer project, demonstrating the potential for solar PV in the region and a positive example of sustainable development

Customers.

Customer Segments.

- The main customer for the project is BC Hydro who will purchase the electricity from the project through their Standard Offer program
- Other customer segments for whom the project creates value include the citizens of Kimberley and partners in the project
- Kimberley has also begun developing letters of agreement with the College of the Rockies and Selkirk College to explore education, research and training opportunities

Distribution Channels.

- For the electricity production: the project is connected directly to the BC Hydro grid
- For communications the strategy is to create ongoing interest and media attention via press releases and news stories in order to drive traffic to their website

Customer Relationship.

- The customer relationship between the City of Kimberley and BC Hydro can be described as a seller – purchaser relationship
- The relationship with the citizens of Kimberley is a relationship of community engagement and communication

- The relationship with EcoSmart and Teck could be characterized as a relationship of support and co-creation
- The relationship with funding groups is grant based
- The relationship with educational institutions could be described as information sharing

Finances.

Cost Structure.

- The cost structure is determined by the capital and operating costs, and financing costs
- SunMine has a $5.35 million construction budget for expenses including the engineering, procurement and construction contract with Conergy, the prefeasibility and interconnection studies, engineering review, equipment and upgrades, among others (see Appendix B for complete breakdown)
- The cost per watt for the Kimberley SunMine comes out around the $5/watt mark (EcoSmart, 2016). The cost per watt is a little higher for this project due to it being a pioneer project and involving much preliminary planning, studies, consultation, permitting, etc. The cost of scaling up the project and/or replicating a similar project would be less expensive

Revenue Streams.

- The main source of revenue going forward comes through the 25 year Electricity Purchase Power Agreement with BC Hydro under its Standing Offer Program. Under this agreement the City of Kimberley will be paid $110.10 per MWh produced (and increasing at the rate of annual Consumer Price Index inflation) and is expected to generate an annual average revenue of $244,000 (SunMine, 2014)
- Net revenue is expected to average $57,800/year over 25 years after accounting loan payments, operations and maintenance expenses (SunMine, 2014)
- Kimberley expects its loan to be paid off within 20 years while generating $1,445,000 in retained earnings over 25 years (SunMine, 2014)
- (See Appendix B for further detail)

Barriers

- Complex project: difficult to set up, lots of decision making and agreements; largest solar tracking system in Canada
- Pioneer project: new experience for most parties involved including BC Hydro; extensive studies and planning required; interconnection decision/configuration took some work; first solar project in BC to sell power to the grid under Standing Offer Program
- Funding: Had to rely on large contributions from multiple donors; getting financing/loans for projects of this size can be difficult because it is a relatively new technology/model for electricity delivery in the province at this scale and can be seen as risky by financial institutions/lenders

Bridges

- Supportive community
- Because the project was not entirely focused on profit but a wider range of values for the community, this gave them the social license to do it. If maximizing return on investment was the main concern the City likely would not have been able to do it
- Experienced solar PV developer (EcoSmart) who understood the value of the solar PV resource in Kimberley and approached City, making them aware of the resource potential, and being involved in development of project
- Mining company with under-utilized resource (site) for which they could create value and large enough to accommodate size of project (and future expansion)
- Having great solar irradiance in the Kimberley area

Critical Success Factors

- Community Engagement: Community Support was crucial for this model. It required a majority vote by way of referendum. They received 76% support form voters being in favor of borrowing money towards construction of project
- Proof and Clarity of Concept: Having a well-designed and credible business plan was important to secure funding and develop the project in a well-organized fashion
- Partnerships: Strong partnerships were key to the project at every phase
- Triple Bottom Line Planning: Meeting economic, social and environmental imperatives were an important part of project and critical to community support

Outcomes

The SunMine has only been operational since the summer of 2015 and despite a couple of relatively minor setbacks (the project was completed 5 months behind schedule and 5.1% over budget) has already been generating positive results. It has won a number of awards: the Clean Energy BC 2015 Community of the Year Award; the Union of BC Municipalities Community Excellence Award; and the Association of Professional Engineers and Geoscientists of BC Sustainability Award (EcoSmart) (SunMine, 2015). The project has provided 8,711 hours of direct local construction labor, and as of the first 19 weeks in production has sold 752 MWh of electricity to BC Hydro and generating $88, 610 in revenue (estimated break-even of $216,000/year). As well, there has been a positive public relations aspect to it, with a sizeable number of visitors to the facility, media articles, projects video views and visits to the website (SunMine, 2015).

As this was a pioneer project there are bound to be lessons learned. One of the key lessons mentioned was the need to hire an electrical engineer to help define the scope of where responsibilities begin and end between the City and the utility (BC Hydro) before renewing the contract.

System Performance

Since the SunMine has only been operational beginning in the summer of 2015, there hasn't been the opportunity to evaluate the performance in terms of annual production. However, EcoSmart has calculated the performance for the first 42 days of operation, and so far the system has performed very well, up to 11.4 MWh, which for a 1.05 MWdc plant is very good, close to a record in North America (EcoSmart, 2015a). Based on test results the project should produce an average of 1945MWh/MW installed per year (with 95% exceedance probability (EcoSmart, 2015b).

5. Salt Spring Community Energy Group - Solar Scholarship Project (Non-Profit Community Solar Project)

Overview

The Solar Scholarship Project is an initiative of the Salt Spring Community Energy Group (SSCEG), a non-profit group based on Salt Spring Island that focuses on community-owned local renewable energy. The group originally had been looking at developing a community solar PV project that locals could invest in, but found that there were too many regulatory/legal hurdles to setting up a project of this nature. They therefore decided to proceed with a community solar project on the local high school (Gulf Islands Secondary School (GISS)) that would be set up as a purely charitable venture, giving away the proceeds from the installation as a “solar scholarship” in order to get around some of these hurdles and solve the accounting problem of what to do with the profits.

The system is composed of 84 solar panels and is expected to generate approximately 23,000 kWh annually, saving the school about $2000 in energy costs. The savings go into a trust fund to generate a scholarship of $2000 (or more) each year for the life of the solar array (25-30 years). The intention for the scholarship is to go to students from the school to be used for education and/or training related to sustainable technologies.

System Characteristics

System Capacity: 21 kW (84 modules)

Type of system: Grid-Tied, Roof mounted, Silicon cell modules, high efficiency string inverters

Model Configuration

Infrastructure.

Key Resources.

- The SSCEG team that facilitated the equipment supply, system analysis, design and construction
- Suitable site: Large roof that could handle system of this size
- Network of committed partners
- Supportive Community
- Donor funding
- BC Hydro Net Metering Program

Partner Network.

- School District 64 partnered with SSCEG to develop the project and provided individuals to help with the install

- GISS Environmental Club, helped with education/awareness and with the initial solar proposal to the school board
- A number of organizations and individuals helped with funding the project, including Bullfrog Power ($20,000), Carbon Neutral Capital program ($9,700), Salt Spring Island Foundation ($5,000), and others

Key Activities.

- Planning and development work (most of it done voluntarily and/or by donation)
- Communications: education and raising awareness about the project
- Fundraising
- Installation labor (most of it done voluntarily and/or by donation)

Offering.

Value Proposition.

- Electricity cost savings for the school
- Providing a scholarship to GISS students
- The project helps to demonstrate and communicate the value of renewable energy

Customers.

Customer Segments.

- The primary target for this specific project can be considered as the School District, however the audience is much broader as it is somewhat of a demonstration project intended to educate and promote renewable energy in the community

- SSCEG aims to engage with local partners (regional district, parks and recreation, school district, etc.) to develop further projects
- SSCEG aims to develop community solar installations for individuals and/or organizations that don't or can't have solar PV on site

Distribution Channels.

