Net-metering:
One Sky Case Study

One Sky office during PV net-meter installation, August 2006

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Introduction

Concerns over the rising costs and reliability of traditional sources of energy, and the threats related to climate change, have prompted a closer look at renewable energy technologies. Many of these technologies are market-ready (such as solar, wind, mico-hydro, geothermal) and have the potential for enormous short and long term job creation. Bulkley Valley residents who live off-grid (not linked to the power lines) have an opportunity to use renewable energy as stand-alone systems instead of incurring great expenses for wire connection or from diesel consumption in generators. Other residents have the additional opportunity to install their own systems that are linked to the grid through net-metering, also known as grid-intertie.

Net-metering allows a residential or commercial building to have an independent source of electricity while maintaining the traditional centralized system as a back up. In British Columbia net-metering, or grid-intertie, refers to feeding excess power generated from a renewable energy system back to BC Hydro for a credit. BC Hydro currently produces 88% of its electricity from large hydro, producing few GHG emissions, and imports 12% from Alberta (80% from coal and 12% from gas). Any additional power produced from renewable energy or saved from energy efficiency measures helps reduce GHGs provincially and therefore reduces the amount of imported power.

Net-metering is a low-cost, easily administered method of encouraging customer investment in renewable energy technologies. Net-metering allows customers to receive full credit for the electricity their renewable energy technologies produce without installing battery storage systems. Some sources are intermittent (the sun only shines during the day, the wind isn't always blowing) and this credit allows producers to maximize benefits including from when they're not using the power at the time it's being generated. This directly affects the economics and pay-back period for the investment. Net-metering also reduces the installation costs for the customer by eliminating the need for a second energy meter or battery bank. Finally, net metering provides a simple, inexpensive, and easily-administered mechanism for encouraging the use of renewable energy systems, which provides important local, national, and global environmental benefits.

Grid-interconnection is fairly new in the province of BC, having been legalized in 2004. Only systems deemed "BC clean" are eligible to tie into the BC Hydro grid. According to BC Hydro:

> *"BC clean electricity refers to alternative energy technologies that result in a net environmental improvement relative to existing energy production. Examples may include small/micro hydro, wind, solar, photovoltaic, geothermal, tidal, wave and biomass energy, as well as cogeneration of heat and power, energy from landfill gas and municipal solid water, fuel cells and efficiency improvement at existing facilities."*

BC Hydro has set up a process to make the interconnecting of small generating units (with a capacity rating of 50 kilowatts or less) to BC Hydro's distribution system. When customers with their own generation facilities produce more than they consume, they receive a credit from BC Hydro that goes to their account and can be applied against future consumption charges. At an anniversary date, the customer will be credited for any excess generation at a rate of 5.4 cents a kWh (slightly less than the current residential rate of 6.1 cents kWh).

While provincial policies allow for net-metering, they do little to actually encourage people to use renewable energy or grid-intertie. In BC when you sell back your energy generated by a renewable source, you are credited at the same rate you would purchase the electricity, providing little incentive to install renewable energy systems. This contrasts places in Europe and recently Ontario where

what is known as Advanced Renewable Tariffs (ARTs) or Standard Offer Contracts exist. ARTs permit the interconnection of renewable sources of electricity to the grid and set a specified rate to be paid for the electricity generated over a fixed period of time. The rates are significantly higher then the market price of buying electricity. The benefits of ARTs are threefold. Firstly, they make renewable energy more affordable with the guarantee of a faster payback to help compensate the high initial capital investment. Secondly, it levels the playing fields to counterbalance the perverse subsidies traditional power production companies enjoy. Thirdly, it helps encourage a sustainable base of electricity generation for the future.
In implementing ARTs, Germany has successfully implemented 21,000 MW in 7 years and created 170,000 new jobs. The key elements of their ARTs are:

- guaranteed and priority access of renewable energy to the grid;
- guaranteed fees for 20 years and differentiated prices between energy options (e.g. photovoltaics require a higher capital investment for the amount of power produced so are granted a higher rate of return than wind, which is more cost competitive); and
- no limitations set (i.e. prices wouldn't stop when a certain number of megawatts were reached so investment in production facilities occurred).

The BC government recently released their new Energy Plan that includes provision for Standard Offer Contracts. This is an important move forward to increase renewable energy supply in BC but needs to be implemented with the same key components that Germany used to ensure widespread up-take and success.

One Sky Case Study

This case study will examine the implementation of a grid-intertied photovoltaic system in Smithers, BC. The system was installed for the office of One Sky – an environmental non-profit organization that promotes sustainable living globally. One Sky initiated this project to promote renewable energy technologies and to act as a demonstration for the community. As a pioneer in this field One Sky hopes to encourage changes in policy and social perceptions in BC, across Canada, and around the world. Support from a Green Building grant administered by the VanCity/Realestate Foundation made this installment possible. The following case study examines the process and insights brought out by this collaborative project.

Context

One Sky's office is two-stories high with a total gross building size of 2,480 square feet, as well as a small attic and a crawl space. The One Sky office has fluctuating energy loads. Staff travel significantly for work and the number of employees in the office doubles during the summer months with youth interns and summer students. The electrical load is higher in the summer than winter. The office, located in northern BC, counters their energy needs in the winter with a highly efficient wood stove and natural gas back-up. They also have a solar hot water heater installed which lowers demand from their electric hot water heater.

At its current maximum there can be as many as 12 people in the building. There are 6 laptops, 2 desktops and three printers operating regularly in the building. In the summer the lights in the office are rarely used during the workday, as there are big windows to provide sunlight. There are 6 phones, of which only one has an electrical demand. The biggest energy loads are the fridge, oven, and microwave, which are not very efficient.

Contracting and PV equipment

One Sky purchased the photovoltaic equipment (panels, inverter and roof mounts) from Energy Alternatives (EA), and contracted EA to do the installation. This renewable energy company is located in Victoria and has been designing, selling and installing renewable power systems for over 23 years. The company focuses mostly on solar systems, though it does work on some microhydro systems, and has resources for wind power. They have trained nearly 100 people across Canada and a few internationally in solar technologies. Randy Rodgers, of Rodgers Electric in Smithers, also donated his time to help realize this project. Randy is now a trained and certified photovoltaic installer for the Bulkley Valley. Randy has plans to become a local provider of renewable energy electrical equipment through a partnership with Energy Alternatives. Miscellaneous items for the installation (wires, cable, junction box, etc.) were purchased from local building and electric stories.

Permits

The administration process for BC grid-intertied systems is not burdensome. The BC Hydro and government regulations were developed in collaboration with industry experts to ensure that the process was as simple as possible. There are only two permits required, an electrical permit and a BC Hydro Interconnection permit. The electrical permit is taken care of when you employ a certified electrician to install the system. The BC Hydro permit requires a form to be completed and submitted prior to hooking up your system (it can be found online at www.bchydro.ca). After installation an electrical inspector visits the site to make sure the system is connected properly and BC Hydro may decide to replace older meters to a digital one. One Sky continues to have its old meter and staff have literally watched the meter go backward as energy is sold back to BC Hydro.

Installation Process

The photovoltaic system that was installed consists of 7 Sharp© 175 watt solar panels with a total capacity of 1.2 kilowatts. They are mounted on the southwest facing roof, in a series of three and a series of four panels. A man-lift was used to transport the panels onto the roof for the installation. The panels were mounted on metal frames so that the angle of installation would maximize sun exposure. The panels are clearly visible from the street, and the inverter itself is on the outside of the building. The inverter connects directly to the electrical panel to feed power generated into the system, and excess power into the grid.

Randy Rodgers and two workshop participants preparing the panels for mounting.

For this project, One Sky had the assistance of two professionals, Kevin Pegg and Randy Rodgers, who generously donated their time. As trained electricians they were familiar with relevant electrical codes, which enabled them to do their work safely and properly. The only real complications that arose early on was that the place originally appointed for the panels had, since the initial survey, had two stand-alone solar panels installed. This problem was easily resolved by dismounting the two smaller panels to make room for the bigger system. Furthermore, One Sky facilitated a solar workshop in conjunction with the installation so that participants could get a hands-on experience

and see the process. This meant that the installation took longer than usual, as so much time was dedicated to answering questions and walking participants through the steps involved.

Installing PV system on One Sky roof.