- SSCEG reaches its target audience through an active newsletter with around 400 subscribers, social media channels including Facebook and Twitter, word of mouth and projects visible to the community, through their website and via articles in local news
- There were a number of community events and initiatives to raise awareness for the project and perform fundraising

Customer Relationship.

- The relationship dynamic for this project is one of community and co-creation. SSCEG facilitated the project but had a lot of support from the school district and other partners

Finances.

Cost Structure.

- The project had an original target of $60,000, which expanded to a total budget of $106,000 as time went on, donations exceeded the target, and the idea expanded beyond covering the costs of just the solar array to including funding to support educational initiatives in the district and implementing electric vehicle charging capacity in the school district
- It is difficult to calculate the cost performance (cost per watt) for the installation as there were a lot of donated costs (design, labour, etc.). However, the SSCEG says that they typically install systems in the range of $3-4/watt

Revenue Streams.

- The main source of revenue for the project going forward will be cost savings on electricity for GISS which will be channeled into a scholarship

Barriers

- Lots of development work
- A lot of the soft costs (i.e. labor, design, etc.) were donated which is not sustainable for multiple projects
- The overall project/process was fairly difficult and fairly complex - not easy to replicate this specific project/model
- Install took a little longer compared to the average commercial install, they chose a solar panel that required a specific clamp which slowed them down but paid off with improved production

- This type of project relied heavily on local expertise and they were fortunate to have professionals as part of the team

Bridges

- Pre-existing non-profit organizations with experience in solar PV
- Good amount of volunteer contribution (i.e. labor, design)
- Access to funding: Bullfrog Power ($20,000), Carbon Neutral Capital program ($9,700), Salt Spring Island Foundation ($5,000), community donations
- Can provide charitable tax receipts for donors because of charitable status of project
- Relies on and provides work and experience to local workers
- Due to non-profit/charitable status - did not require extensive legal, regulatory work to make project happen
- Local, grassroots nature of project led to little resistance and lots of community support (could be more difficult for outside organization to come in and do a similar project in community)

Critical Success Factors

- Community Engagement: Strong community values around sustainability and renewable energy, combined with strong community participation and funding
- Leadership: Committed and experienced team of volunteers to lead project including Professional/Skilled labor from SSCEG and School District
- Partnerships: Strong partnership with School District

- Proof and Clarity of Concept: Easy to understand and well supported focus for the fundraising effort: renewable energy + solar scholarship
- Triple Bottom Line Planning combined with Short and long term benefits management: Nature of project (positive economic, social & environmental outcomes) was critical for support, involving youth and channeling proceeds into well supported initiative (Solar Scholarship)
- Donations: As this was a charitable venture the fundraising activities and subsequent donations and grant funding were critical to the success of the project

Outcomes

It's been a little over a year since the completion of the installation and the project has been a success. The system has been running well with electricity production exceeding expectation (See Figure 3), and they have awarded the first of their annual solar scholarships. Though the project took considerable work it is one that can be replicated and scaled up. A similar project is being planned for a school roof on nearby Pender Island between School District 64 and Pender Solar Initiative 2020.

The project leader also mentioned that the project seems to have made other positive effects in the community, empowering and inspiring people to make the shift to a greener lifestyle, and noticing an uptake in PV installations, electric vehicles and related infrastructure.

Some of the lessons noted were that it would be helpful for any organizing group wanting to do a similar project to have a sustainable financial model in place, get organized around fundraising, and don't underestimate the value and importance of the communications aspect/getting the word out about the project.

The SSCEG plans to turn their attention to a solar PV investment project in the future.

System Performance

As this is a relatively new system, some of the metrics for assessing performance (LCOE, ROI, Simple Payback period) either could not be or have not been calculated yet. However, the production so far has been exceeding expectation, with the average annual energy yield of 1285 kWh/kWp.

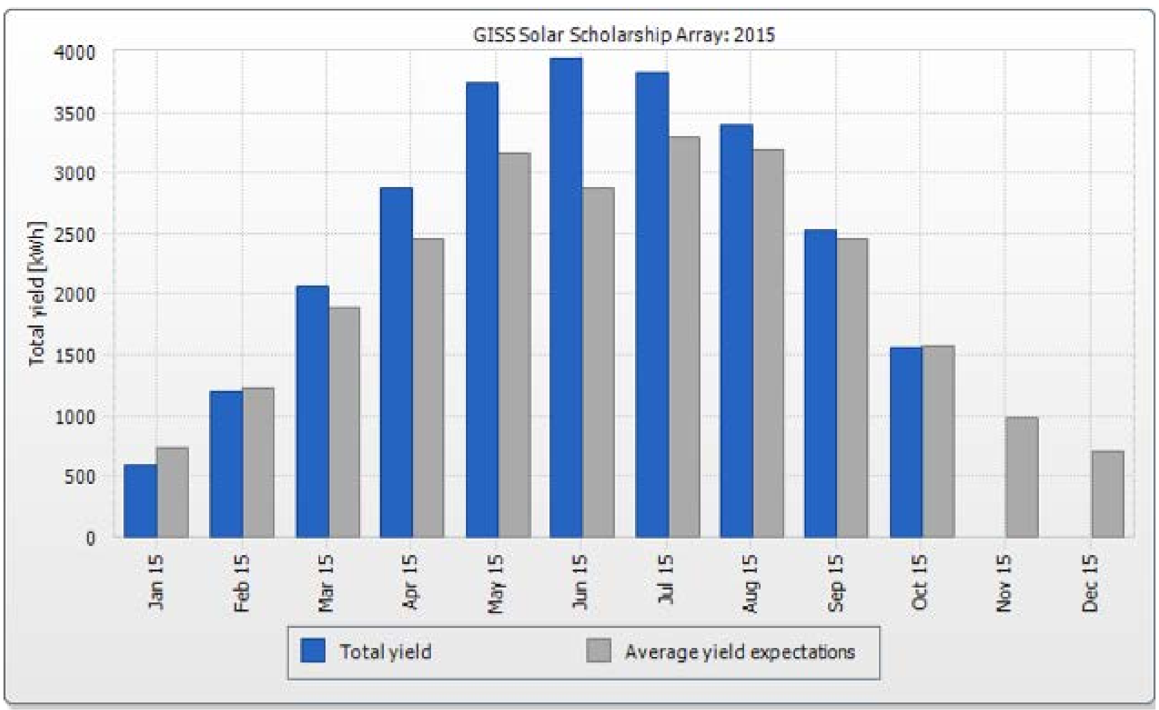

Figure 3. Total Yield vs. Average Yield Expectations: 2015. Copyright 2015 Salt Spring Community Energy Group. Reprinted with permission.

Comparison of Models - Overview

As noted earlier, there are two general categories of models for solar PV delivery in BC; commercially led approaches that focus on customer owned systems (i.e. individual home or building owners) and community led approaches that focus on community owned and/or financed systems. Within the community led approaches there is significant variation, mostly around the consumption of the electricity produced (shared consumption or not), the financing, purchasing and ownership of the system, and the system location (Onsite vs. Offsite). The variations between all of the models profiled are outlined in Table 7.