The process of installing a grid-intertied system like One Sky's is relatively straightforward compared to off-grid systems, partly because no batteries are required. In the One Sky project, many of the typical problems that can arise did not for several reasons. First of all, One Sky is located in town, so bringing in required equipment like the man-lift was easily accomplished. The man-lift was actually the only extra equipment needed and there was no need to subcontract services such as digging trenches for a mounting device for this project. In addition, One Sky's roof faces southwest meaning no special mounting systems had to be constructed to optimize sun exposure. There was also enough space on the roof to mount the panels appropriately and the roof had been redone one year prior to installation. Another factor that made the project relatively simple was that there was no expectation that wires had to be hidden, a task that can take considerable amounts of time. Finally, the circuit box was not full, facilitating the simple connection of the system.

Breakdown of Costs

Key System Components	Description	Cost
7 Sharp © Solar PV Panels	175 watt capacity each	$ 10,290.49
1 Xantrex © Inverter	GT 2.5 Grid Tri Solar, 240VAC	$ 2,939.06
Onsite Labour	2 people	$ 1,540.00
Roof Mounts	7 PV Modules	$ 994.58
Airfare to Smithers	1 person	$ 822.00
Miscellaneous Items	Wires, cables, junction box, etc…	$ 584.89
Shipping *(estimate)*	From Vancouver to Smithers	$ 330.00
Permit	BC Electrical Safety Authority Permit	$ 323.00
	TOTAL:	**$17,824.02**
** $3,460.00 of this cost was donated, including labour, travel costs, and some miscellaneous items*		

In any renewable energy installation, there are some costs that are fixed and others that are site or project specific. The costs of materials for photovoltaic systems are relatively fixed. Installation, labour and transportation costs, on the other hand, can vary quite significantly. For example location, building features, and degree of customer participation affect costs that will be incurred. Energy Alternatives gave discounts and donated all their labour for the One Sky project, which significantly reduced the costs for this project. In addition, there are PST exemptions available when a system is bought in its entirety, like One Sky did. There are unfortunately no GST exemptions at the present time.

On-going Maintenance

The system does not use batteries, and the connection is permanent, therefore there are few foreseeable on-going maintenance issues that will arise. The panels will need to be kept clean and snow-free, though they are mounted in such a way that they are accessible. If problemsdo arise, most troubleshooting could be done with Energy Alternatives over the phone or local- operator

Rodgers Electric could stop by. The only issues that would require a site visit would be hardware replacements, upgrades, or in the unlikely event of a complete system failure. These problems are very unlikely to happen for One Sky's system because it was installed professionally and securely.

Pay-back on investment

One Sky's kilowatt/day average electricity consumption at the office was approximately 10.8 kWh between September 2005 and August 2006. On an average day in late-summer, the meter runs backwards, as more energy is being produced than is being used. Winter arrived early in Smithers this year with record snow falls starting late October. The erratic weather caused some build up of snow for a few days in a row and low solar power production with several cloudy days. To date, from September 2006 to March 1, 2007, One Sky's system has produced 280 kWh with our net-metered system (monitored with a computer program linked to the inverter). One Sky is anticipating much higher results during spring and summer.

Conclusion

There are still challenges to increasing the number of net-metered systems in BC including implementing appropriate policy measures that provide incentives, the small number of retailers, lack of trained electricians and contractors (especially in small towns), lack of education and awareness about renewable energy systems among home-owners and commercial operators, financing options, and clear market signals to promote domestic manufacturing. However, the BC Hydro policy to allow net-metering is still relatively new and interest in renewable energy and climate change mitigation could potentially lead to higher numbers of installations. By installing a demonstration system One Sky has raised awareness, provided basic training through a workshop, developed connections with a local electrician, and raised the profile of renewable energy options in the Bulkley Valley.

One Sky's office with 1.2 kW net-metered PV system and solar hot water heater

If we are to reduce fossil fuel dependence, decrease greenhouse gas emissions and improve access to energy globally, we must find solutions to maximizing the full potential of renewable energy and energy efficiency. Net-metering is one mechanism to do so. Any future energy plans in the northwest should take into consideration the viability of renewable energy versus traditional fossil fuels in terms of access, longevity, cost, environmental impacts, job creation and economic impact.

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