Table 7

Different Financing and Purchasing Methods for Distributed PV Systems

Arrangement	**Location**	**Ownership**	**Number of Consumers per System**	**Group Purchasing**	**Application to Present Study**
Onsite Individual Net Metering	Onsite	Solely owned; TPO	Single	Not usually	Customer Owned models
Offsite Virtual Net Metering	Offsite	Solely Owned; TPO	Single	Not necessarily	Not in BC
Onsite Shared Solar	Onsite	Jointly Owned; TPO	Multiple	Yes	Solar Strata; T'Souke
Offsite Shared Solar (Solar Gardens)	Offsite	Jointly Owned; Utility; TPO	Multiple	Yes	Nelson Hydro
Community driven financial models	Offsite	Jointly Owned; TPO	Energy not consumed by crowd-funding participants	Yes	Kimberley, Salt Spring Island School
"Green Power"	Offsite	Utility; TPO	Consumption	Yes	e.g.

Purchasing Plans			from no distinct system		Bullfrog Power (not covered)

Note: Adapted from: Shared Solar: Current Landscape, Market Potential, and the Impact of Federal Securities Regulation (NREL 2015, p. 3)

Commercially Led Approaches

These types of models focus primarily on households and small-medium enterprises (SME) that have a suitable site for the system and the ability to pay for the significant up-front cost. As noted by Frantzis et al., (2008) these customer owned systems facilitated by solar PV supplier/installers are usually the first wave of PV market penetration, and this has been the case in BC. A key part of the value proposition for these models is the customer cost savings on electricity, which can be substantial, especially for residential customers with BC Hydro's two tiered electricity rates, and will continue to improve as electricity rates increase. For those consumers who are able to afford the cost of the system up front, they can normally make their investment back (through costs savings on electricity) in 15-25 years, with a typical ROI in the range of 4-5%. For this reason, solar PV systems for residential and SME consumers will continue to be an attractive investment, with more consumers entering the market and increasing business for dealers.

The main difference in this category has to do with the institutional arrangements of the suppliers. In the present study two different arrangements have been profiled: For-Profit Workers Cooperative and Non-Profit. Both arrangements are focused on making it easy for individuals and organizations to access and benefit from PV and more broadly, to facilitate the growth of solar PV in the province. Whether a consumer chooses to go with one supplier/installer or another will depend on the particular suite of products and services that best suit their needs and budget. If individuals or organizations wish to set up a similar enterprise and enter the market for distributing PV products and services, the two organization profiled here provide good examples of for-profit and non-profit approaches to do so. The following table provides a cross case comparison in order to summarize the similarities and differences between the two approaches.

Table 8

Cross Case Comparison for Commercially Led Approaches: For-Profit Co-op vs. Non-Profit

Business Model Canvas	**VREC: For-Profit Co-op Model**	**GabEnergy: Non-Profit Model**
Key Resources	• Equipment • Personnel • Financing • Revenue	• Equipment • Personnel • Financing • Revenue
Similarities/Differences	The Key Resources for both the For-Profit Co-op and Non-Profit models are fairly similar, the difference comes between the methods of financing (VREC: self-financed initially and member purchasing of co-op shares ongoing; GabEnergy: some seed financing from Bullfrog Power, but little financing required initially, volunteer driven) and ongoing revenue structure	
Key Activities	• Design/consulting • Sales • Installs • Maintenance • Education • Energy Conservation services	• Design/consulting • Sales • Installs • Maintenance • Education • Energy Conservation services
Similarities/Differences	The Key Activities for both models are very similar.	
Partner Network	• Suppliers • Soft links with other co-ops • SolShare partners • Memberships in various renewable energy	• Suppliers • Soft links with local community organizations

	organizations and Coop Federation	
Similarities/Differences	Similar, mostly supplier relationships and some soft links with similar organizations. But, VREC partners with organizations interested in hosting PV systems for their SolShare model	
Value Proposition	• Electricity cost savings for customers • Consultation, sales and installation of renewable energy equipment • SolShare: provides access to solar PV to those who normally can't have solar on their properties; provides an investment opportunity	• Electricity cost savings for customers • Primary value proposition is providing high quality solar PV equipment at lowest cost possible, serving as a channel to connect consumers to wholesaler • Consultation, sales and installation of renewable energy equipment
Similarities/Differences	Somewhat similar value propositions, except for the low cost focus catering more towards DIY for GabEnergy, and the SolShare offering for VREC	
Customer Segments	• Individuals/households interested in the technology • Majority residential, some commercial	• DIY individual/household • Some larger installs for buildings (e.g. recycling centre) • Community projects: serving as a supplier for larger installations
Similarities/Differences	Customer segments are quite similar for both models	
Distribution Channels	• VREC serves it clients primarily through its own channels (storefront, employee service) and partner channels (suppliers/distributors) • Customer acquisition: primarily through website, word of mouth, media	• Equipment: main channel is via their wholesale equipment provider in ON • GabEnergy also serves customers by providing assistance with installs if necessary • Customer acquisition: primarily through website, word of mouth, media

Similarities/Differences	Similar distribution channels, except VREC has a storefront	
Customer Relationship	• Personal assistance	• Personal assistance
Similarities/Differences	The customer relationship dynamic is very similar for both models	
Cost Structure	• The most important costs relate to typical operating and overhead expenses for a small-medium enterprise (purchasing product, salaries, rent, etc.)	• The structure is cost driven, basically trying to provide customers access to the lowest costs possible for solar equipment. The cost is primarily passed onto the customer • There is a small cost that goes towards the General Manager who receives compensation based on a percentage of a 5% handling fee collected from consumers for services rendered
Similarities/Differences	The cost structure is a little simpler for GabEnergy. VREC is a larger organization with more employees, a building space that they rent, and inventory. Whereas, GabEnergy functions more like a conduit to a larger supplier.	
Revenue	• Revenue from products and services	• Main source of revenue comes by way of the 5% fee that charge customers based on the equipment and shipping (not including taxes)
Similarities/Differences	Main difference is that GabEnergy functions as a non-profit, and just collecting the 5% handling fee that is necessary to sustain operations	

Advantages and Disadvantages of Each Model

Both models profiled here seem to doing well, with business on the upswing in both cases. However, there are advantages and disadvantages to each approach as noted in the detailed case summaries. The non-profit approach relies heavily on volunteer contribution and can lack the stability that a for-profit company approach could provide. The interviewees also noted that their volunteer pool is composed mainly of older individuals, and that succession planning and training in the next generation would be required to ensure long term sustainability of the organization. Although not specifically noted in the case of GabEnergy, non-profits can experience difficulty in raising capital since they cannot issue receipts for donations (like a registered charity would) and are generally more limited in attracting investors with the promise of return on investments (Manwaring, Valentine & Thomson, 2011).

The advantages to the non-profit approach as noted by GabEnergy interviewees are that it comes with a certain perception from the public of trustworthiness, it was relatively easy to set up, and it is a useful model for advancing social/environmental initiatives. And even though the approach is non-profit, it is still a good way to stimulate local economies and provide a fair wage to people. More generally, non-profits benefit from having tax exempt status (non-profits are generally exempt from income tax), more operational flexibility than a registered charity, and because they do not have shareholders with direct financial investments in their operations, they can focus on their social/environmental mission without having to worry about making profits for external investors (Manwaring, Valentine & Thomson, 2011).

In the for-profit workers cooperative model, some of the disadvantages included a lack of understanding from the public about what a co-op is (not understanding that they function like a regular business for the most part), the financing can be tough since lenders are not used to working with them, and the internal decision making can be challenging at times with each member of the co-op having voting rights on decisions. More generally, cooperatives can also experience challenges in maintaining member participation which is a key requirement of the model; and can make the management more difficult than other corporate forms (Manwaring, Valentine & Thomson, 2011).

The advantages of the for-profit cooperative approach as noted by VREC are that many employees are owners which engenders a high quality of service/work, the co-op approach is viewed positively by the public, the team input inherent to the co-op structure is often helpful, and under the co-op framework they do not have to generate profit for external investors. Although co-ops are generally designed such that the majority of capital comes from member contributions, co-ops are able to issue shares and loans to non-members, and offering limited returns on investment, which allows them to attract external capital if necessary (Manwaring, Valentine & Thomson, 2011).

Although the for-profit approach is profiled to an extent with the case study of the for-profit workers cooperative, it should be noted that other more traditional for-profit vehicles are absent from this study, most notably a for-profit business corporation. Several businesses were approached to participate but either could not participate or declined to participate.

Community Led Approaches

Community led approaches to solar PV delivery bring community stakeholders together to deploy solar PV projects. Traditional approaches to distributed solar PV have focused on decisions by individual home or building owners to purchase PV systems. This approach is limited to those consumers who have a suitable site for a PV system and who can afford the significant up-front costs. Community solar models expand the availability of solar PV to a much wider audience, and offer economies of scale to project developers (NREL, 2014). As noted earlier, there are a number of variations to these approaches, including community investment, crowd financing, group purchasing, and donation based models, several examples of which can be found in BC. The following tables provide a cross case comparison in order to summarize the similarities and differences between the five community led approaches profiled.

Table 9

Cross Case Comparison for Community Led Approaches – Key Resources

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Site • Supportive Community • Financing • Partners (Supplier, Installer, Electrician, etc.) • Leadership	• Site • Supportive Community • Financing/ Funding • Partners (Supplier, Installer, Electrician, etc.)	• Site • Supportive Community • Financing/ Funding • Partners (Supplier, Installer, Electrician, etc.)	• Site • Supportive Community • Financing/ Funding • Partners (Supplier, Installer, Electrician, etc.)	• Site • Supportive Community • Funding • Partners (Supplier, Installer, Electrician, etc.) • Leadership

• Net Metering	• Leadership • Net Metering	• Leadership • Virtual Net Metering	• Leadership • Standing Offer Program	• Net Metering

In looking at the Key Resources for each model summarized in this table we can see that there are many similarities; each must have an adequate site for the system, a supportive community of stakeholders, start-up financing and/or funding, partners (suppliers, installers, electricians, etc.), leadership, and a source of revenue. The main differences lie in the economics of the project; in the five cases profiled it is interesting to note that only the Solar Strata project did not receive some form of outside funding. This is likely because the project is smaller and designed to benefit primarily the owners of the system, but it may also speak to the necessity of other community projects being reliant on donor funding in order to be feasible. While these funds may be available, and especially because the projects have value as pioneer projects, it may be difficult to access this type of funding for similar projects moving forward. The other main difference is in the revenue channel; with the Strata, T'Souke, and Salt Spring projects utilizing BC Hydro's Net Metering Program, the Kimberley project utilizing a PPA with BC Hydro through the Standing Offer Program, and the Nelson project incorporating the solar electricity produced into the electricity it can sell to customers, and using virtual net metering to credit subscribers.

Table 10

Cross Case Comparison for Community Led Approaches – Key Activities

Strata (Onsite Shared	**T'Souke (First Nations**	**Nelson (Utility Solar**	**Kimberley (Community**	**Salt Spring (Donation**

Solar)	Solar)	Garden)	Investment)	Based)
• Feasibility Studies • Meeting with Stakeholders • RFP • Community Approval • Installation • Monitoring	• Visioning • Feasibility Studies • Meeting with Stakeholders • Community Approval • Acquire Funding • Installation • Kick-Off • Monitoring	• Community Engagement • Feasibility Studies & Presentation to Council • Site Selection • Budget • Acquire Funding • Info Session • Pre-Sale • Kick-Off • Installation • Monitoring	• Feasibility Studies • Funding Applications • Public Presentation • Acquire financing and funding • Community Approval • Roles, responsibiliti es, ownership, design • RFP • Issue Contracts • Info Sessions • Construction • Monitoring	• Feasibility Studies • Planning/ Design • Community Engagement • Community Support • Fundraising • Installation • Monitoring

There are many similarities with regards to each model's Key Activities. Undertaking initial feasibility studies to analyze the solar resource and evaluate the economic potential is crucial to understanding if the project is worthwhile. Engaging with community/stakeholders and securing approval is also critical to each. Acquiring start-up capital is essential and comes in the form of financing from members, bank loans and/or acquiring funding (grants, donations, etc.). Generally, the larger the project the more stakeholders and steps are involved. Also, the order of the steps can vary from case to case.

It is worthwhile to note that each of these cases is a pioneer project in its own right, and therefore the Key Activities found herein are likely to be more involved than would be the case if similar projects were to replicated.

Table 11

Cross Case Comparison for Community Led Approaches – Partner Network

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Strata members • Supplier • Electrician • Property Manager	• BC ICE Fund • Solar BC/ ecoEnergy Program • WED Program • Indian & Northern Affairs • Supplier • BC Hydro	• Bullfrog Power • West Kootenay Eco-Society	• EcoSmart • Teck • BC Ministry of Energy & Mines • BC Hydro • Columbia Basin trust • Southern Interior Development Initiative Trust • Contractors	• SD 64 • GISS Env. Club • Funders

Though there are some general congruencies; such as suppliers, installers, electricians, etc., the partner networks for these community led solar PV models are fairly different from each other. The Strata model is fairly insular, mostly requiring outside help in the form of the supplier/installer and electrician. The T'Souke and Kimberley models listed the largest number of partners, which included a good number of funding partners. The T'Souke project was the earliest undertaken and so it required a good deal of planning with partners, and consultation with BC Hydro in setting up the interconnection and net metering. And even though it is only older than the other projects by several years, the cost for the project at that time was significantly greater than newer projects, which meant that a relatively larger pool of funds needed to be secured, requiring the assistance of additional partners. The Kimberley model has a lot of partners primarily because of the size of the project, requiring multiple funding partners, consultants and contractors. The Nelson Hydro model needs relatively fewer partners since they are a utility and are well equipped to provide the resources and activities needed mostly internally. The Salt Spring school project has a large base of partners, as the funding was crowd-sourced but relatively fewer categories of partners, since the project was smaller, and a good deal of the design and install was provided by the local Salt Spring Community Energy Group with the assistance of the School District.

Table 12

Cross Case Comparison for Community Led Approaches – Value Proposition

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Electricity Cost Savings • Demonstration	• Electricity Cost Savings • Fulfillment of Community Vision • Demonstration • Education • Advances economic opportunities	• Community benefits by addition of renewable energy • Utility gains in experience • Access to PV for customers • Bill Credit to participants	• Selling electricity to BC Hydro • Community Asset • Economic Development • Demonstration	• Electricity Cost Savings • Scholarship • Demonstration

		• ROI • Efficiency of Scale • Demonstration		

The value proposition is really the key item that sets these models apart. Though there is some overlap, each of these projects has been designed for a different reason and therefore has a different suite of goods/services being offered, needs being met, and values being delivered.

A primary value proposition for the Strata, T'Souke, and Salt Spring models is the cost savings on electricity for consumers; however, the rationale behind each is slightly different. In the Strata model, the focus is primarily economic; the owners will save money over the long term. In T'Souke's model, they will be saving on electricity costs, but the autonomy derived from the project and the fulfillment of the community vision is likely equal to or greater than the economic rationale. In the Salt Spring model, the electricity cost savings is important, but the educational/demonstration value of the project, the fulfillment of community energy goals and the provision of a scholarship to students is likely equal to the economic rationale. In these last two cases, equal consideration was given to the ecological and social imperatives of 'getting energy right'. In all cases however, the economic rationale needed to make sense in order to proceed with the project.

The value proposition in the Nelson Hydro model is manifold; the consumer, community and utility all benefit from the addition of renewable energy to the community, the utility benefits by gaining experience in solar PV, it provides access to solar PV for customers who may otherwise not be able to afford it or access it, it offers a smart invest for consumers, and the project helps to demonstrate and communicate the value of renewable energy.

The value proposition in the Kimberley model has multiple facets as well; selling electricity to BC Hydro and generating a return on investment for the citizens of Kimberley, creating a community asset to draw people and business to Kimberley, providing economic development and local jobs, and demonstrating the potential for large scale solar PV.

The common thread for all of these models is the demonstrational and community value. Each of the cases is a pioneer project in its own way and therefore has value in demonstrating the feasibility of solar PV in a number of different scenarios and applications, and serving as a template for future projects to follow. These projects are showing that solar PV makes economic sense, it makes sense from a community and environmental perspective and it can be accomplished in a number of different ways.

Table 13

Cross Case Comparison for Community Led Approaches – Customer Segments

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Strata owners	• Band • BC Hydro	• Nelson Hydro customers • Potentially local schools, churches, businesses	• BC Hydro • Citizenry • Educational Institutions	• School District

The segments for whom the projects create value again have some similarities but also some key differences. In each case there is value created for the primary community that is developing the project, but not necessarily an external audience. For example, the Strata project is creating value primarily for the Strata owners; therefore the value created primarily remains internal. However, projects like the Kimberley SunMine are creating value for BC Hydro as a customer purchasing electricity, for the citizens of Kimberley in stimulating the local economy, achieving a return on investment and providing an attraction to the community, and also to educational institutions that they have partnered with to develop educational programs related to the project. The customer segments are linked quite closely to the value proposition in that if there is value being created for multiple audiences, then there are a related number of customer segments.

Table 14

Cross Case Comparison for Community Led Approaches – Distribution Channels

Strata (Onsite Shared Solar)	T'Souke (First Nations Solar)	Nelson (Utility Solar Garden)	Kimberley (Community Investment)	Salt Spring (Donation Based)
• Communication: Strata Meetings • Product: Supplier • Credit: Net Metering	• Communication (Internal): Visioning Sessions • Product: Supplier • Communication (External): website,	• Communication: Info Sessions, media, kick-off, website • Product: Supplier (TBD) • Credit: Nelson Hydro billing	• Communication: Website, media • Product: Suppliers • Credit: BC Hydro SOP	• Communication: Newsletter, social media, word of mouth, website, media • Product: Supplier • Credit: Net

	media, kick-off, tours • Credit: net Metering			Metering

Distribution channels are the means whereby an organization delivers its products and services to customers and also includes its marketing, communications and distribution strategies. There are similar distribution channels for all the models; they all rely on suppliers for the product (solar PV equipment), the electricity is generated from the solar panels and is either consumed on site or distributed to the grid, they rely on communication strategies to reach their target audiences and they rely on electrical metering to determine the credit for electricity generated. However, there are also some noticeable differences, mainly related to communications.

In the case of the Strata project the distribution channels are relatively straightforward; they have mostly internal communications through their strata meetings, the channel for the product comes through a local supplier and installer, the electricity is delivered to the building from the solar panels through the buildings electrical system and the channel for the credit is through BC Hydro’s net metering. The distribution channels get more complex once more stakeholders are involved, customer segments shift from internal to external and/or more customer segments are involved, and as more avenues for funding are required. For example, the Salt Spring school project is similar to the Strata project in several ways; it is a rooftop system of similar size, the electricity is primarily consumed onsite, and credit is assessed via the net metering program. However, where the Strata is internally funded, their communication piece stays internal, while the Salt Spring project relied on donation funding and so the communication piece was extensive, relying on their website, social media, local media, word of mouth and social events to raise support and funds for the project.

The T'Souke, Nelson and Kimberley projects also had extensive communications pieces. Community engagement was vital to the development of these models and so a great deal of work was undertaken to communicate the project, get feedback, and ultimately approval from their respective communities. In the case of T'Souke First Nation, they also play a leadership role among indigenous communities by networking and sharing their learning experiences (insert reference from website, www.mc-3.ca).

Table 15

Cross Case Comparison for Community Led Approaches – Customer Relationships

Strata (Onsite Shared Solar)	T'Souke (First Nations Solar)	Nelson (Utility Solar Garden)	Kimberley (Community Investment)	Salt Spring (Donation Based)
• Community • Co-Creation	• Community • Co-Creation	• Personal Assistance • Self Service • Community • Co-Creation	• Electricity supply/ purchase • Community • Co-Creation	• Community • Co-Creation

Customer relationships also have a high degree of similarity. As these are community driven projects, the customer relationship dynamic has a high degree of community and co-creation in the overall implementation of the project. A target consumer for most of these models is the community itself, so it manifests as one segment of the community convincing the rest of the community of the value of the project. The customer relationships become expanded in the Kimberley and Nelson models. In the Kimberley model the primary element is the sale of electricity (vs. community consumption), the community owns the system and is selling electricity to BC Hydro, so there is a strong seller-purchaser relationship present. The Nelson model has a high degree of community and co-creation as well, but it is also a utility model, where the utility is generating and selling electricity. In this case the utility has a personal assistance relationship with its customers who want to participate in the program and/or purchase electricity generated, and also the customers have a self-service option whereby the utility has made it easy for consumers to participate in the program via the Nelson Hydro website and customer billing system.

Table 16

Cross Case Comparison for Community Led Approaches – Cost Structure

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Total Cost of $47000 • Cost/Watt: $3.00 • Payback in 5 years at $9400/year, equals payments of $10-15 unit per month	• Total Cost of $900,000 • Further cost statistics n/a	• Total Cost (estimated): $224,689 • Estimated Cost/Watt: $3-4/watt • *See Nelson Case Study summary for full details	• Total Cost: $5,350,000 • Estimated Cost/Watt: $5/watt	• Total Cost: $106,000 (not limited specifically to solar array) • Estimated Cost/Watt: n/a

There are a few important things to look for in the cost structures for the community led approaches. The first is the total cost, and this refers to the total installed costs for the system, made up of the hard costs (i.e. solar panels, inverters, racking, etc.), and soft costs (i.e. consultation, design, legal, labour, permitting, interconnection, inspection, etc.). This helps one to understand the cost per watt ($/W) and the levelized cost of electricity (LCOE) for the systems, and offers a way to compare the capital costs of the different projects and their effectiveness and efficiency in producing electricity. The lower the cost per watt and LCOE, the better, as you will be effectively producing more electricity for a lower cost. Of the projects that had some cost calculations available, we can see that the cost per watt for the Strata project is the lowest amongst those profiled. The reason for this is that the project was relatively straightforward to implement and they got a good deal from the contractor and supplier who wanted to showcase the Central Park Strata as an example for other strata organizations to follow. Although the Kimberley SunMine is the largest project and can benefit from an economy of scale it has relatively higher estimated costs per watt. The reason for this is that extensive planning, consultation and design work was required, which elevated the soft costs for the project.

The Nelson project is still in the design phase, but they expect a cost per watt in the $3-4.00 range. One of the reasons they can keep their costs a little lower is that they already own the land for the project site, and being a utility they have the resources available to do a large portion of the work internally.

The T'Souke project did not have statistics available on their project, but since it is the oldest of the projects profiled it can be assumed that the costs were a little higher, since the price of equipment has dropped significantly over the several years since the project was initiated.

The Salt Spring school project was not able to provide comparable cost statistics for a few reasons, one being that it is a very new project and the calculations simply have not been performed yet. Also, because the total project costs were not limited to the solar array (some of the funds went to educational initiatives and developing an EV charging program), and because a lot of the costs were donated, it is difficult to calculate the cost performance in comparable terms. However, the SSCEG did say that they typically install systems in the range of $3-4/watt.

Table 17

Cross Case Comparison for Community Led Approaches – Revenue Streams

Strata (Onsite Shared Solar)	**T'Souke (First Nations Solar)**	**Nelson (Utility Solar Garden)**	**Kimberley (Community Investment)**	**Salt Spring (Donation Based)**
• Cost savings on electricity • ROI estimated to be ~4.6% of initial investment in first year and increasing slightly over life of project	• Cost savings on electricity • Selling to grid in times of excess production	• Customer investment covers cost of project • Electricity produced is sold to Nelson Hydro customers	• 25 year PPA with BC Hydro: $110.10/MWh • Estimated annual average revenue: $244,000 • Estimated annual net revenue: $57,800	• Cost savings on electricity

			• Estimated retained earnings over life of project: $1,445,000	

The Revenue Streams (and/or Value Streams) for the projects take some different forms. For the Strata, T'Souke and Salt Spring projects the primary revenue stream comes through cost savings on electricity. The costs savings on electricity is variable so it makes sense to design the project to maximize the return. For example, the Strata project did careful calculations to find out what the optimal size of system would be so that they would primarily be offsetting their Tier 2 electricity consumption. Offsetting the Tier 2 rates means that their PV system is effectively saving them from paying for electricity at a higher rate (13.17¢/kWh). If they were to offset more than their Tier 2 consumption, they would only be saving 8.8¢/kWh at the Tier 1 rates, which would be much less economical. In fact it may make more economic sense to purchase electricity from the grid rather than invest in a PV system that will offset more than the Tier 2 consumption, because at today's costs for PV compared to Tier 1 electricity prices, a PV system may not be able to produce electricity at a LCOE of 8.8¢/kWh or lower.

In the case of the Nelson project the primary objective is not to produce electricity to sell to their customers at a profit. This may be counterintuitive for a utility; however, the greater value for this project is in bringing a new form of renewable energy online for the community and to gain in experience in PV in the process. The Nelson Hydro project is a good experiment for the utility. The costs (and some of the benefits) of the project are primarily being passed onto their customers who subscribe to the project. They get the benefit of experimenting with solar PV and their customers reap the benefit of utilizing solar PV and getting a long-term economic benefit. The experience may prove invaluable for the utility as solar continues to improve its cost position relative to other forms of energy, such that when the time comes to expand the Nelson Hydro system, the cost of solar may be cheaper than hydro and they will already have experience in bringing this new technology into their grid portfolio.

In the Kimberley project, the revenue model is geared more traditionally like an investment project, in this case as an independent power producer, producing electricity for sale to the grid. Though in strict economic terms an independent power producer in BC may be able to produce electricity for sale at a lower cost than the SunMine produces solar PV electricity for sale, the project makes sense for Kimberley for other reasons. The solar resource in the area is great, they were able to acquire land for the site through a good partnership with a company that has operated in the area for many years, they were able to produce clean, renewable energy and create an attractive feature for the community that may pay dividends in attracting people and business to the community.

Advantages and Disadvantages of Each Model

Although community led models are just starting to develop in BC, already we can see that there is significant diversity in the approaches undertaken. Communities are beginning to experiment with solar PV to meet a number of different goals. The models profiled here offer a number of approaches, however, as with the commercially led approaches, there are advantages and disadvantages to each model (as noted in the detailed case summaries), and each will be a more or less suitable approach depending on the context and application required.

The Strata model may be one of the easier models to replicate. The major barrier for this type of project is getting the majority of the strata members to buy-in to the idea. Once the support for the idea is secured, and assuming the building has a suitable roof for a PV system, it is relatively straightforward to set up the system. With a Strata arrangement there is usually some shared use of electricity with accordingly shared costs, and a shared pool of funds to use to pay for it. This spreads out the investment for any one individual which makes it quite affordable to participate. Additionally, there is a good economic case to proceed with a system that will offset electricity being paid for at the highest rate (the residential rate for Step 2 electricity). This maximizes the return on investment for the system, and will only improve as the price of electricity rises in coming years. There is also additional re-sale value for suites in the building as the addition of the PV system adds an attractive selling feature.

The T'Souke model offers a good example of a solar community in BC, and specifically First Nations community solar. It was one of the first examples of a community solar project in the province and offers many lessons. It shows that utilizing solar PV for a First Nations community is an effective way to enhance autonomy and restore their respectful relationship with nature, and provides important environmental, economic and cultural benefits and opportunities.

One of the big challenges that T'Souke faced was in financing the project. This will be a major hurdle going forward for similar projects. T'Souke was able to tap into a number of funds for their project as it was the first of its kind, they had access to certain funds as First Nations community and many organizations were interested in helping them. However, these types of funds may not be as readily available (at least in the same amounts that were delivered to T'Souke) to others planning similar developments. This may not matter though, since the cost of installing PV systems has come down significantly and the economics for a similar project may make sense at this point without the need for the type of funding that T'Souke received. It should also be noted that T'Souke is currently developing a four million dollar solar powered commercial greenhouse operation to recapture indigenous foods, potentially for sale to the wider community. This type of integrated systems planning could be used to augment or offset funding for PV energy systems if the commercial greenhouse operation is profitable.

The Nelson Hydro model has a number of advantages; it offers an economy of scale, it reduces the cost of participation, it allows homeowners and businesses to access solar energy in their community without having to install and maintain panels on their own property, and it will demonstrate the feasibility of virtual net metering in a utility setting in BC. The shared solar array also allows for increased siting flexibility, and Nelson did choose the best option from several different sites. Furthermore, the fact that they have their own utility is a significant advantage as this gives them the autonomy to implement this new and innovative PV arrangement.

Some of the disadvantages of this model include the length of the contract (25 years) and the payback period, which may not be attractive for certain customer segments, and as noted earlier, certain features may be difficult to replicate in other communities since it is utility driven.

The Kimberley model is interesting, because unlike the other models, the electricity being produced is not for primary consumption but rather it is set up more as an investment project with a wide range in the value proposition. Although the project is designed to sell electricity to BC Hydro for a profit, it is also creating an attractive asset for the community that may draw people and business to the area, and help to provide economic development and local jobs.

There were a number of challenges to Kimberley's model that others seeking to do a similar project should take note. It was a very complex project with a lot of steps. Extensive feasibility studies and business planning was required. There was an extensive communications and decision-making process involving many stakeholders, and necessitating many formal agreements. It used new technology (tracking system) that other projects in Canada have yet to experiment with and the interconnection configuration took some work. Additionally, multiple sources of funding and financing were necessary. Despite these challenges the project has been successful and it should be noted that many of the challenges were related to the pioneer nature of the project, which won't be as big a factor in subsequent related projects.

The Salt Spring solar scholarship model has a number of advantages that could see it being replicated in other communities. The charitable nature of the project opens some doors for grant funding, it allows for the issuance of tax receipts for donors, and it removes a number of issues related to ownership, and legal and regulatory work that can add extra time to project planning and development, and require extra capital costs. This model may be a good approach for other communities that have strong community support for such initiatives and local organizations with the skills to develop the project. In addition, it contributes to education imperatives and enhanced energy literacy, both in the school and the community.

There are a few challenges to consider with the Salt Spring model. The largest perhaps is that it requires a lot of volunteers, including those with the necessary technical skills. Attempting to replicate a similar project would likely require a formal non-profit group with expertise in the field to facilitate the project, as was the case in the present example. Another large part of the equation is the reliance on fundraising. This was a large undertaking that relied on many communications pieces and community events. However, it did also foster community engagement and proved that financing a solar PV array of this type is possible entirely through community/donor contributions.

Discussion

The results show that organizations are using a number of different models to overcome the barriers for solar PV in BC, and that they are increasing the diffusion of PV in the province. It shows how they are shaped by their context and in response to a variety of customer and community needs. The decision to go with one approach or another will depend on a number of factors: Is the fundamental purpose of the venture to make money for investors, or to further a social purpose? Who will maintain ownership and control? How will the project be financed, both at start-up and on an ongoing basis? What legal issues may be involved? Each of the models responds to these questions in different ways and therefore each model will be suitable for different applications.

Despite the increase in customer and community owned systems many interviewees noted that PV was not very attractive yet from an investment perspective, citing the long payback period, lack of guarantee and low returns on investment (in the range of 3-5%), questions surrounding RRSP eligibility, legal work and securities law issues, and the need for a "lock in" period for funds (as investors withdrawing their money would put the model (business/other investors) in jeopardy). It is interesting to contrast this scenario with Ontario, whose Feed-In Tariff program helps to eliminate some of these very concerns. This program provides fixed prices over long term (20 years) contract periods and provides a measure of security and guaranteed revenue to producers and investors. For example, this allows organizations such as the Ottawa Renewable Energy Co-operative (OREC) to enter into 20-year lease agreements with property owners in the Ottawa area, using their land or rooftops for renewable energy systems and to generate a guaranteed payment for each kilowatt hour of electricity produced (Foon & Dale, 2014). This helps OREC to generate a model where they can reliably repay capital investments and provide attractive dividends over a 20 year period, and whose security has allowed the model to meet criteria for RRSP eligibility. BC may do well to look to this type of model if prices for solar PV generated electricity increase and become fixed for longer periods under future updates to BC Hydro's programs.

Trying to find the right angle for economic feasibility in BC is challenging as there a number of scenarios for revenue. The best payback comes through offsetting the most expensive Step 2 rates (13.17); however, this would require a model that targets many smaller residential/small commercial types of systems that consume electricity at this rate, rather than looking at developing one large project. This would likely require a more complex business model than would be the case if a single large installation was under consideration. Setting up a project that relies on straight up net metering will only pay 9.99¢/kWh, and will be limited in size to 100kW or less. For larger projects, it can be tough to get into the Standing Offer Program (SOP). The program only allows for a target volume of 150GWh/year under a first come first serve basis, where developers must apply to be accepted and allowed to produce energy and be compensated through the program. The program has no more room for 2016 applications, and as of Jan 22, 2016, has little room left for 2017. However, BC Hydro will be hosting an information session in February 2016 regarding updates to the SOP and launching the micro-SOP for First Nations and Communities, so there may be enhanced opportunities available in the near future.

At any rate there is already a modest investment opportunity that may pay off better than an RRSP, and offer more stability than investments in the stock market. Furthermore, the ROI for solar projects will only become more and more attractive as time goes on, electricity prices increase and the cost of installing systems keeps coming down. Once the opportunities for maximizing the ROI become clear and stable, we will see the advancement of more and more models taking advantage of the improved economics and increasing the diffusion of PV in the province. It is also worthwhile to note that in some scenarios (globally) solar PV is already cost competitive on an unsubsidized basis with conventional generation technologies including nuclear, coal and natural gas, without needing to take into account the potential social and environmental externalities (i.e. nuclear waste disposal, environmental impacts) of these technologies (Lazard, 2015). As these scenarios spread and become more common and as electricity storage improves, more individuals and organizations will start to take advantage of solar PV technologies and models for delivery without the need for tax incentives, tariff programs or other subsidies.

Critical Success Factors

In profiling the models for this study a number of critical success factors for the projects emerged and it is interesting to note that they aligned closely with those identified by the International Institute for Sustainable Development study (2008) that sought to understand the key factors critical to the success of social and environmental enterprises. The eight CSF identified focusing on Leadership, Partnerships, Proof and Clarity of concept, Business Planning & Marketing, Triple Bottom Line Planning, Short and Long term benefits management, Community Engagement, and Risk Management, tended to be reflected in interviewee responses to the CSF for their particular models. Leadership in particular seemed to come out as one of the key CSF, especially for the community projects. This was likely due to the pioneering nature of these projects, and the fact that an enterprising and resourceful individual was essential to initiating these novel (to British Columbia) projects. Although not every one of these CSF was identified for every model, future project developers would be wise to consider this suite of CSF when planning for future projects.

In addition, interviewees identified a number of more specific CSF for solar PV projects in BC. The bottom line is that the payback on the project is critical to determining if the project is viable or not. Some of the key metrics to focus on are bringing down the cost per watt and LCOE for the project, aiming for installed costs less than $3.00/watt and achieving LCOE of $0.10 per kWh or better. Achieving numbers like this ensures that projects are competitive or better than current grid electricity rates.

Conclusions and Recommendations

Compared to other locations, British Columbia has what can be considered a fairly challenging environment for the proliferation of solar PV. The province has some of the lowest electricity rates in the country, it has a steady and reliable supply of hydropower (which once built has very little greenhouse gas emissions), and aside from not charging provincial sales tax on PV equipment there is little incentive to support the market. In spite of these hurdles, solar PV is expanding in the province and may have reached a tipping point that ushers in an era of accelerated deployment. VREC notes that in 2015 they installed more kW of solar energy than they did in the last ten years combined (Vancouver Renewable Energy, 2015b). Interest in solar PV from the community angle seems to be increasing as well, as the recent number of community oriented PV arrangements evidenced in this study alone will attest. In addition, third party models, which have been key to opening up the market in other locales (most notably the USA), seem to be on the cusp of appearing in the province. Anecdotal evidence from participants in this study and conversations with other industry insiders reveals that public interest is strong, with many individuals and organizations ready and willing to invest in solar PV projects as a way to support green renewable energy in the province and gain a reliable, if modest, return on investment.

The key to this industry growth has been the drop in cost for PV equipment, the prospect of increasing electricity prices and the ease of net metering, which combined makes the economics more and more attractive, especially in the residential and small commercial customer-owned market. In addition, community arrangements are opening up the technology to parties that heretofore have been unable to access it, due to their being unable to afford the large upfront costs and/or not having the appropriate site for individual systems. This growth will likely continue to accelerate as costs for equipment continue to fall and if policies supportive of PV development are enacted. For example, acquiring a permit for rooftop solar in Vancouver is both onerous and relatively expensive when compared to other jurisdictions. Making the permitting process easier and cheaper will bring down the total installed cost for systems and bring the systems online much quicker.

It should be noted that in almost all of the larger community based installations grant funding played a significant role in getting the project up and running. While the availability of this funding is promising and indicates the presence of communities of stakeholders willing to support these types of projects, reliance on funding of this type is likely not sustainable over the long term and difficult to scale up. Regardless, as noted earlier, the cost of installing PV systems has come down significantly such that the economics for similar projects may make sense at this point without the need for the grant funding that assisted the present models.

In order to accelerate its development, solar PV needs to become increasingly low-risk, have an updated regulatory framework and rely on well-known models that offer standardized and easily implementable solutions with product offerings designed for the contextual environment. The present study offers a range of models that can be used to help expand solar PV energy delivery in BC. Moving forward, care must be taken to align the interests of utilities, with solar companies, project developers, technology providers and customers in order to create benefits for all stakeholders (Bell et al., 2014). “Aligning the interests of the stakeholders will involve two major threads: (1) maximize the delivered value of DPV to customers and the electricity system by further decreasing costs and increasing benefits and (2) create new business models that enable and incent solar companies, utilities, and customers to optimize and capture that expanded pool of DPV value through win-win-win opportunities” (Bell et al., 2014, p. 6). The present discussion serves as an initial step in discussing the pros and cons, and critical success factors of the models studied. Future research may focus on identifying how to align the interests of all stakeholders so that there are no unnecessary roadblocks to the development of PV in the province; how to further decrease costs and increase benefits within the operating context of the province; how to improve and/or create new business models to maximize efficiency and value for all stakeholders; and what policies can be developed to support the growth of this industry.

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Appendix A – Draft Comparison of BC Hydro's Distributed Generation Offers

Comparison of BC Hydro's Distributed Generation Offers

Draft for feedback

ISSUE	Net Metering – RS 1289 (proposed up to 100 kW)	Existing SOP (50 kW to 15 MW)	Proposed Micro-SOP (100 kW to 1 MW)
Application Process	2-page application form	27 pages of rules 23-page application	Simplify SOP application process; reduce amount of information required
Electricity Purchase Agreement (EPA)	None	68-page EPA (including appendices)	Simplified EPA of about 20 pages (with few appendices)
Contract Term	NA – customer can discontinue participation at any time	20 to 40 years	Consider a more flexible term of 5 to 20 years
Base Price	Price is periodically set at a fixed level based on the SOP price	Regional pricing, however BC Hydro is engaging on and evaluating the potential for a single price	Proposing a single price
Price Escalation	No escalation	50% of base price is escalated at CPI after signing of EPA	Same as SOP, but may allow developer a 100% escalation option (with lower price)
Delivery Requirements	Non-firm with no delivery requirements	Non-firm with no delivery requirements. COD must be within 3 years of EPA signing. If proponent doesn't deliver for 2 consecutive years, can terminate EPA.	Same as SOP
Technical Interconnection Requirements	Simplified - prescribed in Net Metering Interconnection Requirements (NMIR)	Use Distribution Interconnection Requirements for Power Generators 35 kV and Below	Will follow Distribution Interconnection Requirements, with some modifications for projects under 1 MW
Interconnection Studies	Engineering review and multiple screening tests may be required for more complex projects	Optional $5,000 Screening Study followed by required interconnections study	Mandatory Screening Study. Where further studies are required (10% of offers), a reduced-scope interconnection study will be used
Network Upgrades	NU costs are typically minimal; for projects > 50 kW, system upgrade costs will be recovered from customer	BC Hydro is responsible for all upgrade costs up to a cap of $150/kW installed capacity; developer provides security for NU costs	Similar to SOP, with BC Hydro paying for all upgrade costs up to a cap of $150/kW and developer providing security for such costs
Metering	Most customers now have Smart Meters	IPP pays for installation of meter ($25,000) and transformers plus monthly fee ($250) for meter lease, telecom and e-metering	Use Smart Meters as revenue meters; developer pays one-time installation fee of $3,000 with no monthly fees
Load vs. Generation	Customers must offset their load. Customer receives payment for generation in excess of load	Customer-owned generation that receives load displacement or DSM funding is not eligible for SOP.	Require customers to offset their load prior to selling any excess electricity to BC Hydro.
Regulatory	RS 1289 is subject to BCUC approval	Exempt per *Clean Energy Act*	Exempt per *Clean Energy Act*

Figure 4. Comparison of BC Hydro's Distributed Generation Offers. BC Hydro (2014).

Appendix B – Summary of the Case Studies

Commercially Led Approaches	**Organizational Arrangement**
Vancouver Renewable Energy Co-op (VREC)	For-Profit Workers Cooperative
GabEnergy	Non-Profit/Social Enterprise
Community Led Approaches	**Organizational Arrangement**
Central Park Strata	Strata Owned – Onsite Shared Solar
T'Souke First Nation	First Nations Community Solar
City of Nelson/Nelson Hydro	Utility Driven Offsite Shared Solar (Solar Garden)
Kimberley SunMine	Community Owned Solar Project
Salt Spring Community Energy Group (SSCEG)	Non-Profit Community Solar Project (Solar Scholarship)

Appendix C – SunMine Project Construction Budget

SunMine Project Construction Budget

Updated June 23rd, 2014

SunMine Construction Budget	Expense
Contractor (Conergy)	
Engineering, Procurement, and Construction Fixed Price Contract	4,047,972
Bonding - Performance, Labour and Materials	121,439
City of Kimberley/Teck Resources Ltd.	
Course of Construction Insurance	24,839
Access Road Construction	10,650
Land Clearing and Grubbing	10,000
BC Hydro Network upgrades (280k offset by BC Hydro grant)	0
Interconnection Upgrade Costs	50,000
BC Hydro Monitoring Equipment	25,000
Teck Expenses (Prefeasability, EcoSmart, Interconnection Study)	806,702
Payment Certifier/Eng. Review (Jetson Consulting)	66,000
City Project Coordinator (Don Schacher)	50,000
Debt Reserve Contribution & Loan Legal	27,500
Letter of Credit service	7,500
SunMine Communications, including website	5,000
Subtotal	**5,252,602**
Project Contigency	**97,398**
GRAND TOTAL	**5,350,000**

SunMine Project Funding	Revenue
City of Kimberley (Borrowing)	2,000,000
Teck Resources Contribution	2,000,000
Innovative Clean Energy, BC Govt	1,000,000
Columbia Basin Trust Funding	300,000
Southern Interior Development Initiative Trust	50,000
TOTAL PROJECT FUNDING	**5,350,000**

Figure 5. SunMine Construction Budget. SunMine (2014).

Appendix D – Letter of Invitation

Letter of Invitation

Dear [**Prospective Participant],**

My name is Rhett Reilkoff; I am a graduate student in the School of Environment and Sustainability at Royal Roads University (RRU). My credentials can be verified by contacting Chris Ling, Program Head and Director of the School of Environment and Sustainability at RRU (xxx-xxx-xxxx ext. xxxx). I am conducting a research study as part of the requirements of my Masters degree in Environment and Management, and I would like to invite you to participate.

The objective of my research study is to compare and contrast models for solar energy delivery in British Columbia in order to illustrate the pros and cons of different models and to understand the obstacles, opportunities and critical success factors for each. The goal is to provide a resource to help individuals, organizations or communities plan and implement solar PV projects.

My research project takes a case study approach involving document review and semi-structured interviews. If you decide to participate you will be asked to take part in a semi-structured interview lasting approximately one hour. The interview may take place in-person, by phone, or online (whichever is most convenient). Information will be recorded in hand written format, and where appropriate, summarized in the body of the final report. You are also asked (but not required) to share any relevant information about your organization (i.e. reports, data, etc.) that may assist in the purposes of the study.

Participation can be confidential if desired. Study information will be kept on a password protected USB drive and stored in a safe location at Royal Roads University. At no time will any specific comments be attributed to you unless your agreement has been obtained beforehand. The results of the study may be published or presented but participants' identity will not be revealed unless agreement has been obtained beforehand.

There is no foreseeable harm to participating in the project and I have no foreseeable conflicts of interest. Potential benefits could include an enhanced understanding of your organization and how it may become more sustainable.

You are not compelled to participate in this research project. If you do choose to participate, you are free to withdraw at any time without prejudice and do not have to answer any questions you are not comfortable answering. You may choose to have your data withdrawn from the study up until the point that it becomes part of an anonymous data set.

Thank you for your consideration. Please feel free to contact me at any time should you have questions regarding the project and its outcomes ((email) or xxx-xxx-xxxx). If you would like to participate, please reply to this message indicating so and I will send you a Consent Form and further instruction.

Kind Regards,